Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD1-100

Wilton Center—Loretto

June 1, 2018

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement.

For Local and Network Upgrades which are required due to overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost less than $5,000,000, the cost of the Local and Network Upgrades will be shared by all proposed projects which have been assigned a Queue Position in the New Services Queue in which the need for the Local and Network Upgrades was identified. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects. •

For Local and Network Upgrades which are required due to the overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost of $5,000,000 or greater, the cost of the Local and Network Upgrades will be allocated according to the order of the New Service Requests in the New Services Queue and the MW contribution of each individual Interconnection Request for those projects which cause or contribute to the need for the Local or Network Upgrades. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects.

Cost allocation rules can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.

An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment G-2 of Manual 14A. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately

represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 2.2.2. of Manual 14A for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment G-1 of Manual 14A) in order to document the request for the study.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

Queue AD1-100 project is a proposal to connect a 1000 MW Energy (176 MW Capacity) Wind facility to be located in Ford County, IL. It is proposed in the Interconnection Request (Attachment N) that the primary point of interconnection to be studied as a new interconnecting substation looping in the Wilton Center-Loretto 345kV line and one of the Braidwood-Davis Creek 345kV lines (the Blue). They are selecting a secondary POI as the 345kV bus at Wilton Center.

IC has proposed a service date for this project of September 30, 2020.

Impacts on the MISO member transmission systems are not included in this analysis, but will be included in the Impact Study Phase.

This Generation Interconnection Feasibility Study provides analysis results to aid the IC in assessing the practicality and cost of incorporating the facility into the PJM system. This study was limited to load flow analyses of probable contingencies. If the IC elects to pursue a System Impact Study, a more comprehensive analysis will be performed.

Primary Point of Interconnection (Option-1)

The Interconnection Customer (IC) AD1-100, a 1,000 MW wind farm, proposes to interconnect with the ComEd transmission system by tapping into Wilton Center-Loretto 345kV line 11212 and Braidwood-Davis Creek 345kV line 2002.

Attachment Facilities

The AD1-100 wind farm generator lead interconnection to a new 345kV Interconnection Substation would require one 345kV line MOD, a dead-end structure and revenue metering as shown in the one line diagram.

The cost for the attachment facilities is estimated at $1M.

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

Direct Connection Network Upgrades

In order to accommodate interconnection of AD1-100, a new 345kV Interconnection Substation would need to be built looping in the Wilton Center-Loretto 345kV line 11212 and Braidwood-Davis Creek 345kV line 2002.

The scope of work includes installation of eight (8) 345kV circuit breakers in 'breaker-and-a-half' bus configuration to create five line terminations and tie in the Interconnection Substation to Wilton Center-Loretto 345kV line 11212 and Braidwood-Davis Creek 345kV line 2002, as shown in the one line diagram below.

The Interconnection Customer is responsible for constructing all of the facilities on the Interconnection Customer side of the point of interconnection outside of the substation. It will be

Interconnection Customer's responsibility to obtain the site for the Interconnection Substation and right-of-way between the Interconnection Substation and the 345kV transmission lines.

In the event that the IC exercises the option to build the interconnecting substation, the IC will be required to construct all interconnection facilities that will be turned over to ComEd in accordance with ComEd published standards.

ComEd would design, engineer and construct the tie-in of the Interconnection Substation to Wilton Center-Loretto 345kV line 11212 and Braidwood-Davis Creek 345kV line 2002.

The preliminary cost estimate for Direct Connection Network Upgrade is given in the following tables.

For Option to Build Direct Connection cost estimates:

Scope of Work	Cost Estimate
Installation of a new 345kV substation as described above	N/A
Transmission lines tie in work (foundations, structures, conductors)	$6,000,000
ComEd oversight and testing	$2,000,000
Total Cost Estimate (see notes below on cost estimate)	$8,000,000

For ComEd building the interconnecting substation cost estimates:

Scope of Work	Cost Estimate
Installation of a new 345kV substation as described above	$30,000,000
Transmission lines tie in work (foundations, structures, conductors)	$6,000,000
Total Cost Estimate (see notes below on cost estimate)	$36,000,000

ComEd would take approximately 24-months to construct after the ISA / ICSA are signed.

Non-Direct Connection Network Upgrades

The integration of the new 345kV Interconnection Substation would require relay/communications/SCADA upgrades at Wilton Center TSS 112, Loretto TSS 93, Braidwood Station 20 and Davis Creek TSS 86. The ComEd cost is given below:

Scope of Work	Cost Estimate
Relay/communications/SCADA upgrades at Wilton Center TSS 112, Loretto TSS 93, Braidwood Station 20 and Davis Creek TSS 86.	$3,000,000
Total Cost Estimate (see notes below on cost estimate)	$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. Per the PJM Tariff, Interconnection Customer will be responsible for paying all actual costs of ComEd's work.

4) The Interconnection Customer is responsible for all engineering, procurement, testing and construction of all equipment on the Interconnection Customer’s side of the Point of Interconnection (POI).

Network Impacts

The Queue Project AD1-100 was evaluated as a 1000.0 MW (Capacity 176.0 MW) injection tapping both the Wilton Center (Blue) to Loretto 345kV line and the Braidwood (Blue) to Davis Creek (Blue) 345kV line in the ComEd area. Project AD1-100 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-100 was studied with a commercial probability of 53%. 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)

1. (MISO NIPS - CE) The 17GREEN_ACRE-GREENACRE; T 345 kV line (from bus 255104 to bus 270771 ckt 1) loads from 98.34% to 99.6% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 86.47 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

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)

1. (AEP - OVEC) The 05JEFRSO-06CLIFTY 345 kV line (from bus 242865 to bus 248000 ckt Z1) loads from 101.57% to 102.09% (**DC power flow**) of its emergency rating (2045 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#6189_05HANG R 765'. This project contributes approximately 93.32 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#6189_05HANG R 765'
 OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1          / 242921 05CORNU 765 242924 05HANG R 765 1
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1          / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 122.15% to 122.94% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 73.3 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

3. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.83% to 113.69% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 79.97 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
```

4. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.82% to 113.69% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 79.97 MW to the thermal violation.

```
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
```

5. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.8% to 113.67% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 79.99 MW to the thermal violation.

```
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
```

6. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 109.37% to 110.77% (**DC power flow**) of its emergency rating (1091

MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 93.03 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

7. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.6% to 110.01% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 93.68 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
```

8. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.59% to 110.0% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 93.68 MW to the thermal violation.

```
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
```

9. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.52% to 109.93% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 93.8 MW to the thermal violation.

```
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
```

10. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 161.72% to 163.39% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 151.99 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

11. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.51% to 160.26% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 156.33 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
```

12. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.32% to 160.07% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 156.44 MW to the thermal violation.

```
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
```

13. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 114.99% to 115.87% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 27.49 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

14. (CE - AEP) The WILTON ;-05DUMONT 765 kV line (from bus 270644 to bus 243206 ckt 1) loads from 106.87% to 108.22% (**DC power flow**) of its emergency rating (4105 MVA) for the tower line contingency outage of 'COMED_P7_345-L94507_B-S_+_345-L97008_R-S'. This project contributes approximately 341.38 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L94507_B-S_+_345-L97008_R-S'
 TRIP BRANCH FROM BUS 274750 TO BUS 255112 CKT 1          / CRETE;BP 345 17STJOHN 345
 TRIP BRANCH FROM BUS 274804 TO BUS 243229 CKT 1          / UPNOR;RP 345 05OLIVE 345
 END
```

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

15. (CE - AEP) The WILTON ;-05DUMONT 765 kV line (from bus 270644 to bus 243206 ckt 1) loads from 103.91% to 105.19% (**DC power flow**) of its emergency rating (4105 MVA) for

the tower line contingency outage of 'COMED_P7_641'. This project contributes approximately 334.45 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_641'
 OPEN BRANCH FROM BUS 243229 TO BUS 270771 CKT 1          / 243229 05OLIVE 345 270771 GREENACRE; T 345 1
 OPEN BRANCH FROM BUS 243229 TO BUS 274804 CKT 1          / 243229 05OLIVE 345 274804 UNIV PK N;RP 345 1
 END
```

16. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 130.18% to 131.86% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 128.06 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

17. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.74% to 131.45% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 129.29 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
```

18. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.25% to 130.94% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 129.3 MW to the thermal violation.

```
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
```

19. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 110.41% to 111.83% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 86.47 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

20. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 109.04% to 110.48% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 87.5 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
```

21. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 109.02% to 110.47% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 87.62 MW to the thermal violation.

```
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
```

22. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 109.37% to 110.77% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 93.03 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

23. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.6% to 110.01% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 93.68 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
```

24. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.59% to 110.0% (**DC power flow**) of its emergency rating

(1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 93.68 MW to the thermal violation.

```
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
```

25. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.51% to 109.92% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 93.8 MW to the thermal violation.

```
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
```

26. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 142.36% to 144.89% (**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 200.41 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
```

Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

27. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 145.39% to 147.97% (**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 204.35 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
```

Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

28. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.61% to 128.12% (**DC power flow**) of its emergency rating (1399

MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 128.07 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 12 for a table containing the generators having contribution to this flowgate.

29. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.21% to 127.73% (**DC 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 128.55 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
```

30. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.19% to 127.7% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 128.57 MW to the thermal violation.

```
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
```

31. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 125.98% to 127.5% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 128.75 MW to the thermal violation.

```
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
```

32. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.75% to 134.43% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 102.89 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
```

```
OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
END
```

Please refer to Appendix 13 for a table containing the generators having contribution to this flowgate.

33. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 131.68% to 133.38% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 103.7 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
```

34. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 131.68% to 133.38% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 103.7 MW to the thermal violation.

```
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
```

35. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 131.57% to 133.27% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 103.72 MW to the thermal violation.

```
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
```

36. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 106.1% to 106.98% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 18.26 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

37. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 142.36% to 144.89% (**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 200.41 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
```

Please refer to Appendix 14 for a table containing the generators having contribution to this flowgate.

38. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 145.39% to 147.97% (**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 204.35 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
```

Please refer to Appendix 15 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

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

To be determined

Short Circuit

(Summary of impacted circuit breakers)

The breakers in the following chart have been identified as being overdutied:

AD1-100 option 1

Bus Name	BREAKER	Breaker Capacity (Amps)	Duty Percent With AD1-100	Duty Percent Without AD1-100	Duty Percent Difference	Duty Amps With AD1-100	Duty Amps Without AD1-100
DaviCrk B3 138.kV	86 8604	49858.2	101.95%	96.49%	5.45%	50828.6	48110
DaviCrk B4 138.kV	86 8605	49858.2	101.62%	96.14%	5.48%	50667.9	47934.5
DaviCrk R1 138.kV	86 8603	49858.2	100.92%	95.53%	5.39%	50319.2	47630.4

Affected System Analysis & Mitigation

MISO Impacts:

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

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.

1. (AEP - OVEC) The 05JEFRSO-06CLIFTY 345 kV line (from bus 242865 to bus 248000 ckt Z1) loads from 116.31% to 116.93% (**DC power flow**) of its normal rating (1756 MVA) for the single line contingency outage of 'AEP_P1-2_#709'. This project contributes approximately 93.57 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#709'
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1          / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.8% to 113.67% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 79.99 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

3. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.51% to 109.93% (**DC power flow**) of its emergency rating (1091

MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 93.74 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

4. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.31% to 160.05% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 156.17 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

5. (CE - AEP) The WILTON ;-05DUMONT 765 kV line (from bus 270644 to bus 243206 ckt 1) loads from 99.54% to 100.77% (**DC power flow**) of its normal rating (4105 MVA) for the single line contingency outage of 'COMED_P1-2_697_B2'. This project contributes approximately 317.84 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_697_B2'
 OPEN BRANCH FROM BUS 243229 TO BUS 274804 CKT 1              / 243229 05OLIVE 345 274804 UPNOR;RP 345 1
 END
```

6. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.22% to 130.91% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 128.93 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

7. (CE - CE) The COLLINS ; R-COLLINS ;2M 345 kV line (from bus 270697 to bus 275168 ckt 1) loads from 95.53% to 97.32% (**DC power flow**) of its emergency rating (1379 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-A'. This project contributes approximately 53.22 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-A'
 TRIP BRANCH FROM BUS 270926 TO BUS 934720 CKT 1              / WILTO; B 345 AD1-100 TAP 345
 END
```

8. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 109.02% to 110.46% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 87.49 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206
05DUMONT 765 270644 WILTO; 765 1
 END
```

9. (CE - CE) The PONTIAC ; R-AD1-133 TAP 345 kV line (from bus 270853 to bus 935000 ckt 1) loads from 103.88% to 106.57% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-A'. This project contributes approximately 90.0 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-A'
  TRIP BRANCH FROM BUS 270926 TO BUS 934720 CKT 1                / WILTO; B 345
AD1-100 TAP 345
  END
```

10. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.5% to 109.92% (**DC power flow**) of its emergency rating (1091 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 93.74 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

11. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 125.98% to 127.5% (**DC power flow**) of its emergency rating (1399 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 128.73 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

12. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 131.57% to 133.27% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 103.75 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

13. (CE - CE) The AC1-067 TAP-BURNHAM ;1R 345 kV line (from bus 925880 to bus 270675 ckt 1) loads from 102.91% to 104.78% (**DC power flow**) of its emergency rating (1383 MVA) for the single line contingency outage of 'COMED_P1-2_345-L2001__B-S'. This project contributes approximately 57.23 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L2001__B-S'
 TRIP BRANCH FROM BUS 270670 TO BUS 270728 CKT 1              / BRAID; B 345 E FRA; B 345
 TRIP BRANCH FROM BUS 270728 TO BUS 270766 CKT 1              / E FRA; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270728 TO BUS 274750 CKT 1              / E FRA; B 345 CRETE;BP 345
 END
```

14. (CE - CE) The AD1-100 TAP-WILTON ; B 345 kV line (from bus 934720 to bus 270926 ckt 1) loads from 102.81% to 124.29% (**DC power flow**) of its emergency rating (1528 MVA)

for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 323.21 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8014_T_-S-B'
 TRIP BRANCH FROM BUS 935000 TO BUS 270717 CKT 1              / AD1-133 TAP 345 DRESDEN ; R 345
 END
```

15. (CE - CE) The AD1-100 TAP-WILTON ; B 345 kV line (from bus 934720 to bus 270926 ckt 1) loads from 88.87% to 111.95% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 312.84 MW to the thermal violation.

16. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 102.25% to 104.91% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-A'. This project contributes approximately 90.0 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-A'
 TRIP BRANCH FROM BUS 270926 TO BUS 934720 CKT 1              / WILTO; B 345 AD1-100 TAP 345
 END
```

Light Load Analysis - 2021

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

System Reinforcements

Short Circuit

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

AD1-100 option 1

Bus Name	BREAKER	Cost & Time Estimate
DaviCrk B3 138.kV	86 8604	$9 M, 24 - 30 months
DaviCrk B4 138.kV	86 8605	
DaviCrk R1 138.kV	86 8603	

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined in System Impact Study phase

Summer Peak 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)

Multiple Facility Contingency

1. (MISO NIPS - CE) The 17GREEN_ACRE-GREENACRE; T 345 kV line (from bus 255104 to bus 270771 ckt 1) loads from 98.34% to 99.6% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 86.47 MW to the thermal violation.

COMED:
ComEd 345kV L6615 SLD & ALDR ratings are 1195 MVA & 1374 MVA. No upgrade is required.

MISO NIPS:
The external (i.e. Non-PJM) Transmission Owner, MISO NIPS, will not evaluate this violation until the impact study phase.

Note: this project is not the first to cause and the mitigation may be greater than $5 million; this violation was left in the report since it may be valid and cost allocation is not performed during the Feasibility study phase; the violation will be further evaluated during the System Impact Study phase.

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)

1. (AEP - OVEC) The 05JEFRSO-06CLIFTY 345 kV line (from bus 242865 to bus 248000 ckt Z1) loads from 101.57% to 102.09% (**DC power flow**) of its emergency rating (2045 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#6189_05HANG R 765'. This project contributes approximately 93.32 MW to the thermal violation.

AEP:
There is a 2018 baseline upgrade B2878 to replace the Clifty riser and increase the ratings to match the Jefferson-end ratings of 2354/2354 MVA SN/SE. An approximate construction time would be 12 months after signing an interconnection agreement.

OVEC:
The external (i.e. Non-PJM) Transmission Owner, OVEC, will not evaluate this violation until the impact study phase.

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 122.15% to 122.94% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 73.3 MW to the thermal violation.

AEP:
To resolve the X2-052 Tap – Dumont 345 kV line overloads: The upgrade is to perform a sag study which shows remediation work will include the replacement of tower 20 with a custom steel pole and the removal of swing angle brackets on 2 structures (PJM Network Upgrade N4512). Cost estimate is $1.0775M. The sag study will raise the SE rating to 1868 MVA which is not sufficient. The line conductor sections 1 and 2 will have to be reconductored/rebuilt. Estimated Cost: $28.6 Million. Replace Dumont circuit breaker G2 , Estimated cost : $ 1,500,000. The standard time required for construction differs from state to state. An Approximate construction would be 24 to 36 months after signing an interconnection agreement.

3. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.83% to 113.69% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 79.97 MW to the thermal violation.

Same as Contribution to Previously Identified #2

4. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.82% to 113.69% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 79.97 MW to the thermal violation.

Same as Contribution to Previously Identified #2

5. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.8% to 113.67% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 79.99 MW to the thermal violation.

Same as Contribution to Previously Identified #2

6. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 109.37% to 110.77% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of

'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 93.03 MW to the thermal violation.

COMED:
ComEd 345kV L6617 SLD & ALDR ratings are 1237 MVA & 1423 MVA. No upgrade is required.

MISO NIPS:
The external (i.e. Non-PJM) Transmission Owner, MISO NIPS, will not evaluate this violation until the impact study phase.

7. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.6% to 110.01% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 93.68 MW to the thermal violation.

Same as Contribution to Previously Identified #6

8. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.59% to 110.0% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 93.68 MW to the thermal violation.

Same as Contribution to Previously Identified #6

9. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.52% to 109.93% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 93.8 MW to the thermal violation.

Same as Contribution to Previously Identified #6

10. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 161.72% to 163.39% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 151.99 MW to the thermal violation.

AEP:
• (N4058) Sag study results: Stillwell - Dumont 345 kV line 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 wavetrap and possibly the conductor.

- **This upgrade is driven by a prior queue. Per PJM cost allocation rules, AC1-002 LTF presently does not receive cost allocation for this upgrade. Note: as**

changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, AC1-002 LTF could receive cost allocation.

• Additional AEP-end upgrade: Rebuild 8.6 miles of the AEP owned line and upgrade necessary Dumont terminal equipment (wavetrap) at a cost of $20M. PJM Network Upgrade N4790. New AEP-end ratings to be 1409/2045 MVA (SN/SE). Limited by Dumont risers.

• Additional AEP-end upgrade: In addition to upgrading the Dumont risers, a different conductor (compared to the prior upgrade) will need to be selected to achieve the desired rating. The new conductor would be 1272 dual ACSR conductor. The additional cost for this work scope is $2M. The new AEP-end ratings to be 1690/2278 MVA SN/SE (limited by the conductor). PJM Network Upgrade N5064.

• Additional AEP-end upgrade: AEP said it would cost $4.8M to string a second Stillwell- Dumont 345 kV line on the existing tower. The $4.8M is for 8.5 miles of the AEP portion. Would need a NIPSCO portion (2.87 miles) cost estimate.

• MISO end – ratings are 1409/1779 MVA. MISO end upgrade: Rebuild NIPSCO portion of line (2.87 miles) at a cost of $6.5M and upgrade Stillwell substation equipment at a cost of $1.5M. Total cost is $8.0M. New expected MISO end ratings will be 1582/1898 MVA SN/SE.

• Additional MISO-end upgrade: Reconductor 2.87 miles of transmission conductor to bundled 954 ACSS, replace substation conductor to bundled 2500 AL, and replace wavetrap. $12M. New MISO-end ratings to be 2550/2923 MVA SN/SE.

Estimated Schedule: (1) Sag study : 6 to 12 months. (2) Rebuild. The standard time required for construction differs from state to state. An Approximate construction would be 36 to 48 months after signing an interconnection agreement.

MISO NIPS:
The external (i.e. Non-PJM) Transmission Owner, MISO NIPS, will not evaluate this violation until the impact study phase.

11. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.51% to 160.26% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 156.33 MW to the thermal violation.

Same as Contribution to Previously Identified #10

12. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.32% to 160.07% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 156.44 MW to the thermal violation.

Same as Contribution to Previously Identified #10

13. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 114.99% to 115.87% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 27.49 MW to the thermal violation.

Same as Contribution to Previously Identified #10

14. (CE - AEP) The WILTON ;-05DUMONT 765 kV line (from bus 270644 to bus 243206 ckt 1) loads from 106.87% to 108.22% (**DC power flow**) of its emergency rating (4105 MVA) for the tower line contingency outage of 'COMED_P7_345-L94507_B-S_+_345-L97008_R-S'. This project contributes approximately 341.38 MW to the thermal violation.

COMED:
ComEd 765kV L11215 SLD & ALDR ratings are 4802 MVA & 5522 MVA. No upgrade is required.

AEP:
(1) An Engineering study need to be conducted to determine if the relay compliance trip limits settings can be adjusted to mitigate the overload, Estimated Cost: $25,000. New relay packages will be required if the settings cannot be adjusted, Estimated Cost:$600,000. An approximate construction time would be 12 months after signing an interconnection agreement.

15. (CE - AEP) The WILTON ;-05DUMONT 765 kV line (from bus 270644 to bus 243206 ckt 1) loads from 103.91% to 105.19% (**DC power flow**) of its emergency rating (4105 MVA) for the tower line contingency outage of 'COMED_P7_641'. This project contributes approximately 334.45 MW to the thermal violation.

Same as Contribution to Previously Identified #14

16. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 130.18% to 131.86% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 128.06 MW to the thermal violation.

COMED:
ComEd 345kV L17703 SLD & ALDR ratings are 1367 MVA & 1572 MVA. The post contingency flow exceeds the ratings therefore an upgrade is required. The upgrade will be re-sag the line. Upon completion of this upgrade the ratings will be 1201/1479/1768/2033 MVA, SN/SE/SLD/ALDR. The preliminary estimate for this upgrade is $4.5M with a construction timeline of 24-30 months.

MISO NIPS:
The external (i.e. Non-PJM) Transmission Owner, MISO NIPS, will not evaluate this violation until the impact study phase.

17. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.74% to 131.45% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 129.29 MW to the thermal violation.

Same as Contribution to Previously Identified #16

18. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.25% to 130.94% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 129.3 MW to the thermal violation.

Same as Contribution to Previously Identified #16

19. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 110.41% to 111.83% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 86.47 MW to the thermal violation.

COMED:
ComEd 345Kv L6615 SLD & ALDR ratings are 2070 MVA & 2381 MVA. No upgrade required.

AEP:
(1)A sag study will be required on the 40.64 mile section line to mitigate the overload. Depending on the sag study results, cost for the upgrade is expected to be between $1,62,560 (no remediations required just sag study) and $81.28 million (complete line reconductor/rebuild required).
(2)This is a CE -AEP tie line , therefore PJM will have to coordinate this upgrade with CE as well as to make sure their equipment will not set a limit lower than what is specified here.
(3)Replace olive line risers , estimated cost :$ 100,000.

Estimated Time: (1) Sag study : 6 to 12 months. (2) Rebuild. The standard time required for construction differs from state to state. An Approximate construction would be 24 to 36 months after signing an interconnection agreement.

20. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 109.04% to 110.48% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 87.5 MW to the thermal violation.

Same as Contribution to Previously Identified #19

21. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 109.02% to 110.47% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 87.62 MW to the thermal violation.

Same as Contribution to Previously Identified #19

22. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 109.37% to 110.77% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 93.03 MW to the thermal violation.

COMED:
ComEd 345Kv L6617 SLD & ALDR ratings are 1237 MVA & 1423 MVA. No upgrade is required.

MISO NIPS:
The external (i.e. Non-PJM) Transmission Owner, MISO NIPS, will not evaluate this violation until the impact study phase.

23. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.6% to 110.01% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 93.68 MW to the thermal violation.

Same as Contribution to Previously Identified #22

24. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.59% to 110.0% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 93.68 MW to the thermal violation.

Same as Contribution to Previously Identified #22

25. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.51% to 109.92% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 93.8 MW to the thermal violation.

Same as Contribution to Previously Identified #22

26. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 142.36% to 144.89% (**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 200.41 MW to the thermal violation.

COMED:
ComEd post contingency facility overloaded by this event is Tr. 93 @ Station 112 Wilton Center. The upgrade will be to build out the 765kV ring bus at Wilton Center, installation of two 765 kV Bus Tie Circuit Breakers (BT 6-8 & 8-2) along with a relocation of 765kV L11216 from bus 6 to bus 8. Preliminary estimate for upgrade is $8M with an estimated construction time line of 24 months. Note, the rating for Tr. 93 at Wilton Center will remain current however with this upgrade the 112-65-BT5-6 contingency file will no longer include the Wilton Center Tr. 94 and will allow both transformers to remain in service eliminating the overload.

27. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 145.39% to 147.97% (**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 204.35 MW to the thermal violation.

COMED:
ComEd TSS 112 Tr. 94 SLD & ALDR ratings are 1601 MVA & 1841 MVA. The post contingency flow for this event exceeds the ratings therefore an upgrade is required. The proposed upgrade will be to install a third transformer at Wilton Center. Upgrades include expansion on the 765kV & 345kV buses at Wilton Center. The preliminary estimate for this upgrade is $15.2M with a preliminary construction time line of 24-30 months.

28. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.61% to 128.12% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 128.07 MW to the thermal violation.

COMED:
ComEd 345kV L94507 SLD is 1674 MVA & ALDR is 1925 MVA. No upgrade required.

MISO NIPS:
The external (i.e. Non-PJM) Transmission Owner, MISO NIPS, will not evaluate this violation until the impact study phase.

29. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.21% to 127.73% (**DC 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 128.55 MW to the thermal violation.

Same as Contribution to Previously Identified #28

30. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.19% to 127.7% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 128.57 MW to the thermal violation.

Same as Contribution to Previously Identified #28

31. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 125.98% to 127.5% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 128.75 MW to the thermal violation.

Same as Contribution to Previously Identified #28

32. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.75% to 134.43% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 102.89 MW to the thermal violation.

COMED:
ComEd 345kV L97008 SLD is 1237 MVA and the ALDR is 1423 MVA. No upgrade required.

AEP:
(1) The 40.64 mile section of line will have to reconductored/rebuilt to mitigate the overload. Estimated Cost is $80.42 million.
(2)This is a CE -AEP tie line , therefore PJM is going to coordinate this upgrade with CE as well as to make sure that this equipment will not set a limit lower than what is specified here.
(3)Replace the Olive switches to line risers , estimated cost :100,000.
(4) An Engineering study need to be conducted to determine if the relay compliance trip limits settings can be adjusted to mitigate the overload, Estimated Cost: $25,000.New relay packages will be required if the settings cannot be adjusted, Estimated cost:$600,000.
An Approximate construction time would be 24 to 36 months after signing an interconnection agreement.

33. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 131.68% to 133.38% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 103.7 MW to the thermal violation.

Same as Contribution to Previously Identified #32

34. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 131.68% to 133.38% (**DC power flow**) of its emergency rating (971 MVA) for the

line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 103.7 MW to the thermal violation.

Same as Contribution to Previously Identified #32

35. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 131.57% to 133.27% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 103.72 MW to the thermal violation.

Same as Contribution to Previously Identified #32

36. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 106.1% to 106.98% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 18.26 MW to the thermal violation.

Same as Contribution to Previously Identified #32

37. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 142.36% to 144.89% (**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 200.41 MW to the thermal violation.

Same as Contribution to Previously Identified #26

38. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 145.39% to 147.97% (**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 204.35 MW to the thermal violation.

Same as Contribution to Previously Identified #27

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(MISO NIPS - CE) The 17GREEN_ACRE-GREENACRE; T 345 kV line (from bus 255104 to bus 270771 ckt 1) loads from 98.34% to 99.6% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 86.47 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.57*
932012	*AC2-007 E*	*1.05*
932881	*AC2-115 1*	*1.61*
932891	*AC2-115 2*	*1.61*
932921	*AC2-116*	*0.56*
933341	*AC2-147 C*	*0.59*
933342	*AC2-147 E*	*0.96*
933351	*AC2-148 C*	*0.58*
933352	*AC2-148 E*	*0.95*
933361	*AC2-149 C*	*0.63*
933362	*AC2-149 E*	*1.02*
933371	*AC2-150 C*	*0.58*
933372	*AC2-150 E*	*0.95*
933381	*AC2-151 C*	*0.65*
933382	*AC2-151 E*	*1.07*
933401	*AC2-153 C*	*0.31*
933402	*AC2-153 E*	*0.51*
933411	*AC2-154 C*	*1.7*
933412	*AC2-154 E*	*2.78*
933431	*AC2-156 C*	*0.64*
933432	*AC2-156 E*	*1.05*
933511	*AC2-166 C*	*1.57*
933512	*AC2-166 E*	*1.74*
933911	*AD1-013 C O1*	*1.24*
933912	*AD1-013 E O1*	*1.98*
933931	*AD1-016 C*	*0.63*
933932	*AD1-016 E*	*1.02*
934001	*AD1-024 C*	*1.68*
934002	*AD1-024 E*	*2.75*
934101	*AD1-039 1*	*5.2*
934111	*AD1-039 2*	*5.49*

934401	*AD1-064 C O1*	*2.19*
934402	*AD1-064 E O1*	*10.24*
934431	*AD1-067 C*	*0.09*
934432	*AD1-067 E*	*0.37*
934651	*AD1-096 C*	*0.6*
934652	*AD1-096 E*	*0.98*
934701	*AD1-098 C O1*	*4.63*
934702	*AD1-098 E O1*	*3.38*
934721	*AD1-100 C*	*15.22*
934722	*AD1-100 E*	*71.25*
934871	*AD1-116 C*	*0.63*
934872	*AD1-116 E*	*1.02*
934881	*AD1-117 C*	*3.62*
934882	*AD1-117 E*	*2.41*
934941	*AD1-126 C*	*3.94*
934942	*AD1-126 E*	*2.63*
934971	*AD1-129 C*	*0.61*
934972	*AD1-129 E*	*0.41*
935001	*AD1-133 C O1*	*13.91*
935002	*AD1-133 E O1*	*9.28*
274890	*CAYUG;1U E*	*9.03*
274891	*CAYUG;2U E*	*9.03*
274751	*CRETE EC ;1U*	*2.49*
274752	*CRETE EC ;2U*	*2.49*
274753	*CRETE EC ;3U*	*2.49*
274754	*CRETE EC ;4U*	*2.49*
274859	*EASYR;U1 E*	*7.4*
274860	*EASYR;U2 E*	*7.4*
290051	*GSG-6; E*	*7.04*
951131	*J643*	*15.61*
981291	*J740 C*	*4.38*
981292	*J740 E*	*17.51*
275149	*KEMPTON ;1E*	*12.54*
290108	*LEEDK;1U E*	*16.37*
274850	*MENDOTA H;RU*	*4.05*
293061	*N-015 E*	*10.41*
293516	*O-009 E1*	*4.75*
293517	*O-009 E2*	*2.41*
293518	*O-009 E3*	*2.66*
293715	*O-029 E*	*6.54*
293716	*O-029 E*	*3.58*
293717	*O-029 E*	*3.29*
293644	*O22 E1*	*7.36*
293645	*O22 E2*	*14.3*
290021	*O50 E*	*13.18*

294392	*P-010 E*	*13.23*
294763	*P-046 E*	*6.32*
274888	*PILOT HIL;1E*	*12.54*
274830	*PWR VTREC;1U*	*4.12*
274831	*PWR VTREC;2U*	*4.12*
274722	*S-055 E*	*7.63*
884780	*S58 FTIR*	*34.95*
884781	*S58 NFTIR*	*104.84*
295111	*SUBLETTE E*	*1.83*
299993	*U3-031C*	*3.55*
903433	*W3-046*	*16.18*
274874	*WALNR;2U*	*1.61*
294502	*WALNR;2U E*	*6.42*
295109	*WESTBROOK E*	*3.77*
274687	*WILL CNTY;4U*	*47.06*
910542	*X3-005 E*	*0.53*
914641	*Y2-103*	*30.52*
915011	*Y3-013 1*	*2.54*
915021	*Y3-013 2*	*2.54*
915031	*Y3-013 3*	*2.54*
916502	*Z1-106 E1*	*0.85*
916504	*Z1-106 E2*	*0.85*
916512	*Z1-107 E*	*1.73*
916522	*Z1-108 E*	*1.68*
916651	*Z1-127 1*	*1.19*
916652	*Z1-127 2*	*0.54*
918051	*AA1-018 C*	*1.6*
918052	*AA1-018 E*	*10.73*
918972	*AA1-116 E*	*1.79*
918982	*AA1-117 E*	*1.79*
919221	*AA1-146*	*11.83*
919581	*AA2-030*	*11.83*
919591	*AA2-035*	*87.13*
920112	*AA2-107 E*	*1.66*
920272	*AA2-123 E*	*1.65*
930481	*AB1-089*	*44.39*
930491	*AB1-090*	*44.39*
930501	*AB1-091*	*50.2*
930761	*AB1-122 1*	*47.85*
930771	*AB1-122 2*	*50.48*
931221	*AB1-172*	*0.54*
924471	*AB2-096*	*28.61*
925161	*AB2-173*	*2.11*
925301	*AB2-191 C*	*0.85*
925302	*AB2-191 E*	*0.76*

925881	*AC1-067*	*104.09*
926311	*AC1-109 1*	*1.29*
926321	*AC1-109 2*	*1.29*
926331	*AC1-110 1*	*1.29*
926341	*AC1-110 2*	*1.29*
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*
927522	*AC1-113 2*	*0.8*
926431	*AC1-114*	*1.61*
927451	*AC1-142A 1*	*2.87*
927461	*AC1-142A 2*	*2.87*
926701	*AC1-153 C1*	*52.01*
926711	*AC1-153 C2*	*54.87*
926702	*AC1-153 E1*	*2.08*
926712	*AC1-153 E2*	*2.19*
926821	*AC1-168 C*	*0.78*
926822	*AC1-168 E*	*5.21*
927531	*AC1-185 1*	*0.46*
927541	*AC1-185 2*	*0.46*
927551	*AC1-185 3*	*0.46*
927561	*AC1-185 4*	*0.46*
927571	*AC1-185 5*	*0.46*
927581	*AC1-185 6*	*0.46*
927591	*AC1-185 7*	*0.46*
927601	*AC1-185 8*	*0.46*
927091	*AC1-204 1*	*49.44*
927101	*AC1-204 2*	*49.4*

Appendix 2

(AEP - OVEC) The 05JEFRSO-06CLIFTY 345 kV line (from bus 242865 to bus 248000 ckt Z1) loads from 101.57% to 102.09% (**DC power flow**) of its emergency rating (2045 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#6189_05HANG R 765'. This project contributes approximately 93.32 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#6189_05HANG R 765'
 OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1          / 242921 05CORNU 765 242924 05HANG R 765 1
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1          / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
243859	*05FR-11G C*	*0.46*
247900	*05FR-11G E*	*9.33*
243862	*05FR-12G C*	*0.45*
247901	*05FR-12G E*	*9.17*
243864	*05FR-21G C*	*0.48*
247902	*05FR-21G E*	*9.8*
243866	*05FR-22G C*	*0.46*
247903	*05FR-22G E*	*9.39*
243870	*05FR-3G C*	*0.93*
247904	*05FR-3G E*	*19.01*
243873	*05FR-4G C*	*0.72*
247905	*05FR-4G E*	*14.29*
246909	*05MDL-1G C*	*0.97*
247906	*05MDL-1G E*	*19.69*
246910	*05MDL-2G C*	*0.48*
247907	*05MDL-2G E*	*9.77*
246976	*05MDL-3G C*	*0.48*
247912	*05MDL-3G E*	*10.21*
246979	*05MDL-4G C*	*0.97*
247913	*05MDL-4G E*	*9.74*
243442	*05RKG1*	*54.19*
243443	*05RKG2*	*53.37*
932601	*AC2-080 C*	*3.12*
932602	*AC2-080 E*	*20.91*
932931	*AC2-117*	*4.31*
933281	*AC2-140 C*	*3.76*
933441	*AC2-157 C*	*9.83*
933442	*AC2-157 E*	*16.04*
934721	*AD1-100 C*	*5.39*
934722	*AD1-100 E*	*25.24*
884780	*S58 FTIR*	*38.46*
884781	*S58 NFTIR*	*115.39*
247556	*T-127 C*	*0.49*

247943	*T-127 E*	*9.99*
299993	*U3-031C*	*3.78*
907041	*X1-020 C*	*27.78*
907042	*X1-020 E*	*185.92*
910542	*X3-005 E*	*0.52*
900404	*X3-028 C*	*194.03*
900405	*X3-028 E*	*258.7*
913222	*Y1-054 E*	*-2.27*
915662	*Y3-099 E*	*0.24*
915672	*Y3-100 E*	*0.24*
916182	*Z1-065 E*	*0.64*
919591	*AA2-035*	*95.13*
930041	*AB1-006 C*	*3.21*
930042	*AB1-006 E*	*21.45*
930461	*AB1-087*	*71.14*
930471	*AB1-088*	*71.14*
930501	*AB1-091*	*51.36*
925242	*AB2-178 E*	*2.39*
927331	*AC1-040 C*	*9.21*
927332	*AC1-040 E*	*15.03*
925881	*AC1-067*	*102.32*

Appendix 3

(AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 122.15% to 122.94% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 73.3 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
247900	*05FR-11G E*	*6.85*
247901	*05FR-12G E*	*6.74*
247902	*05FR-21G E*	*7.2*
247903	*05FR-22G E*	*6.89*
247904	*05FR-3G E*	*13.96*
247905	*05FR-4G E*	*10.5*
247906	*05MDL-1G E*	*15.64*
247907	*05MDL-2G E*	*7.76*
247912	*05MDL-3G E*	*8.11*
247913	*05MDL-4G E*	*7.74*
932011	*AC2-007 C*	*0.5*
932012	*AC2-007 E*	*0.92*
932601	*AC2-080 C*	*3.73*
932602	*AC2-080 E*	*24.95*
932881	*AC2-115 1*	*1.41*
932891	*AC2-115 2*	*1.41*
932921	*AC2-116*	*0.49*
932931	*AC2-117*	*5.2*
933341	*AC2-147 C*	*0.52*
933342	*AC2-147 E*	*0.85*
933351	*AC2-148 C*	*0.52*
933352	*AC2-148 E*	*0.85*
933361	*AC2-149 C*	*0.55*
933362	*AC2-149 E*	*0.89*
933371	*AC2-150 C*	*0.52*
933372	*AC2-150 E*	*0.85*
933381	*AC2-151 C*	*0.57*
933382	*AC2-151 E*	*0.93*
933401	*AC2-153 C*	*0.27*
933402	*AC2-153 E*	*0.45*
933411	*AC2-154 C*	*1.41*
933412	*AC2-154 E*	*2.3*
933431	*AC2-156 C*	*0.56*

933432	*AC2-156 E*	*0.91*
933511	*AC2-166 C*	*1.37*
933512	*AC2-166 E*	*1.51*
933911	*AD1-013 C O1*	*1.09*
933912	*AD1-013 E O1*	*1.74*
933931	*AD1-016 C*	*0.55*
933932	*AD1-016 E*	*0.89*
934001	*AD1-024 C*	*1.41*
934002	*AD1-024 E*	*2.31*
934101	*AD1-039 1*	*4.55*
934111	*AD1-039 2*	*4.65*
934401	*AD1-064 C O1*	*1.9*
934402	*AD1-064 E O1*	*8.89*
934431	*AD1-067 C*	*0.08*
934432	*AD1-067 E*	*0.33*
934651	*AD1-096 C*	*0.53*
934652	*AD1-096 E*	*0.87*
934701	*AD1-098 C O1*	*4.07*
934702	*AD1-098 E O1*	*2.97*
934721	*AD1-100 C*	*12.9*
934722	*AD1-100 E*	*60.4*
934871	*AD1-116 C*	*0.57*
934872	*AD1-116 E*	*0.94*
934881	*AD1-117 C*	*3.22*
934882	*AD1-117 E*	*2.15*
934941	*AD1-126 C*	*3.44*
934942	*AD1-126 E*	*2.29*
934971	*AD1-129 C*	*0.53*
934972	*AD1-129 E*	*0.36*
935001	*AD1-133 C O1*	*12.64*
935002	*AD1-133 E O1*	*8.43*
274890	*CAYUG;1U E*	*8.26*
274891	*CAYUG;2U E*	*8.26*
274859	*EASYR;U1 E*	*6.6*
274860	*EASYR;U2 E*	*6.6*
290051	*GSG-6; E*	*6.19*
275149	*KEMPTON ;1E*	*10.39*
290108	*LEEDK;1U E*	*14.28*
274850	*MENDOTA H;RU*	*3.56*
293061	*N-015 E*	*9.02*
293644	*O22 E1*	*5.94*
293645	*O22 E2*	*11.53*
290021	*O50 E*	*11.5*
294392	*P-010 E*	*11.46*
294763	*P-046 E*	*5.59*

274888	*PILOT HIL;1E*	*10.39*
274830	*PWR VTREC;1U*	*3.6*
274831	*PWR VTREC;2U*	*3.6*
274722	*S-055 E*	*6.57*
884780	*S58 FTIR*	*29.41*
884781	*S58 NFTIR*	*88.22*
295111	*SUBLETTE E*	*1.61*
247943	*T-127 E*	*7.94*
299993	*U3-031C*	*2.9*
291984	*U4-033*	*0.8*
274814	*UNIV PK N;0U*	*0.65*
274808	*UNIV PK N;4U*	*0.65*
274809	*UNIV PK N;5U*	*0.65*
274810	*UNIV PK N;6U*	*0.65*
274811	*UNIV PK N;7U*	*0.65*
274812	*UNIV PK N;8U*	*0.65*
274813	*UNIV PK N;9U*	*0.65*
274815	*UNIV PK N;XU*	*0.65*
274816	*UNIV PK N;YU*	*0.65*
903433	*W3-046*	*14.48*
274874	*WALNR;2U*	*0.86*
294502	*WALNR;2U E*	*3.43*
295109	*WESTBROOK E*	*3.31*
274687	*WILL CNTY;4U*	*38.09*
247611	*X2-052*	*73.95*
914641	*Y2-103*	*26.29*
915011	*Y3-013 1*	*2.19*
915021	*Y3-013 2*	*2.19*
915031	*Y3-013 3*	*2.19*
916502	*Z1-106 E1*	*0.73*
916504	*Z1-106 E2*	*0.73*
916512	*Z1-107 E*	*1.52*
916522	*Z1-108 E*	*1.45*
916651	*Z1-127 1*	*0.96*
916652	*Z1-127 2*	*0.57*
917711	*Z2-114 C*	*0.08*
917712	*Z2-114 E*	*0.39*
918051	*AA1-018 C*	*1.47*
918052	*AA1-018 E*	*9.85*
918972	*AA1-116 E*	*1.48*
918982	*AA1-117 E*	*1.48*
919591	*AA2-035*	*75.55*
920112	*AA2-107 E*	*1.44*
920272	*AA2-123 E*	*1.44*
930041	*AB1-006 C*	*2.55*

930042	*AB1-006 E*	*17.04*
930391	*AB1-080*	*4.38*
930481	*AB1-089*	*38.91*
930491	*AB1-090*	*38.91*
930501	*AB1-091*	*40.61*
930761	*AB1-122 1*	*41.9*
930771	*AB1-122 2*	*42.8*
931221	*AB1-172*	*0.47*
924471	*AB2-096*	*24.97*
925301	*AB2-191 C*	*0.75*
925302	*AB2-191 E*	*0.66*
926311	*AC1-109 1*	*1.11*
926321	*AC1-109 2*	*1.11*
926331	*AC1-110 1*	*1.1*
926341	*AC1-110 2*	*1.1*
926351	*AC1-111 1*	*0.44*
926361	*AC1-111 2*	*0.44*
926371	*AC1-111 3*	*0.44*
926381	*AC1-111 4*	*0.44*
926391	*AC1-111 5*	*0.44*
926401	*AC1-111 6*	*0.44*
927511	*AC1-113 1*	*0.71*
927522	*AC1-113 2*	*0.71*
926431	*AC1-114*	*1.41*
927451	*AC1-142A 1*	*2.43*
927461	*AC1-142A 2*	*2.43*
926701	*AC1-153 C1*	*45.54*
926711	*AC1-153 C2*	*46.52*
926702	*AC1-153 E1*	*1.82*
926712	*AC1-153 E2*	*1.86*
926821	*AC1-168 C*	*0.71*
926822	*AC1-168 E*	*4.77*
927531	*AC1-185 1*	*0.41*
927541	*AC1-185 2*	*0.41*
927551	*AC1-185 3*	*0.41*
927561	*AC1-185 4*	*0.41*
927571	*AC1-185 5*	*0.41*
927581	*AC1-185 6*	*0.41*
927591	*AC1-185 7*	*0.41*
927601	*AC1-185 8*	*0.41*
927091	*AC1-204 1*	*42.04*
927101	*AC1-204 2*	*42.04*

Appendix 4

(MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 109.37% to 110.77% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 93.03 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.63*
932012	*AC2-007 E*	*1.17*
932881	*AC2-115 1*	*1.78*
932891	*AC2-115 2*	*1.78*
932921	*AC2-116*	*0.62*
933341	*AC2-147 C*	*0.65*
933342	*AC2-147 E*	*1.06*
933351	*AC2-148 C*	*0.64*
933352	*AC2-148 E*	*1.05*
933361	*AC2-149 C*	*0.69*
933362	*AC2-149 E*	*1.13*
933371	*AC2-150 C*	*0.64*
933372	*AC2-150 E*	*1.05*
933381	*AC2-151 C*	*0.72*
933382	*AC2-151 E*	*1.18*
933401	*AC2-153 C*	*0.35*
933402	*AC2-153 E*	*0.57*
933411	*AC2-154 C*	*1.74*
933412	*AC2-154 E*	*2.84*
933431	*AC2-156 C*	*0.71*
933432	*AC2-156 E*	*1.16*
933511	*AC2-166 C*	*1.74*
933512	*AC2-166 E*	*1.92*
933911	*AD1-013 C O1*	*1.37*
933912	*AD1-013 E O1*	*2.19*
933931	*AD1-016 C*	*0.7*
933932	*AD1-016 E*	*1.13*
934001	*AD1-024 C*	*1.77*
934002	*AD1-024 E*	*2.88*
934101	*AD1-039 1*	*5.74*
934111	*AD1-039 2*	*6.15*
934401	*AD1-064 C O1*	*2.42*
934402	*AD1-064 E O1*	*11.35*

934431	*AD1-067 C*	*0.1*
934432	*AD1-067 E*	*0.41*
934651	*AD1-096 C*	*0.67*
934652	*AD1-096 E*	*1.09*
934701	*AD1-098 C O1*	*5.13*
934702	*AD1-098 E O1*	*3.74*
934721	*AD1-100 C*	*16.37*
934722	*AD1-100 E*	*76.66*
934871	*AD1-116 C*	*0.68*
934872	*AD1-116 E*	*1.1*
934881	*AD1-117 C*	*4.*
934882	*AD1-117 E*	*2.67*
934941	*AD1-126 C*	*4.36*
934942	*AD1-126 E*	*2.91*
934971	*AD1-129 C*	*0.68*
934972	*AD1-129 E*	*0.45*
935001	*AD1-133 C O1*	*15.2*
935002	*AD1-133 E O1*	*10.14*
274654	*BRAIDWOOD;1U*	*24.35*
274655	*BRAIDWOOD;2U*	*23.69*
274751	*CRETE EC ;1U*	*4.32*
274752	*CRETE EC ;2U*	*4.32*
274753	*CRETE EC ;3U*	*4.32*
274754	*CRETE EC ;4U*	*4.32*
274859	*EASYR;U1 E*	*8.2*
274860	*EASYR;U2 E*	*8.2*
290051	*GSG-6; E*	*7.79*
275149	*KEMPTON ;1E*	*12.84*
274704	*KENDALL ;1C*	*3.62*
274705	*KENDALL ;1S*	*2.41*
274706	*KENDALL ;2C*	*3.62*
274707	*KENDALL ;2S*	*2.41*
274660	*LASCO STA;1U*	*22.68*
274661	*LASCO STA;2U*	*22.72*
290108	*LEEDK;1U E*	*18.12*
274850	*MENDOTA H;RU*	*4.48*
293061	*N-015 E*	*11.71*
293644	*O22 E1*	*8.59*
293645	*O22 E2*	*16.67*
290021	*O50 E*	*14.73*
294392	*P-010 E*	*14.87*
294763	*P-046 E*	*7.01*
274888	*PILOT HIL;1E*	*12.84*
274830	*PWR VTREC;1U*	*4.57*
274831	*PWR VTREC;2U*	*4.57*

274722	*S-055 E*	*8.48*
884780	*S58 FTIR*	*37.57*
884781	*S58 NFTIR*	*112.7*
295111	*SUBLETTE E*	*2.03*
274861	*TOP CROP ;1U*	*0.42*
274862	*TOP CROP ;2U*	*0.82*
299993	*U3-031C*	*3.69*
903433	*W3-046*	*18.05*
274874	*WALNR;2U*	*1.78*
294502	*WALNR;2U E*	*7.11*
295109	*WESTBROOK E*	*4.17*
274687	*WILL CNTY;4U*	*52.69*
914641	*Y2-103*	*33.9*
915011	*Y3-013 1*	*2.83*
915021	*Y3-013 2*	*2.83*
915031	*Y3-013 3*	*2.83*
916502	*Z1-106 E1*	*0.95*
916504	*Z1-106 E2*	*0.95*
916512	*Z1-107 E*	*1.85*
916522	*Z1-108 E*	*1.87*
916651	*Z1-127 1*	*1.16*
916652	*Z1-127 2*	*0.57*
918051	*AA1-018 C*	*1.74*
918052	*AA1-018 E*	*11.62*
918972	*AA1-116 E*	*1.83*
918982	*AA1-117 E*	*1.83*
919221	*AA1-146*	*3.39*
919581	*AA2-030*	*13.09*
919591	*AA2-035*	*95.31*
920112	*AA2-107 E*	*1.83*
920272	*AA2-123 E*	*1.83*
930481	*AB1-089*	*49.2*
930491	*AB1-090*	*49.2*
930501	*AB1-091*	*50.9*
930761	*AB1-122 1*	*52.8*
930771	*AB1-122 2*	*56.57*
931221	*AB1-172*	*0.57*
924471	*AB2-096*	*31.72*
925161	*AB2-173*	*2.33*
925301	*AB2-191 C*	*0.94*
925302	*AB2-191 E*	*0.84*
926311	*AC1-109 1*	*1.42*
926321	*AC1-109 2*	*1.42*
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*
927522	*AC1-113 2*	*0.89*
926431	*AC1-114*	*1.78*
927451	*AC1-142A 1*	*3.21*
927461	*AC1-142A 2*	*3.21*
926701	*AC1-153 C1*	*57.39*
926711	*AC1-153 C2*	*61.49*
926702	*AC1-153 E1*	*2.3*
926712	*AC1-153 E2*	*2.46*
926821	*AC1-168 C*	*0.86*
926822	*AC1-168 E*	*5.78*
927531	*AC1-185 1*	*0.51*
927541	*AC1-185 2*	*0.51*
927551	*AC1-185 3*	*0.51*
927561	*AC1-185 4*	*0.51*
927571	*AC1-185 5*	*0.51*
927581	*AC1-185 6*	*0.51*
927591	*AC1-185 7*	*0.51*
927601	*AC1-185 8*	*0.51*
927091	*AC1-204 1*	*55.4*
927101	*AC1-204 2*	*55.32*

Appendix 5

(MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 161.72% to 163.39% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 151.99 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.98*
932012	*AC2-007 E*	*1.83*
932881	*AC2-115 1*	*2.78*
932891	*AC2-115 2*	*2.78*
932921	*AC2-116*	*0.97*
932931	*AC2-117*	*2.49*
933341	*AC2-147 C*	*1.02*
933342	*AC2-147 E*	*1.67*
933351	*AC2-148 C*	*1.01*
933352	*AC2-148 E*	*1.65*
933361	*AC2-149 C*	*1.09*
933362	*AC2-149 E*	*1.77*
933371	*AC2-150 C*	*1.01*
933372	*AC2-150 E*	*1.65*
933381	*AC2-151 C*	*1.13*
933382	*AC2-151 E*	*1.84*
933401	*AC2-153 C*	*0.54*
933402	*AC2-153 E*	*0.89*
933411	*AC2-154 C*	*3.06*
933412	*AC2-154 E*	*4.99*
933431	*AC2-156 C*	*1.11*
933432	*AC2-156 E*	*1.82*
933511	*AC2-166 C*	*2.72*
933512	*AC2-166 E*	*3.01*
933911	*AD1-013 C O1*	*2.15*
933912	*AD1-013 E O1*	*3.43*
933931	*AD1-016 C*	*1.08*
933932	*AD1-016 E*	*1.77*
934001	*AD1-024 C*	*2.99*
934002	*AD1-024 E*	*4.88*
934101	*AD1-039 1*	*9.03*
934111	*AD1-039 2*	*9.38*

934401	*AD1-064 C O1*	*3.78*
934402	*AD1-064 E O1*	*17.7*
934431	*AD1-067 C*	*0.15*
934432	*AD1-067 E*	*0.64*
934651	*AD1-096 C*	*1.04*
934652	*AD1-096 E*	*1.7*
934701	*AD1-098 C O1*	*8.04*
934702	*AD1-098 E O1*	*5.87*
934721	*AD1-100 C*	*26.75*
934722	*AD1-100 E*	*125.24*
934871	*AD1-116 C*	*1.11*
934872	*AD1-116 E*	*1.81*
934881	*AD1-117 C*	*6.29*
934882	*AD1-117 E*	*4.19*
934941	*AD1-126 C*	*6.83*
934942	*AD1-126 E*	*4.55*
934971	*AD1-129 C*	*1.06*
934972	*AD1-129 E*	*0.7*
935001	*AD1-133 C O1*	*24.5*
935002	*AD1-133 E O1*	*16.33*
274890	*CAYUG;1U E*	*16.09*
274891	*CAYUG;2U E*	*16.09*
274859	*EASYR;U1 E*	*12.87*
274860	*EASYR;U2 E*	*12.87*
290051	*GSG-6; E*	*12.21*
940531	*J351*	*434.41*
951131	*J643*	*25.85*
981291	*J740 C*	*5.52*
981292	*J740 E*	*22.07*
275149	*KEMPTON ;1E*	*22.53*
290108	*LEEDK;1U E*	*28.35*
274850	*MENDOTA H;RU*	*7.03*
293061	*N-015 E*	*17.82*
293516	*O-009 E1*	*10.68*
293517	*O-009 E2*	*5.42*
293518	*O-009 E3*	*5.97*
293715	*O-029 E*	*11.41*
293716	*O-029 E*	*6.26*
293717	*O-029 E*	*5.75*
293644	*O22 E1*	*12.15*
293645	*O22 E2*	*23.59*
290021	*O50 E*	*22.68*
294392	*P-010 E*	*22.63*
294763	*P-046 E*	*10.98*
274888	*PILOT HIL;1E*	*22.53*

274830	*PWR VTREC;1U*	*7.13*
274831	*PWR VTREC;2U*	*7.13*
274722	*S-055 E*	*13.16*
884780	*S58 FTIR*	*61.25*
884781	*S58 NFTIR*	*183.74*
274789	*SE CHICAG;6U*	*1.47*
274790	*SE CHICAG;7U*	*1.47*
274791	*SE CHICAG;8U*	*1.47*
295111	*SUBLETTE E*	*3.18*
299993	*U3-031C*	*6.33*
903433	*W3-046*	*28.02*
274874	*WALNR;2U*	*2.79*
294502	*WALNR;2U E*	*11.18*
295109	*WESTBROOK E*	*6.54*
274687	*WILL CNTY;4U*	*79.95*
910542	*X3-005 E*	*1.01*
914641	*Y2-103*	*52.64*
915011	*Y3-013 1*	*4.39*
915021	*Y3-013 2*	*4.39*
915031	*Y3-013 3*	*4.39*
916502	*Z1-106 E1*	*1.47*
916504	*Z1-106 E2*	*1.47*
916512	*Z1-107 E*	*3.07*
916522	*Z1-108 E*	*2.91*
916651	*Z1-127 1*	*2.21*
916652	*Z1-127 2*	*1.02*
918051	*AA1-018 C*	*2.84*
918052	*AA1-018 E*	*19.02*
918972	*AA1-116 E*	*3.22*
918982	*AA1-117 E*	*3.22*
919221	*AA1-146*	*20.6*
919581	*AA2-030*	*20.6*
919591	*AA2-035*	*151.87*
920112	*AA2-107 E*	*2.87*
920272	*AA2-123 E*	*2.85*
930481	*AB1-089*	*76.91*
930491	*AB1-090*	*76.91*
930501	*AB1-091*	*89.68*
930761	*AB1-122 1*	*83.11*
930771	*AB1-122 2*	*86.3*
931221	*AB1-172*	*0.95*
924471	*AB2-096*	*49.52*
925161	*AB2-173*	*3.67*
925301	*AB2-191 C*	*1.48*
925302	*AB2-191 E*	*1.31*

925881	*AC1-067*	*201.2*
926311	*AC1-109 1*	*2.22*
926321	*AC1-109 2*	*2.22*
926331	*AC1-110 1*	*2.22*
926341	*AC1-110 2*	*2.22*
926351	*AC1-111 1*	*0.89*
926361	*AC1-111 2*	*0.89*
926371	*AC1-111 3*	*0.89*
926381	*AC1-111 4*	*0.89*
926391	*AC1-111 5*	*0.89*
926401	*AC1-111 6*	*0.89*
927511	*AC1-113 1*	*1.39*
927522	*AC1-113 2*	*1.39*
926431	*AC1-114*	*2.78*
927451	*AC1-142A 1*	*4.91*
927461	*AC1-142A 2*	*4.91*
926701	*AC1-153 C1*	*90.34*
926711	*AC1-153 C2*	*93.8*
926702	*AC1-153 E1*	*3.61*
926712	*AC1-153 E2*	*3.75*
926821	*AC1-168 C*	*1.36*
926822	*AC1-168 E*	*9.09*
927531	*AC1-185 1*	*0.8*
927541	*AC1-185 2*	*0.8*
927551	*AC1-185 3*	*0.8*
927561	*AC1-185 4*	*0.8*
927571	*AC1-185 5*	*0.8*
927581	*AC1-185 6*	*0.8*
927591	*AC1-185 7*	*0.8*
927601	*AC1-185 8*	*0.8*
927091	*AC1-204 1*	*84.55*
927101	*AC1-204 2*	*84.53*

Appendix 6

(CE - AEP) The WILTON ;-05DUMONT 765 kV line (from bus 270644 to bus 243206 ckt 1) loads from 106.87% to 108.22% (**DC power flow**) of its emergency rating (4105 MVA) for the tower line contingency outage of 'COMED_P7_345-L94507_B-S_+_345-L97008_R-S'. This project contributes approximately 341.38 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L94507_B-S_+_345-L97008_R-S'
 TRIP BRANCH FROM BUS 274750 TO BUS 255112 CKT 1          / CRETE;BP 345 17STJOHN 345
 TRIP BRANCH FROM BUS 274804 TO BUS 243229 CKT 1          / UPNOR;RP 345 05OLIVE 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*2.26*
932012	*AC2-007 E*	*4.19*
932881	*AC2-115 1*	*6.38*
932891	*AC2-115 2*	*6.38*
932921	*AC2-116*	*2.23*
932931	*AC2-117*	*15.09*
933341	*AC2-147 C*	*2.33*
933342	*AC2-147 E*	*3.81*
933351	*AC2-148 C*	*2.31*
933352	*AC2-148 E*	*3.76*
933361	*AC2-149 C*	*2.54*
933362	*AC2-149 E*	*4.14*
933371	*AC2-150 C*	*2.31*
933372	*AC2-150 E*	*3.76*
933381	*AC2-151 C*	*2.6*
933382	*AC2-151 E*	*4.24*
933391	*AC2-152 C*	*1.07*
933392	*AC2-152 E*	*1.74*
933401	*AC2-153 C*	*1.27*
933402	*AC2-153 E*	*2.08*
933411	*AC2-154 C*	*6.08*
933412	*AC2-154 E*	*9.91*
933431	*AC2-156 C*	*2.66*
933432	*AC2-156 E*	*4.34*
933511	*AC2-166 C*	*6.37*
933512	*AC2-166 E*	*7.04*
933911	*AD1-013 C O1*	*4.99*
933912	*AD1-013 E O1*	*7.97*
933931	*AD1-016 C*	*2.49*
933932	*AD1-016 E*	*4.07*
934001	*AD1-024 C*	*6.13*
934002	*AD1-024 E*	*10.*
934101	*AD1-039 1*	*21.13*

934111	*AD1-039 2*	*20.71*
934401	*AD1-064 C O1*	*8.75*
934402	*AD1-064 E O1*	*40.95*
934421	*AD1-066*	*2.79*
934431	*AD1-067 C*	*0.36*
934432	*AD1-067 E*	*1.5*
934651	*AD1-096 C*	*2.39*
934652	*AD1-096 E*	*3.9*
934701	*AD1-098 C O1*	*18.63*
934702	*AD1-098 E O1*	*13.6*
934721	*AD1-100 C*	*60.08*
934722	*AD1-100 E*	*281.3*
934871	*AD1-116 C*	*2.38*
934872	*AD1-116 E*	*3.88*
934881	*AD1-117 C*	*14.36*
934882	*AD1-117 E*	*9.57*
934941	*AD1-126 C*	*15.94*
934942	*AD1-126 E*	*10.63*
934971	*AD1-129 C*	*2.42*
934972	*AD1-129 E*	*1.61*
935001	*AD1-133 C O1*	*56.52*
935002	*AD1-133 E O1*	*37.68*
274832	*ANNAWAN ; 1U*	*28.51*
274890	*CAYUG;1U E*	*36.45*
274891	*CAYUG;2U E*	*36.45*
274849	*CRESCENT ;1U*	*15.32*
274859	*EASYR;U1 E*	*29.39*
274860	*EASYR;U2 E*	*29.39*
290051	*GSG-6; E*	*28.32*
275149	*KEMPTON ;1E*	*44.77*
290108	*LEEDK;1U E*	*66.12*
274770	*LINCOLN ;1U*	*6.07*
274771	*LINCOLN ;2U*	*6.07*
274772	*LINCOLN ;3U*	*6.07*
274773	*LINCOLN ;4U*	*6.07*
274774	*LINCOLN ;5U*	*6.07*
274775	*LINCOLN ;6U*	*6.07*
274776	*LINCOLN ;7U*	*6.07*
274777	*LINCOLN ;8U*	*6.07*
274850	*MENDOTA H;RU*	*16.29*
293061	*N-015 E*	*41.55*
293516	*O-009 E1*	*24.16*
293517	*O-009 E2*	*12.27*
293518	*O-009 E3*	*13.51*
293715	*O-029 E*	*25.83*

293716	*O-029 E*	*14.16*
293717	*O-029 E*	*13.02*
293771	*O-035 E*	*16.66*
293644	*O22 E1*	*25.57*
293645	*O22 E2*	*49.63*
290021	*O50 E*	*49.76*
294392	*P-010 E*	*52.76*
294763	*P-046 E*	*25.12*
274888	*PILOT HIL;1E*	*44.77*
274830	*PWR VTREC;1U*	*16.37*
274831	*PWR VTREC;2U*	*16.37*
296308	*R-030 C1*	*9.3*
296271	*R-030 C2*	*9.3*
296125	*R-030 C3*	*9.41*
296309	*R-030 E1*	*37.2*
296272	*R-030 E2*	*37.2*
296128	*R-030 E3*	*37.65*
274722	*S-055 E*	*29.84*
884780	*S58 FTIR*	*206.05*
884781	*S58 NFTIR*	*618.14*
295111	*SUBLETTE E*	*7.37*
299993	*U3-031C*	*16.07*
903433	*W3-046*	*61.11*
274874	*WALNR;2U*	*6.38*
294502	*WALNR;2U E*	*25.52*
295109	*WESTBROOK E*	*15.16*
274687	*WILL CNTY;4U*	*167.32*
910542	*X3-005 E*	*1.59*
914641	*Y2-103*	*119.35*
915011	*Y3-013 1*	*9.95*
915021	*Y3-013 2*	*9.95*
915031	*Y3-013 3*	*9.95*
916502	*Z1-106 E1*	*3.44*
916504	*Z1-106 E2*	*3.44*
916512	*Z1-107 E*	*6.59*
916522	*Z1-108 E*	*6.68*
916651	*Z1-127 1*	*4.12*
916652	*Z1-127 2*	*2.13*
917501	*Z2-087 C*	*4.24*
917502	*Z2-087 E*	*28.34*
918051	*AA1-018 C*	*6.1*
918052	*AA1-018 E*	*40.84*
918972	*AA1-116 E*	*6.4*
918982	*AA1-117 E*	*6.4*
919221	*AA1-146*	*46.9*

919581	*AA2-030*	*46.9*
919591	*AA2-035*	*388.95*
920112	*AA2-107 E*	*6.71*
920272	*AA2-123 E*	*6.56*
930481	*AB1-089*	*176.79*
930491	*AB1-090*	*176.79*
930501	*AB1-091*	*174.23*
930761	*AB1-122 1*	*194.37*
930771	*AB1-122 2*	*190.55*
931221	*AB1-172*	*2.04*
924471	*AB2-096*	*113.65*
925161	*AB2-173*	*8.36*
925301	*AB2-191 C*	*3.43*
925302	*AB2-191 E*	*3.04*
926311	*AC1-109 1*	*5.26*
926321	*AC1-109 2*	*5.26*
926331	*AC1-110 1*	*5.17*
926341	*AC1-110 2*	*5.17*
926351	*AC1-111 1*	*2.09*
926361	*AC1-111 2*	*2.09*
926371	*AC1-111 3*	*2.09*
926381	*AC1-111 4*	*2.09*
926391	*AC1-111 5*	*2.09*
926401	*AC1-111 6*	*2.09*
927511	*AC1-113 1*	*3.19*
927522	*AC1-113 2*	*3.19*
926431	*AC1-114*	*6.38*
927451	*AC1-142A 1*	*10.71*
927461	*AC1-142A 2*	*10.71*
926701	*AC1-153 C1*	*211.28*
926711	*AC1-153 C2*	*207.12*
926702	*AC1-153 E1*	*8.45*
926712	*AC1-153 E2*	*8.28*
926821	*AC1-168 C*	*3.04*
926822	*AC1-168 E*	*20.4*
927531	*AC1-185 1*	*1.84*
927541	*AC1-185 2*	*1.84*
927551	*AC1-185 3*	*1.84*
927561	*AC1-185 4*	*1.84*
927571	*AC1-185 5*	*1.84*
927581	*AC1-185 6*	*1.84*
927591	*AC1-185 7*	*1.84*
927601	*AC1-185 8*	*1.84*
927091	*AC1-204 1*	*186.09*
927101	*AC1-204 2*	*186.13*

927201	*AC1-214 C*	*5.35*
927202	*AC1-214 E*	*14.21*

Appendix 7

(CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 130.18% to 131.86% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 128.06 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.82*
932012	*AC2-007 E*	*1.53*
932881	*AC2-115 1*	*2.33*
932891	*AC2-115 2*	*2.33*
932921	*AC2-116*	*0.81*
932931	*AC2-117*	*5.4*
933341	*AC2-147 C*	*0.85*
933342	*AC2-147 E*	*1.39*
933351	*AC2-148 C*	*0.84*
933352	*AC2-148 E*	*1.37*
933361	*AC2-149 C*	*0.91*
933362	*AC2-149 E*	*1.49*
933371	*AC2-150 C*	*0.84*
933372	*AC2-150 E*	*1.37*
933381	*AC2-151 C*	*0.95*
933382	*AC2-151 E*	*1.55*
933401	*AC2-153 C*	*0.46*
933402	*AC2-153 E*	*0.75*
933411	*AC2-154 C*	*2.89*
933412	*AC2-154 E*	*4.71*
933431	*AC2-156 C*	*0.94*
933432	*AC2-156 E*	*1.53*
933511	*AC2-166 C*	*2.29*
933512	*AC2-166 E*	*2.53*
933911	*AD1-013 C O1*	*1.8*
933912	*AD1-013 E O1*	*2.87*
933931	*AD1-016 C*	*0.91*
933932	*AD1-016 E*	*1.48*
934001	*AD1-024 C*	*2.73*
934002	*AD1-024 E*	*4.45*
934101	*AD1-039 1*	*7.6*
934111	*AD1-039 2*	*7.78*

934401	*AD1-064 C O1*	*3.17*
934402	*AD1-064 E O1*	*14.84*
934431	*AD1-067 C*	*0.13*
934432	*AD1-067 E*	*0.54*
934651	*AD1-096 C*	*0.87*
934652	*AD1-096 E*	*1.42*
934701	*AD1-098 C O1*	*6.72*
934702	*AD1-098 E O1*	*4.9*
934721	*AD1-100 C*	*22.54*
934722	*AD1-100 E*	*105.52*
934871	*AD1-116 C*	*0.99*
934872	*AD1-116 E*	*1.62*
934881	*AD1-117 C*	*5.23*
934882	*AD1-117 E*	*3.49*
934941	*AD1-126 C*	*5.72*
934942	*AD1-126 E*	*3.82*
934971	*AD1-129 C*	*0.88*
934972	*AD1-129 E*	*0.59*
935001	*AD1-133 C O1*	*20.4*
935002	*AD1-133 E O1*	*13.6*
274890	*CAYUG;1U E*	*13.37*
274891	*CAYUG;2U E*	*13.37*
274859	*EASYR;U1 E*	*10.7*
274860	*EASYR;U2 E*	*10.7*
290051	*GSG-6; E*	*10.21*
275149	*KEMPTON ;1E*	*21.27*
290108	*LEEDK;1U E*	*23.76*
274850	*MENDOTA H;RU*	*5.87*
293061	*N-015 E*	*14.99*
293644	*O22 E1*	*9.29*
293645	*O22 E2*	*18.03*
290021	*O50 E*	*18.72*
294392	*P-010 E*	*19.04*
294763	*P-046 E*	*9.15*
274888	*PILOT HIL;1E*	*21.27*
274830	*PWR VTREC;1U*	*5.97*
274831	*PWR VTREC;2U*	*5.97*
274723	*RIVER EC ;12*	*5.5*
274722	*S-055 E*	*11.05*
884780	*S58 FTIR*	*53.1*
884781	*S58 NFTIR*	*159.29*
274794	*SE CHICAG;1U*	*1.22*
274795	*SE CHICAG;2U*	*1.22*
295111	*SUBLETTE E*	*2.66*
299993	*U3-031C*	*5.66*

903433	*W3-046*	*23.03*
274874	*WALNR;2U*	*2.32*
294502	*WALNR;2U E*	*9.27*
295109	*WESTBROOK E*	*5.46*
274687	*WILL CNTY;4U*	*64.65*
910541	*X3-005 C*	*0.11*
910542	*X3-005 E*	*0.91*
914641	*Y2-103*	*44.22*
915011	*Y3-013 1*	*3.68*
915021	*Y3-013 2*	*3.68*
915031	*Y3-013 3*	*3.68*
916502	*Z1-106 E1*	*1.24*
916504	*Z1-106 E2*	*1.24*
916512	*Z1-107 E*	*2.61*
916522	*Z1-108 E*	*2.44*
916651	*Z1-127 1*	*1.81*
916652	*Z1-127 2*	*0.89*
918051	*AA1-018 C*	*2.54*
918052	*AA1-018 E*	*17.03*
918972	*AA1-116 E*	*3.04*
918982	*AA1-117 E*	*3.04*
919221	*AA1-146*	*17.07*
919581	*AA2-030*	*17.07*
919591	*AA2-035*	*130.09*
920112	*AA2-107 E*	*2.41*
920272	*AA2-123 E*	*2.39*
930481	*AB1-089*	*64.28*
930491	*AB1-090*	*64.28*
930501	*AB1-091*	*93.67*
930761	*AB1-122 1*	*69.89*
930771	*AB1-122 2*	*71.58*
931221	*AB1-172*	*0.81*
924471	*AB2-096*	*41.46*
925161	*AB2-173*	*3.04*
925301	*AB2-191 C*	*1.24*
925302	*AB2-191 E*	*1.1*
925881	*AC1-067*	*308.11*
926311	*AC1-109 1*	*1.88*
926321	*AC1-109 2*	*1.88*
926331	*AC1-110 1*	*1.87*
926341	*AC1-110 2*	*1.87*
926351	*AC1-111 1*	*0.75*
926361	*AC1-111 2*	*0.75*
926371	*AC1-111 3*	*0.75*
926381	*AC1-111 4*	*0.75*

926391	*AC1-111 5*	*0.75*
926401	*AC1-111 6*	*0.75*
927511	*AC1-113 1*	*1.16*
927522	*AC1-113 2*	*1.16*
926431	*AC1-114*	*2.33*
927451	*AC1-142A 1*	*4.13*
927461	*AC1-142A 2*	*4.12*
926701	*AC1-153 C1*	*75.97*
926711	*AC1-153 C2*	*77.8*
926702	*AC1-153 E1*	*3.04*
926712	*AC1-153 E2*	*3.11*
926821	*AC1-168 C*	*1.01*
926822	*AC1-168 E*	*6.76*
927531	*AC1-185 1*	*0.67*
927541	*AC1-185 2*	*0.67*
927551	*AC1-185 3*	*0.67*
927561	*AC1-185 4*	*0.67*
927571	*AC1-185 5*	*0.67*
927581	*AC1-185 6*	*0.67*
927591	*AC1-185 7*	*0.67*
927601	*AC1-185 8*	*0.67*
927091	*AC1-204 1*	*70.64*
927101	*AC1-204 2*	*70.7*

Appendix 8

(CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 110.41% to 111.83% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 86.47 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.57*
932012	*AC2-007 E*	*1.05*
932881	*AC2-115 1*	*1.61*
932891	*AC2-115 2*	*1.61*
932921	*AC2-116*	*0.56*
933341	*AC2-147 C*	*0.59*
933342	*AC2-147 E*	*0.96*
933351	*AC2-148 C*	*0.58*
933352	*AC2-148 E*	*0.95*
933361	*AC2-149 C*	*0.63*
933362	*AC2-149 E*	*1.02*
933371	*AC2-150 C*	*0.58*
933372	*AC2-150 E*	*0.95*
933381	*AC2-151 C*	*0.65*
933382	*AC2-151 E*	*1.07*
933401	*AC2-153 C*	*0.31*
933402	*AC2-153 E*	*0.51*
933411	*AC2-154 C*	*1.7*
933412	*AC2-154 E*	*2.78*
933431	*AC2-156 C*	*0.64*
933432	*AC2-156 E*	*1.05*
933511	*AC2-166 C*	*1.57*
933512	*AC2-166 E*	*1.74*
933911	*AD1-013 C O1*	*1.24*
933912	*AD1-013 E O1*	*1.98*
933931	*AD1-016 C*	*0.63*
933932	*AD1-016 E*	*1.02*
934001	*AD1-024 C*	*1.68*
934002	*AD1-024 E*	*2.75*
934101	*AD1-039 1*	*5.2*
934111	*AD1-039 2*	*5.49*
934401	*AD1-064 C O1*	*2.19*
934402	*AD1-064 E O1*	*10.24*

934431	*AD1-067 C*	*0.09*
934432	*AD1-067 E*	*0.37*
934651	*AD1-096 C*	*0.6*
934652	*AD1-096 E*	*0.98*
934701	*AD1-098 C O1*	*4.63*
934702	*AD1-098 E O1*	*3.38*
934721	*AD1-100 C*	*15.22*
934722	*AD1-100 E*	*71.25*
934871	*AD1-116 C*	*0.63*
934872	*AD1-116 E*	*1.02*
934881	*AD1-117 C*	*3.62*
934882	*AD1-117 E*	*2.41*
934941	*AD1-126 C*	*3.94*
934942	*AD1-126 E*	*2.63*
934971	*AD1-129 C*	*0.61*
934972	*AD1-129 E*	*0.41*
935001	*AD1-133 C O1*	*13.91*
935002	*AD1-133 E O1*	*9.28*
274890	*CAYUG;1U E*	*9.03*
274891	*CAYUG;2U E*	*9.03*
274751	*CRETE EC ;1U*	*2.49*
274752	*CRETE EC ;2U*	*2.49*
274753	*CRETE EC ;3U*	*2.49*
274754	*CRETE EC ;4U*	*2.49*
274859	*EASYR;U1 E*	*7.4*
274860	*EASYR;U2 E*	*7.4*
290051	*GSG-6; E*	*7.04*
951131	*J643*	*15.61*
981291	*J740 C*	*4.38*
981292	*J740 E*	*17.51*
275149	*KEMPTON ;1E*	*12.54*
290108	*LEEDK;1U E*	*16.37*
274850	*MENDOTA H;RU*	*4.05*
293061	*N-015 E*	*10.41*
293516	*O-009 E1*	*4.75*
293517	*O-009 E2*	*2.41*
293518	*O-009 E3*	*2.66*
293715	*O-029 E*	*6.54*
293716	*O-029 E*	*3.58*
293717	*O-029 E*	*3.29*
293644	*O22 E1*	*7.36*
293645	*O22 E2*	*14.3*
290021	*O50 E*	*13.18*
294392	*P-010 E*	*13.23*
294763	*P-046 E*	*6.32*

274888	*PILOT HIL;1E*	*12.54*
274830	*PWR VTREC;1U*	*4.12*
274831	*PWR VTREC;2U*	*4.12*
274722	*S-055 E*	*7.63*
884780	*S58 FTIR*	*34.95*
884781	*S58 NFTIR*	*104.84*
295111	*SUBLETTE E*	*1.83*
299993	*U3-031C*	*3.55*
903433	*W3-046*	*16.18*
274874	*WALNR;2U*	*1.61*
294502	*WALNR;2U E*	*6.42*
295109	*WESTBROOK E*	*3.77*
274687	*WILL CNTY;4U*	*47.06*
910542	*X3-005 E*	*0.53*
914641	*Y2-103*	*30.52*
915011	*Y3-013 1*	*2.54*
915021	*Y3-013 2*	*2.54*
915031	*Y3-013 3*	*2.54*
916502	*Z1-106 E1*	*0.85*
916504	*Z1-106 E2*	*0.85*
916512	*Z1-107 E*	*1.73*
916522	*Z1-108 E*	*1.68*
916651	*Z1-127 1*	*1.19*
916652	*Z1-127 2*	*0.54*
918051	*AA1-018 C*	*1.6*
918052	*AA1-018 E*	*10.73*
918972	*AA1-116 E*	*1.79*
918982	*AA1-117 E*	*1.79*
919221	*AA1-146*	*11.83*
919581	*AA2-030*	*11.83*
919591	*AA2-035*	*87.13*
920112	*AA2-107 E*	*1.66*
920272	*AA2-123 E*	*1.65*
930481	*AB1-089*	*44.39*
930491	*AB1-090*	*44.39*
930501	*AB1-091*	*50.2*
930761	*AB1-122 1*	*47.85*
930771	*AB1-122 2*	*50.48*
931221	*AB1-172*	*0.54*
924471	*AB2-096*	*28.61*
925161	*AB2-173*	*2.11*
925301	*AB2-191 C*	*0.85*
925302	*AB2-191 E*	*0.76*
925881	*AC1-067*	*104.09*
926311	*AC1-109 1*	*1.29*

926321	*AC1-109 2*	*1.29*
926331	*AC1-110 1*	*1.29*
926341	*AC1-110 2*	*1.29*
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*
927522	*AC1-113 2*	*0.8*
926431	*AC1-114*	*1.61*
927451	*AC1-142A 1*	*2.87*
927461	*AC1-142A 2*	*2.87*
926701	*AC1-153 C1*	*52.01*
926711	*AC1-153 C2*	*54.87*
926702	*AC1-153 E1*	*2.08*
926712	*AC1-153 E2*	*2.19*
926821	*AC1-168 C*	*0.78*
926822	*AC1-168 E*	*5.21*
927531	*AC1-185 1*	*0.46*
927541	*AC1-185 2*	*0.46*
927551	*AC1-185 3*	*0.46*
927561	*AC1-185 4*	*0.46*
927571	*AC1-185 5*	*0.46*
927581	*AC1-185 6*	*0.46*
927591	*AC1-185 7*	*0.46*
927601	*AC1-185 8*	*0.46*
927091	*AC1-204 1*	*49.44*
927101	*AC1-204 2*	*49.4*

Appendix 9

(CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 109.37% to 110.77% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 93.03 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.63*
932012	*AC2-007 E*	*1.17*
932881	*AC2-115 1*	*1.78*
932891	*AC2-115 2*	*1.78*
932921	*AC2-116*	*0.62*
933341	*AC2-147 C*	*0.65*
933342	*AC2-147 E*	*1.06*
933351	*AC2-148 C*	*0.64*
933352	*AC2-148 E*	*1.05*
933361	*AC2-149 C*	*0.69*
933362	*AC2-149 E*	*1.13*
933371	*AC2-150 C*	*0.64*
933372	*AC2-150 E*	*1.05*
933381	*AC2-151 C*	*0.72*
933382	*AC2-151 E*	*1.18*
933401	*AC2-153 C*	*0.35*
933402	*AC2-153 E*	*0.57*
933411	*AC2-154 C*	*1.74*
933412	*AC2-154 E*	*2.84*
933431	*AC2-156 C*	*0.71*
933432	*AC2-156 E*	*1.16*
933511	*AC2-166 C*	*1.74*
933512	*AC2-166 E*	*1.92*
933911	*AD1-013 C O1*	*1.37*
933912	*AD1-013 E O1*	*2.19*
933931	*AD1-016 C*	*0.7*
933932	*AD1-016 E*	*1.13*
934001	*AD1-024 C*	*1.77*
934002	*AD1-024 E*	*2.88*
934101	*AD1-039 1*	*5.74*
934111	*AD1-039 2*	*6.15*
934401	*AD1-064 C O1*	*2.42*

934402	*AD1-064 E O1*	*11.35*
934431	*AD1-067 C*	*0.1*
934432	*AD1-067 E*	*0.41*
934651	*AD1-096 C*	*0.67*
934652	*AD1-096 E*	*1.09*
934701	*AD1-098 C O1*	*5.13*
934702	*AD1-098 E O1*	*3.74*
934721	*AD1-100 C*	*16.37*
934722	*AD1-100 E*	*76.66*
934871	*AD1-116 C*	*0.68*
934872	*AD1-116 E*	*1.1*
934881	*AD1-117 C*	*4.*
934882	*AD1-117 E*	*2.67*
934941	*AD1-126 C*	*4.36*
934942	*AD1-126 E*	*2.91*
934971	*AD1-129 C*	*0.68*
934972	*AD1-129 E*	*0.45*
935001	*AD1-133 C O1*	*15.2*
935002	*AD1-133 E O1*	*10.14*
274654	*BRAIDWOOD;1U*	*24.35*
274655	*BRAIDWOOD;2U*	*23.69*
274751	*CRETE EC ;1U*	*4.32*
274752	*CRETE EC ;2U*	*4.32*
274753	*CRETE EC ;3U*	*4.32*
274754	*CRETE EC ;4U*	*4.32*
274859	*EASYR;U1 E*	*8.2*
274860	*EASYR;U2 E*	*8.2*
290051	*GSG-6; E*	*7.79*
275149	*KEMPTON ;1E*	*12.84*
274704	*KENDALL ;1C*	*3.62*
274705	*KENDALL ;1S*	*2.41*
274706	*KENDALL ;2C*	*3.62*
274707	*KENDALL ;2S*	*2.41*
274660	*LASCO STA;1U*	*22.68*
274661	*LASCO STA;2U*	*22.72*
290108	*LEEDK;1U E*	*18.12*
274850	*MENDOTA H;RU*	*4.48*
293061	*N-015 E*	*11.71*
293644	*O22 E1*	*8.59*
293645	*O22 E2*	*16.67*
290021	*O50 E*	*14.73*
294392	*P-010 E*	*14.87*
294763	*P-046 E*	*7.01*
274888	*PILOT HIL;1E*	*12.84*
274830	*PWR VTREC;1U*	*4.57*

274831	*PWR VTREC;2U*	*4.57*
274722	*S-055 E*	*8.48*
884780	*S58 FTIR*	*37.57*
884781	*S58 NFTIR*	*112.7*
295111	*SUBLETTE E*	*2.03*
274861	*TOP CROP ;1U*	*0.42*
274862	*TOP CROP ;2U*	*0.82*
299993	*U3-031C*	*3.69*
903433	*W3-046*	*18.05*
274874	*WALNR;2U*	*1.78*
294502	*WALNR;2U E*	*7.11*
295109	*WESTBROOK E*	*4.17*
274687	*WILL CNTY;4U*	*52.69*
914641	*Y2-103*	*33.9*
915011	*Y3-013 1*	*2.83*
915021	*Y3-013 2*	*2.83*
915031	*Y3-013 3*	*2.83*
916502	*Z1-106 E1*	*0.95*
916504	*Z1-106 E2*	*0.95*
916512	*Z1-107 E*	*1.85*
916522	*Z1-108 E*	*1.87*
916651	*Z1-127 1*	*1.16*
916652	*Z1-127 2*	*0.57*
918051	*AA1-018 C*	*1.74*
918052	*AA1-018 E*	*11.62*
918972	*AA1-116 E*	*1.83*
918982	*AA1-117 E*	*1.83*
919221	*AA1-146*	*3.39*
919581	*AA2-030*	*13.09*
919591	*AA2-035*	*95.31*
920112	*AA2-107 E*	*1.83*
920272	*AA2-123 E*	*1.83*
930481	*AB1-089*	*49.2*
930491	*AB1-090*	*49.2*
930501	*AB1-091*	*50.9*
930761	*AB1-122 1*	*52.8*
930771	*AB1-122 2*	*56.57*
931221	*AB1-172*	*0.57*
924471	*AB2-096*	*31.72*
925161	*AB2-173*	*2.33*
925301	*AB2-191 C*	*0.94*
925302	*AB2-191 E*	*0.84*
926311	*AC1-109 1*	*1.42*
926321	*AC1-109 2*	*1.42*
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*
927522	*AC1-113 2*	*0.89*
926431	*AC1-114*	*1.78*
927451	*AC1-142A 1*	*3.21*
927461	*AC1-142A 2*	*3.21*
926701	*AC1-153 C1*	*57.39*
926711	*AC1-153 C2*	*61.49*
926702	*AC1-153 E1*	*2.3*
926712	*AC1-153 E2*	*2.46*
926821	*AC1-168 C*	*0.86*
926822	*AC1-168 E*	*5.78*
927531	*AC1-185 1*	*0.51*
927541	*AC1-185 2*	*0.51*
927551	*AC1-185 3*	*0.51*
927561	*AC1-185 4*	*0.51*
927571	*AC1-185 5*	*0.51*
927581	*AC1-185 6*	*0.51*
927591	*AC1-185 7*	*0.51*
927601	*AC1-185 8*	*0.51*
927091	*AC1-204 1*	*55.4*
927101	*AC1-204 2*	*55.32*

Appendix 10

(CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 142.36% to 144.89% (**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 200.41 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*
932011	*AC2-007 C*	*1.03*
932012	*AC2-007 E*	*1.92*
932881	*AC2-115 1*	*2.92*
932891	*AC2-115 2*	*2.92*
932921	*AC2-116*	*1.02*
932931	*AC2-117*	*6.53*
933341	*AC2-147 C*	*1.07*
933342	*AC2-147 E*	*1.75*
933361	*AC2-149 C*	*1.14*
933362	*AC2-149 E*	*1.86*
933381	*AC2-151 C*	*1.21*
933382	*AC2-151 E*	*1.97*
933391	*AC2-152 C*	*0.57*
933392	*AC2-152 E*	*0.94*
933401	*AC2-153 C*	*0.57*
933402	*AC2-153 E*	*0.93*
933411	*AC2-154 C*	*3.21*
933412	*AC2-154 E*	*5.24*
933431	*AC2-156 C*	*1.17*
933432	*AC2-156 E*	*1.91*
933511	*AC2-166 C*	*2.86*
933512	*AC2-166 E*	*3.16*
933911	*AD1-013 C O1*	*2.26*
933912	*AD1-013 E O1*	*3.61*
933931	*AD1-016 C*	*1.14*
933932	*AD1-016 E*	*1.86*
934001	*AD1-024 C*	*3.14*
934002	*AD1-024 E*	*5.13*
934101	*AD1-039 1*	*9.68*
934111	*AD1-039 2*	*9.86*
934401	*AD1-064 C O1*	*3.97*
934402	*AD1-064 E O1*	*18.61*

934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.68*
934651	*AD1-096 C*	*1.1*
934652	*AD1-096 E*	*1.79*
934701	*AD1-098 C O1*	*8.44*
934702	*AD1-098 E O1*	*6.16*
934721	*AD1-100 C*	*35.27*
934722	*AD1-100 E*	*165.14*
934871	*AD1-116 C*	*1.18*
934872	*AD1-116 E*	*1.92*
934881	*AD1-117 C*	*6.6*
934882	*AD1-117 E*	*4.4*
934941	*AD1-126 C*	*7.17*
934942	*AD1-126 E*	*4.78*
934971	*AD1-129 C*	*1.11*
934972	*AD1-129 E*	*0.74*
935001	*AD1-133 C O1*	*27.74*
935002	*AD1-133 E O1*	*18.49*
274890	*CAYUG;1U E*	*20.69*
274891	*CAYUG;2U E*	*20.69*
290051	*GSG-6; E*	*12.83*
275149	*KEMPTON ;1E*	*23.69*
290108	*LEEDK;1U E*	*29.79*
274770	*LINCOLN ;1U*	*4.36*
274771	*LINCOLN ;2U*	*4.36*
274772	*LINCOLN ;3U*	*4.36*
274773	*LINCOLN ;4U*	*4.36*
274774	*LINCOLN ;5U*	*4.36*
274775	*LINCOLN ;6U*	*4.36*
274776	*LINCOLN ;7U*	*4.36*
274777	*LINCOLN ;8U*	*4.36*
274850	*MENDOTA H;RU*	*7.38*
293061	*N-015 E*	*19.24*
293644	*O22 E1*	*12.63*
293645	*O22 E2*	*24.52*
290021	*O50 E*	*23.89*
294392	*P-010 E*	*24.44*
294763	*P-046 E*	*11.52*
274888	*PILOT HIL;1E*	*23.69*
274830	*PWR VTREC;1U*	*7.49*
274831	*PWR VTREC;2U*	*7.49*
296308	*R-030 C1*	*5.02*
296271	*R-030 C2*	*5.02*
296125	*R-030 C3*	*5.08*
296309	*R-030 E1*	*20.06*

296272	*R-030 E2*	*20.06*
296128	*R-030 E3*	*20.31*
274722	*S-055 E*	*13.81*
884780	*S58 FTIR*	*63.32*
884781	*S58 NFTIR*	*189.95*
295111	*SUBLETTE E*	*3.34*
299993	*U3-031C*	*11.55*
903433	*W3-046*	*29.56*
295109	*WESTBROOK E*	*6.87*
274687	*WILL CNTY;4U*	*82.27*
910542	*X3-005 E*	*0.91*
914641	*Y2-103*	*55.22*
915011	*Y3-013 1*	*4.6*
915021	*Y3-013 2*	*4.6*
915031	*Y3-013 3*	*4.6*
916502	*Z1-106 E1*	*1.55*
916504	*Z1-106 E2*	*1.55*
916512	*Z1-107 E*	*3.18*
916522	*Z1-108 E*	*3.05*
916651	*Z1-127 1*	*2.14*
916652	*Z1-127 2*	*1.05*
917501	*Z2-087 C*	*3.92*
917502	*Z2-087 E*	*26.24*
918051	*AA1-018 C*	*3.03*
918052	*AA1-018 E*	*20.25*
918972	*AA1-116 E*	*3.38*
918982	*AA1-117 E*	*3.38*
919591	*AA2-035*	*161.05*
920112	*AA2-107 E*	*3.01*
920272	*AA2-123 E*	*3.*
930481	*AB1-089*	*80.75*
930491	*AB1-090*	*80.75*
930501	*AB1-091*	*91.4*
930761	*AB1-122 1*	*89.1*
930771	*AB1-122 2*	*90.74*
931221	*AB1-172*	*0.99*
924041	*AB2-047 C O1*	*4.84*
924042	*AB2-047 E O1*	*32.38*
924471	*AB2-096*	*52.*
925301	*AB2-191 C*	*1.55*
925302	*AB2-191 E*	*1.38*
925881	*AC1-067*	*168.19*
926311	*AC1-109 1*	*2.35*
926321	*AC1-109 2*	*2.35*
926331	*AC1-110 1*	*2.33*

926341	*AC1-110 2*	*2.33*
926351	*AC1-111 1*	*0.94*
926361	*AC1-111 2*	*0.94*
926371	*AC1-111 3*	*0.94*
926381	*AC1-111 4*	*0.94*
926391	*AC1-111 5*	*0.94*
926401	*AC1-111 6*	*0.94*
927511	*AC1-113 1*	*1.46*
927522	*AC1-113 2*	*1.46*
926431	*AC1-114*	*2.92*
927451	*AC1-142A 1*	*5.15*
927461	*AC1-142A 2*	*5.15*
926701	*AC1-153 C1*	*96.84*
926711	*AC1-153 C2*	*98.63*
926702	*AC1-153 E1*	*3.87*
926712	*AC1-153 E2*	*3.94*
927531	*AC1-185 1*	*0.02*
927541	*AC1-185 2*	*0.02*
927551	*AC1-185 3*	*0.02*
927561	*AC1-185 4*	*0.02*
927571	*AC1-185 5*	*0.02*
927581	*AC1-185 6*	*0.02*
927591	*AC1-185 7*	*0.02*
927601	*AC1-185 8*	*0.02*
927091	*AC1-204 1*	*89.41*
927101	*AC1-204 2*	*89.41*

Appendix 11

(CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 145.39% to 147.97% (**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 204.35 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*
932011	*AC2-007 C*	*1.05*
932012	*AC2-007 E*	*1.96*
932881	*AC2-115 1*	*2.98*
932891	*AC2-115 2*	*2.98*
932921	*AC2-116*	*1.04*
932931	*AC2-117*	*6.67*
933341	*AC2-147 C*	*1.09*
933342	*AC2-147 E*	*1.79*
933361	*AC2-149 C*	*1.17*
933362	*AC2-149 E*	*1.9*
933381	*AC2-151 C*	*1.23*
933382	*AC2-151 E*	*2.01*
933391	*AC2-152 C*	*0.59*
933392	*AC2-152 E*	*0.96*
933401	*AC2-153 C*	*0.58*
933402	*AC2-153 E*	*0.95*
933411	*AC2-154 C*	*3.28*
933412	*AC2-154 E*	*5.35*
933431	*AC2-156 C*	*1.2*
933432	*AC2-156 E*	*1.95*
933511	*AC2-166 C*	*2.92*
933512	*AC2-166 E*	*3.23*
933911	*AD1-013 C O1*	*2.31*
933912	*AD1-013 E O1*	*3.68*
933931	*AD1-016 C*	*1.16*
933932	*AD1-016 E*	*1.9*
934001	*AD1-024 C*	*3.21*
934002	*AD1-024 E*	*5.23*
934101	*AD1-039 1*	*9.89*
934111	*AD1-039 2*	*10.07*
934401	*AD1-064 C O1*	*4.06*
934402	*AD1-064 E O1*	*19.*

934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.69*
934651	*AD1-096 C*	*1.12*
934652	*AD1-096 E*	*1.82*
934701	*AD1-098 C O1*	*8.62*
934702	*AD1-098 E O1*	*6.3*
934721	*AD1-100 C*	*35.97*
934722	*AD1-100 E*	*168.38*
934871	*AD1-116 C*	*1.21*
934872	*AD1-116 E*	*1.97*
934881	*AD1-117 C*	*6.74*
934882	*AD1-117 E*	*4.49*
934941	*AD1-126 C*	*7.33*
934942	*AD1-126 E*	*4.88*
934971	*AD1-129 C*	*1.13*
934972	*AD1-129 E*	*0.75*
935001	*AD1-133 C O1*	*28.31*
935002	*AD1-133 E O1*	*18.88*
274890	*CAYUG;1U E*	*21.1*
274891	*CAYUG;2U E*	*21.1*
290051	*GSG-6; E*	*13.1*
275149	*KEMPTON ;1E*	*24.18*
290108	*LEEDK;1U E*	*30.43*
274770	*LINCOLN ;1U*	*4.48*
274771	*LINCOLN ;2U*	*4.48*
274772	*LINCOLN ;3U*	*4.48*
274773	*LINCOLN ;4U*	*4.48*
274774	*LINCOLN ;5U*	*4.48*
274775	*LINCOLN ;6U*	*4.48*
274776	*LINCOLN ;7U*	*4.48*
274777	*LINCOLN ;8U*	*4.48*
274850	*MENDOTA H;RU*	*7.54*
293061	*N-015 E*	*19.65*
293644	*O22 E1*	*12.9*
293645	*O22 E2*	*25.03*
290021	*O50 E*	*24.4*
294392	*P-010 E*	*24.95*
294763	*P-046 E*	*11.76*
274888	*PILOT HIL;1E*	*24.18*
274830	*PWR VTREC;1U*	*7.65*
274831	*PWR VTREC;2U*	*7.65*
296308	*R-030 C1*	*5.12*
296271	*R-030 C2*	*5.12*
296125	*R-030 C3*	*5.18*
296309	*R-030 E1*	*20.47*

296272	*R-030 E2*	*20.47*
296128	*R-030 E3*	*20.72*
274722	*S-055 E*	*14.1*
884780	*S58 FTIR*	*64.66*
884781	*S58 NFTIR*	*193.98*
295111	*SUBLETTE E*	*3.41*
299993	*U3-031C*	*11.85*
903433	*W3-046*	*30.19*
295109	*WESTBROOK E*	*7.01*
274687	*WILL CNTY;4U*	*84.02*
910542	*X3-005 E*	*0.92*
914641	*Y2-103*	*56.4*
915011	*Y3-013 1*	*4.7*
915021	*Y3-013 2*	*4.7*
915031	*Y3-013 3*	*4.7*
916502	*Z1-106 E1*	*1.58*
916504	*Z1-106 E2*	*1.58*
916512	*Z1-107 E*	*3.25*
916522	*Z1-108 E*	*3.12*
916651	*Z1-127 1*	*2.19*
916652	*Z1-127 2*	*1.07*
917501	*Z2-087 C*	*4.*
917502	*Z2-087 E*	*26.77*
918051	*AA1-018 C*	*3.09*
918052	*AA1-018 E*	*20.69*
918972	*AA1-116 E*	*3.45*
918982	*AA1-117 E*	*3.45*
919591	*AA2-035*	*164.48*
920112	*AA2-107 E*	*3.08*
920272	*AA2-123 E*	*3.06*
930481	*AB1-089*	*82.47*
930491	*AB1-090*	*82.47*
930501	*AB1-091*	*93.33*
930761	*AB1-122 1*	*90.98*
930771	*AB1-122 2*	*92.67*
931221	*AB1-172*	*1.01*
924041	*AB2-047 C O1*	*4.94*
924042	*AB2-047 E O1*	*33.03*
924471	*AB2-096*	*53.1*
925301	*AB2-191 C*	*1.59*
925302	*AB2-191 E*	*1.41*
925881	*AC1-067*	*171.92*
926311	*AC1-109 1*	*2.4*
926321	*AC1-109 2*	*2.4*
926331	*AC1-110 1*	*2.38*

926341	*AC1-110 2*	*2.38*
926351	*AC1-111 1*	*0.96*
926361	*AC1-111 2*	*0.96*
926371	*AC1-111 3*	*0.96*
926381	*AC1-111 4*	*0.96*
926391	*AC1-111 5*	*0.96*
926401	*AC1-111 6*	*0.96*
927511	*AC1-113 1*	*1.49*
927522	*AC1-113 2*	*1.49*
926431	*AC1-114*	*2.98*
927451	*AC1-142A 1*	*5.26*
927461	*AC1-142A 2*	*5.26*
926701	*AC1-153 C1*	*98.89*
926711	*AC1-153 C2*	*100.73*
926702	*AC1-153 E1*	*3.96*
926712	*AC1-153 E2*	*4.03*
927531	*AC1-185 1*	*0.02*
927541	*AC1-185 2*	*0.02*
927551	*AC1-185 3*	*0.02*
927561	*AC1-185 4*	*0.02*
927571	*AC1-185 5*	*0.02*
927581	*AC1-185 6*	*0.02*
927591	*AC1-185 7*	*0.02*
927601	*AC1-185 8*	*0.02*
927091	*AC1-204 1*	*91.32*
927101	*AC1-204 2*	*91.31*

Appendix 12

(CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.61% to 128.12% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 128.07 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.88*
932012	*AC2-007 E*	*1.64*
932881	*AC2-115 1*	*2.5*
932891	*AC2-115 2*	*2.5*
932921	*AC2-116*	*0.87*
933341	*AC2-147 C*	*0.91*
933342	*AC2-147 E*	*1.49*
933351	*AC2-148 C*	*0.9*
933352	*AC2-148 E*	*1.47*
933361	*AC2-149 C*	*0.97*
933362	*AC2-149 E*	*1.59*
933371	*AC2-150 C*	*0.9*
933372	*AC2-150 E*	*1.47*
933381	*AC2-151 C*	*1.02*
933382	*AC2-151 E*	*1.66*
933401	*AC2-153 C*	*0.49*
933402	*AC2-153 E*	*0.8*
933411	*AC2-154 C*	*2.31*
933412	*AC2-154 E*	*3.78*
933431	*AC2-156 C*	*1.*
933432	*AC2-156 E*	*1.63*
933511	*AC2-166 C*	*2.44*
933512	*AC2-166 E*	*2.7*
933911	*AD1-013 C O1*	*1.92*
933912	*AD1-013 E O1*	*3.07*
933931	*AD1-016 C*	*0.97*
933932	*AD1-016 E*	*1.59*
934001	*AD1-024 C*	*2.39*
934002	*AD1-024 E*	*3.9*
934101	*AD1-039 1*	*8.02*
934111	*AD1-039 2*	*8.68*
934401	*AD1-064 C O1*	*3.4*

934402	*AD1-064 E O1*	*15.92*
934431	*AD1-067 C*	*0.14*
934432	*AD1-067 E*	*0.58*
934651	*AD1-096 C*	*0.93*
934652	*AD1-096 E*	*1.52*
934701	*AD1-098 C O1*	*7.18*
934702	*AD1-098 E O1*	*5.25*
934721	*AD1-100 C*	*22.54*
934722	*AD1-100 E*	*105.53*
934871	*AD1-116 C*	*0.93*
934872	*AD1-116 E*	*1.52*
934881	*AD1-117 C*	*5.61*
934882	*AD1-117 E*	*3.74*
934941	*AD1-126 C*	*6.11*
934942	*AD1-126 E*	*4.07*
934971	*AD1-129 C*	*0.95*
934972	*AD1-129 E*	*0.63*
935001	*AD1-133 C O1*	*21.14*
935002	*AD1-133 E O1*	*14.09*
274654	*BRAIDWOOD;1U*	*34.85*
274655	*BRAIDWOOD;2U*	*33.9*
274751	*CRETE EC ;1U*	*7.39*
274752	*CRETE EC ;2U*	*7.39*
274753	*CRETE EC ;3U*	*7.39*
274754	*CRETE EC ;4U*	*7.39*
274859	*EASYR;U1 E*	*11.49*
274860	*EASYR;U2 E*	*11.49*
290051	*GSG-6; E*	*10.92*
275149	*KEMPTON ;1E*	*17.06*
274704	*KENDALL ;1C*	*5.13*
274705	*KENDALL ;1S*	*3.42*
274706	*KENDALL ;2C*	*5.13*
274707	*KENDALL ;2S*	*3.42*
274660	*LASCO STA;1U*	*32.18*
274661	*LASCO STA;2U*	*32.24*
290108	*LEEDK;1U E*	*25.38*
274850	*MENDOTA H;RU*	*6.28*
293061	*N-015 E*	*16.55*
293644	*O22 E1*	*12.42*
293645	*O22 E2*	*24.11*
290021	*O50 E*	*20.77*
294392	*P-010 E*	*21.02*
294763	*P-046 E*	*9.82*
274888	*PILOT HIL;1E*	*17.06*
274830	*PWR VTREC;1U*	*6.4*

274831	*PWR VTREC;2U*	*6.4*
274722	*S-055 E*	*11.9*
884780	*S58 FTIR*	*51.66*
884781	*S58 NFTIR*	*154.98*
295111	*SUBLETTE E*	*2.84*
274861	*TOP CROP ;1U*	*0.61*
274862	*TOP CROP ;2U*	*1.18*
299993	*U3-031C*	*4.96*
903433	*W3-046*	*25.41*
274874	*WALNR;2U*	*2.49*
294502	*WALNR;2U E*	*9.97*
295109	*WESTBROOK E*	*5.84*
274687	*WILL CNTY;4U*	*74.38*
914641	*Y2-103*	*47.58*
915011	*Y3-013 1*	*3.97*
915021	*Y3-013 2*	*3.97*
915031	*Y3-013 3*	*3.97*
916502	*Z1-106 E1*	*1.33*
916504	*Z1-106 E2*	*1.33*
916512	*Z1-107 E*	*2.54*
916522	*Z1-108 E*	*2.62*
918051	*AA1-018 C*	*2.39*
918052	*AA1-018 E*	*16.03*
918972	*AA1-116 E*	*2.44*
918982	*AA1-117 E*	*2.44*
919221	*AA1-146*	*7.09*
919581	*AA2-030*	*18.34*
919591	*AA2-035*	*132.52*
920112	*AA2-107 E*	*2.57*
920272	*AA2-123 E*	*2.57*
930481	*AB1-089*	*68.98*
930491	*AB1-090*	*68.98*
930501	*AB1-091*	*67.04*
930761	*AB1-122 1*	*73.82*
930771	*AB1-122 2*	*79.86*
931221	*AB1-172*	*0.79*
924471	*AB2-096*	*44.48*
925161	*AB2-173*	*3.27*
925301	*AB2-191 C*	*1.32*
925302	*AB2-191 E*	*1.17*
926311	*AC1-109 1*	*1.99*
926321	*AC1-109 2*	*1.99*
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*
927522	*AC1-113 2*	*1.25*
926431	*AC1-114*	*2.5*
927451	*AC1-142A 1*	*4.53*
927461	*AC1-142A 2*	*4.53*
926701	*AC1-153 C1*	*80.24*
926711	*AC1-153 C2*	*86.81*
926702	*AC1-153 E1*	*3.21*
926712	*AC1-153 E2*	*3.47*
926821	*AC1-168 C*	*1.21*
926822	*AC1-168 E*	*8.1*
927531	*AC1-185 1*	*0.72*
927541	*AC1-185 2*	*0.72*
927551	*AC1-185 3*	*0.72*
927561	*AC1-185 4*	*0.72*
927571	*AC1-185 5*	*0.72*
927581	*AC1-185 6*	*0.72*
927591	*AC1-185 7*	*0.72*
927601	*AC1-185 8*	*0.72*
927091	*AC1-204 1*	*78.19*
927101	*AC1-204 2*	*78.05*

Appendix 13

(CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.75% to 134.43% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 102.89 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.69*
932012	*AC2-007 E*	*1.28*
932881	*AC2-115 1*	*1.95*
932891	*AC2-115 2*	*1.95*
932921	*AC2-116*	*0.68*
932931	*AC2-117*	*10.49*
933341	*AC2-147 C*	*0.71*
933342	*AC2-147 E*	*1.16*
933351	*AC2-148 C*	*0.7*
933352	*AC2-148 E*	*1.15*
933361	*AC2-149 C*	*0.76*
933362	*AC2-149 E*	*1.24*
933371	*AC2-150 C*	*0.7*
933372	*AC2-150 E*	*1.15*
933381	*AC2-151 C*	*0.81*
933382	*AC2-151 E*	*1.32*
933401	*AC2-153 C*	*0.38*
933402	*AC2-153 E*	*0.62*
933411	*AC2-154 C*	*2.05*
933412	*AC2-154 E*	*3.35*
933431	*AC2-156 C*	*0.78*
933432	*AC2-156 E*	*1.28*
933511	*AC2-166 C*	*1.91*
933512	*AC2-166 E*	*2.11*
933911	*AD1-013 C O1*	*1.5*
933912	*AD1-013 E O1*	*2.4*
933931	*AD1-016 C*	*0.76*
933932	*AD1-016 E*	*1.24*
934001	*AD1-024 C*	*2.04*
934002	*AD1-024 E*	*3.33*
934101	*AD1-039 1*	*6.34*
934111	*AD1-039 2*	*6.56*
934401	*AD1-064 C O1*	*2.65*

934402	*AD1-064 E O1*	*12.41*
934431	*AD1-067 C*	*0.11*
934432	*AD1-067 E*	*0.45*
934651	*AD1-096 C*	*0.73*
934652	*AD1-096 E*	*1.19*
934701	*AD1-098 C O1*	*5.61*
934702	*AD1-098 E O1*	*4.1*
934721	*AD1-100 C*	*18.11*
934722	*AD1-100 E*	*84.78*
934871	*AD1-116 C*	*0.85*
934872	*AD1-116 E*	*1.38*
934881	*AD1-117 C*	*4.37*
934882	*AD1-117 E*	*2.92*
934941	*AD1-126 C*	*4.78*
934942	*AD1-126 E*	*3.19*
934971	*AD1-129 C*	*0.74*
934972	*AD1-129 E*	*0.49*
935001	*AD1-133 C O1*	*16.83*
935002	*AD1-133 E O1*	*11.22*
274890	*CAYUG;1U E*	*5.61*
274891	*CAYUG;2U E*	*5.61*
274859	*EASYR;U1 E*	*8.95*
274860	*EASYR;U2 E*	*8.95*
290051	*GSG-6; E*	*8.53*
275149	*KEMPTON ;1E*	*15.12*
290108	*LEEDK;1U E*	*19.84*
274850	*MENDOTA H;RU*	*4.91*
293061	*N-015 E*	*12.83*
293516	*O-009 E1*	*7.39*
293517	*O-009 E2*	*3.75*
293518	*O-009 E3*	*4.13*
293715	*O-029 E*	*7.9*
293716	*O-029 E*	*4.33*
293717	*O-029 E*	*3.98*
293644	*O22 E1*	*7.93*
293645	*O22 E2*	*15.39*
290021	*O50 E*	*15.8*
294392	*P-010 E*	*16.3*
294763	*P-046 E*	*7.66*
274888	*PILOT HIL;1E*	*15.12*
274830	*PWR VTREC;1U*	*5.*
274831	*PWR VTREC;2U*	*5.*
274722	*S-055 E*	*9.26*
884780	*S58 FTIR*	*41.72*
884781	*S58 NFTIR*	*125.16*

295111	*SUBLETTE E*	*2.22*
299993	*U3-031C*	*4.11*
291984	*U4-033*	*1.61*
274814	*UNIV PK N;0U*	*1.31*
274806	*UNIV PK N;2U*	*1.31*
274807	*UNIV PK N;3U*	*1.31*
274808	*UNIV PK N;4U*	*1.31*
274809	*UNIV PK N;5U*	*1.31*
274810	*UNIV PK N;6U*	*1.31*
274811	*UNIV PK N;7U*	*1.31*
274812	*UNIV PK N;8U*	*1.31*
274813	*UNIV PK N;9U*	*1.31*
274815	*UNIV PK N;XU*	*1.31*
274816	*UNIV PK N;YU*	*1.31*
903433	*W3-046*	*19.46*
274874	*WALNR;2U*	*1.94*
294502	*WALNR;2U E*	*7.76*
295109	*WESTBROOK E*	*4.57*
274687	*WILL CNTY;4U*	*53.45*
910542	*X3-005 E*	*0.52*
914641	*Y2-103*	*37.05*
915011	*Y3-013 1*	*3.09*
915021	*Y3-013 2*	*3.09*
915031	*Y3-013 3*	*3.09*
916502	*Z1-106 E1*	*1.04*
916504	*Z1-106 E2*	*1.04*
916512	*Z1-107 E*	*2.23*
916522	*Z1-108 E*	*2.04*
916651	*Z1-127 1*	*1.4*
916652	*Z1-127 2*	*0.95*
918051	*AA1-018 C*	*2.17*
918052	*AA1-018 E*	*14.54*
918972	*AA1-116 E*	*2.16*
918982	*AA1-117 E*	*2.16*
919221	*AA1-146*	*14.28*
919581	*AA2-030*	*14.28*
919591	*AA2-035*	*107.43*
920112	*AA2-107 E*	*2.01*
920272	*AA2-123 E*	*2.*
930481	*AB1-089*	*53.78*
930491	*AB1-090*	*53.78*
930501	*AB1-091*	*58.59*
930761	*AB1-122 1*	*58.36*
930771	*AB1-122 2*	*60.35*
931221	*AB1-172*	*0.69*

924471	*AB2-096*	*34.7*
925161	*AB2-173*	*2.55*
925301	*AB2-191 C*	*1.03*
925302	*AB2-191 E*	*0.92*
925881	*AC1-067*	*99.24*
926311	*AC1-109 1*	*1.57*
926321	*AC1-109 2*	*1.57*
926331	*AC1-110 1*	*1.56*
926341	*AC1-110 2*	*1.56*
926351	*AC1-111 1*	*0.63*
926361	*AC1-111 2*	*0.63*
926371	*AC1-111 3*	*0.63*
926381	*AC1-111 4*	*0.63*
926391	*AC1-111 5*	*0.63*
926401	*AC1-111 6*	*0.63*
927511	*AC1-113 1*	*0.97*
927522	*AC1-113 2*	*0.97*
926431	*AC1-114*	*1.95*
927451	*AC1-142A 1*	*3.49*
927461	*AC1-142A 2*	*3.49*
926701	*AC1-153 C1*	*63.43*
926711	*AC1-153 C2*	*65.6*
926702	*AC1-153 E1*	*2.54*
926712	*AC1-153 E2*	*2.62*
926821	*AC1-168 C*	*0.94*
926822	*AC1-168 E*	*6.33*
927531	*AC1-185 1*	*0.56*
927541	*AC1-185 2*	*0.56*
927551	*AC1-185 3*	*0.56*
927561	*AC1-185 4*	*0.56*
927571	*AC1-185 5*	*0.56*
927581	*AC1-185 6*	*0.56*
927591	*AC1-185 7*	*0.56*
927601	*AC1-185 8*	*0.56*
927091	*AC1-204 1*	*59.85*
927101	*AC1-204 2*	*59.9*

Appendix 14

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 142.36% to 144.89% (**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 200.41 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*
932011	*AC2-007 C*	*1.03*
932012	*AC2-007 E*	*1.92*
932881	*AC2-115 1*	*2.92*
932891	*AC2-115 2*	*2.92*
932921	*AC2-116*	*1.02*
932931	*AC2-117*	*6.53*
933341	*AC2-147 C*	*1.07*
933342	*AC2-147 E*	*1.75*
933361	*AC2-149 C*	*1.14*
933362	*AC2-149 E*	*1.86*
933381	*AC2-151 C*	*1.21*
933382	*AC2-151 E*	*1.97*
933391	*AC2-152 C*	*0.57*
933392	*AC2-152 E*	*0.94*
933401	*AC2-153 C*	*0.57*
933402	*AC2-153 E*	*0.93*
933411	*AC2-154 C*	*3.21*
933412	*AC2-154 E*	*5.24*
933431	*AC2-156 C*	*1.17*
933432	*AC2-156 E*	*1.91*
933511	*AC2-166 C*	*2.86*
933512	*AC2-166 E*	*3.16*
933911	*AD1-013 C O1*	*2.26*
933912	*AD1-013 E O1*	*3.61*
933931	*AD1-016 C*	*1.14*
933932	*AD1-016 E*	*1.86*
934001	*AD1-024 C*	*3.14*
934002	*AD1-024 E*	*5.13*
934101	*AD1-039 1*	*9.68*
934111	*AD1-039 2*	*9.86*
934401	*AD1-064 C O1*	*3.97*
934402	*AD1-064 E O1*	*18.61*

934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.68*
934651	*AD1-096 C*	*1.1*
934652	*AD1-096 E*	*1.79*
934701	*AD1-098 C O1*	*8.44*
934702	*AD1-098 E O1*	*6.16*
934721	*AD1-100 C*	*35.27*
934722	*AD1-100 E*	*165.14*
934871	*AD1-116 C*	*1.18*
934872	*AD1-116 E*	*1.92*
934881	*AD1-117 C*	*6.6*
934882	*AD1-117 E*	*4.4*
934941	*AD1-126 C*	*7.17*
934942	*AD1-126 E*	*4.78*
934971	*AD1-129 C*	*1.11*
934972	*AD1-129 E*	*0.74*
935001	*AD1-133 C O1*	*27.74*
935002	*AD1-133 E O1*	*18.49*
274890	*CAYUG;1U E*	*20.69*
274891	*CAYUG;2U E*	*20.69*
290051	*GSG-6; E*	*12.83*
275149	*KEMPTON ;1E*	*23.69*
290108	*LEEDK;1U E*	*29.79*
274770	*LINCOLN ;1U*	*4.36*
274771	*LINCOLN ;2U*	*4.36*
274772	*LINCOLN ;3U*	*4.36*
274773	*LINCOLN ;4U*	*4.36*
274774	*LINCOLN ;5U*	*4.36*
274775	*LINCOLN ;6U*	*4.36*
274776	*LINCOLN ;7U*	*4.36*
274777	*LINCOLN ;8U*	*4.36*
274850	*MENDOTA H;RU*	*7.38*
293061	*N-015 E*	*19.24*
293644	*O22 E1*	*12.63*
293645	*O22 E2*	*24.52*
290021	*O50 E*	*23.89*
294392	*P-010 E*	*24.44*
294763	*P-046 E*	*11.52*
274888	*PILOT HIL;1E*	*23.69*
274830	*PWR VTREC;1U*	*7.49*
274831	*PWR VTREC;2U*	*7.49*
296308	*R-030 C1*	*5.02*
296271	*R-030 C2*	*5.02*
296125	*R-030 C3*	*5.08*
296309	*R-030 E1*	*20.06*

296272	*R-030 E2*	*20.06*
296128	*R-030 E3*	*20.31*
274722	*S-055 E*	*13.81*
884780	*S58 FTIR*	*63.32*
884781	*S58 NFTIR*	*189.95*
295111	*SUBLETTE E*	*3.34*
299993	*U3-031C*	*11.55*
903433	*W3-046*	*29.56*
295109	*WESTBROOK E*	*6.87*
274687	*WILL CNTY;4U*	*82.27*
910542	*X3-005 E*	*0.91*
914641	*Y2-103*	*55.22*
915011	*Y3-013 1*	*4.6*
915021	*Y3-013 2*	*4.6*
915031	*Y3-013 3*	*4.6*
916502	*Z1-106 E1*	*1.55*
916504	*Z1-106 E2*	*1.55*
916512	*Z1-107 E*	*3.18*
916522	*Z1-108 E*	*3.05*
916651	*Z1-127 1*	*2.14*
916652	*Z1-127 2*	*1.05*
917501	*Z2-087 C*	*3.92*
917502	*Z2-087 E*	*26.24*
918051	*AA1-018 C*	*3.03*
918052	*AA1-018 E*	*20.25*
918972	*AA1-116 E*	*3.38*
918982	*AA1-117 E*	*3.38*
919591	*AA2-035*	*161.05*
920112	*AA2-107 E*	*3.01*
920272	*AA2-123 E*	*3.*
930481	*AB1-089*	*80.75*
930491	*AB1-090*	*80.75*
930501	*AB1-091*	*91.4*
930761	*AB1-122 1*	*89.1*
930771	*AB1-122 2*	*90.74*
931221	*AB1-172*	*0.99*
924041	*AB2-047 C O1*	*4.84*
924042	*AB2-047 E O1*	*32.38*
924471	*AB2-096*	*52.*
925301	*AB2-191 C*	*1.55*
925302	*AB2-191 E*	*1.38*
925881	*AC1-067*	*168.19*
926311	*AC1-109 1*	*2.35*
926321	*AC1-109 2*	*2.35*
926331	*AC1-110 1*	*2.33*

926341	*AC1-110 2*	*2.33*
926351	*AC1-111 1*	*0.94*
926361	*AC1-111 2*	*0.94*
926371	*AC1-111 3*	*0.94*
926381	*AC1-111 4*	*0.94*
926391	*AC1-111 5*	*0.94*
926401	*AC1-111 6*	*0.94*
927511	*AC1-113 1*	*1.46*
927522	*AC1-113 2*	*1.46*
926431	*AC1-114*	*2.92*
927451	*AC1-142A 1*	*5.15*
927461	*AC1-142A 2*	*5.15*
926701	*AC1-153 C1*	*96.84*
926711	*AC1-153 C2*	*98.63*
926702	*AC1-153 E1*	*3.87*
926712	*AC1-153 E2*	*3.94*
927531	*AC1-185 1*	*0.02*
927541	*AC1-185 2*	*0.02*
927551	*AC1-185 3*	*0.02*
927561	*AC1-185 4*	*0.02*
927571	*AC1-185 5*	*0.02*
927581	*AC1-185 6*	*0.02*
927591	*AC1-185 7*	*0.02*
927601	*AC1-185 8*	*0.02*
927091	*AC1-204 1*	*89.41*
927101	*AC1-204 2*	*89.41*

Appendix 15

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 145.39% to 147.97% (**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 204.35 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*
932011	*AC2-007 C*	*1.05*
932012	*AC2-007 E*	*1.96*
932881	*AC2-115 1*	*2.98*
932891	*AC2-115 2*	*2.98*
932921	*AC2-116*	*1.04*
932931	*AC2-117*	*6.67*
933341	*AC2-147 C*	*1.09*
933342	*AC2-147 E*	*1.79*
933361	*AC2-149 C*	*1.17*
933362	*AC2-149 E*	*1.9*
933381	*AC2-151 C*	*1.23*
933382	*AC2-151 E*	*2.01*
933391	*AC2-152 C*	*0.59*
933392	*AC2-152 E*	*0.96*
933401	*AC2-153 C*	*0.58*
933402	*AC2-153 E*	*0.95*
933411	*AC2-154 C*	*3.28*
933412	*AC2-154 E*	*5.35*
933431	*AC2-156 C*	*1.2*
933432	*AC2-156 E*	*1.95*
933511	*AC2-166 C*	*2.92*
933512	*AC2-166 E*	*3.23*
933911	*AD1-013 C O1*	*2.31*
933912	*AD1-013 E O1*	*3.68*
933931	*AD1-016 C*	*1.16*
933932	*AD1-016 E*	*1.9*
934001	*AD1-024 C*	*3.21*
934002	*AD1-024 E*	*5.23*
934101	*AD1-039 1*	*9.89*
934111	*AD1-039 2*	*10.07*
934401	*AD1-064 C O1*	*4.06*
934402	*AD1-064 E O1*	*19.*

934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.69*
934651	*AD1-096 C*	*1.12*
934652	*AD1-096 E*	*1.82*
934701	*AD1-098 C O1*	*8.62*
934702	*AD1-098 E O1*	*6.3*
934721	*AD1-100 C*	*35.97*
934722	*AD1-100 E*	*168.38*
934871	*AD1-116 C*	*1.21*
934872	*AD1-116 E*	*1.97*
934881	*AD1-117 C*	*6.74*
934882	*AD1-117 E*	*4.49*
934941	*AD1-126 C*	*7.33*
934942	*AD1-126 E*	*4.88*
934971	*AD1-129 C*	*1.13*
934972	*AD1-129 E*	*0.75*
935001	*AD1-133 C O1*	*28.31*
935002	*AD1-133 E O1*	*18.88*
274890	*CAYUG;1U E*	*21.1*
274891	*CAYUG;2U E*	*21.1*
290051	*GSG-6; E*	*13.1*
275149	*KEMPTON ;1E*	*24.18*
290108	*LEEDK;1U E*	*30.43*
274770	*LINCOLN ;1U*	*4.48*
274771	*LINCOLN ;2U*	*4.48*
274772	*LINCOLN ;3U*	*4.48*
274773	*LINCOLN ;4U*	*4.48*
274774	*LINCOLN ;5U*	*4.48*
274775	*LINCOLN ;6U*	*4.48*
274776	*LINCOLN ;7U*	*4.48*
274777	*LINCOLN ;8U*	*4.48*
274850	*MENDOTA H;RU*	*7.54*
293061	*N-015 E*	*19.65*
293644	*O22 E1*	*12.9*
293645	*O22 E2*	*25.03*
290021	*O50 E*	*24.4*
294392	*P-010 E*	*24.95*
294763	*P-046 E*	*11.76*
274888	*PILOT HIL;1E*	*24.18*
274830	*PWR VTREC;1U*	*7.65*
274831	*PWR VTREC;2U*	*7.65*
296308	*R-030 C1*	*5.12*
296271	*R-030 C2*	*5.12*
296125	*R-030 C3*	*5.18*
296309	*R-030 E1*	*20.47*

296272	*R-030 E2*	*20.47*
296128	*R-030 E3*	*20.72*
274722	*S-055 E*	*14.1*
884780	*S58 FTIR*	*64.66*
884781	*S58 NFTIR*	*193.98*
295111	*SUBLETTE E*	*3.41*
299993	*U3-031C*	*11.85*
903433	*W3-046*	*30.19*
295109	*WESTBROOK E*	*7.01*
274687	*WILL CNTY;4U*	*84.02*
910542	*X3-005 E*	*0.92*
914641	*Y2-103*	*56.4*
915011	*Y3-013 1*	*4.7*
915021	*Y3-013 2*	*4.7*
915031	*Y3-013 3*	*4.7*
916502	*Z1-106 E1*	*1.58*
916504	*Z1-106 E2*	*1.58*
916512	*Z1-107 E*	*3.25*
916522	*Z1-108 E*	*3.12*
916651	*Z1-127 1*	*2.19*
916652	*Z1-127 2*	*1.07*
917501	*Z2-087 C*	*4.*
917502	*Z2-087 E*	*26.77*
918051	*AA1-018 C*	*3.09*
918052	*AA1-018 E*	*20.69*
918972	*AA1-116 E*	*3.45*
918982	*AA1-117 E*	*3.45*
919591	*AA2-035*	*164.48*
920112	*AA2-107 E*	*3.08*
920272	*AA2-123 E*	*3.06*
930481	*AB1-089*	*82.47*
930491	*AB1-090*	*82.47*
930501	*AB1-091*	*93.33*
930761	*AB1-122 1*	*90.98*
930771	*AB1-122 2*	*92.67*
931221	*AB1-172*	*1.01*
924041	*AB2-047 C O1*	*4.94*
924042	*AB2-047 E O1*	*33.03*
924471	*AB2-096*	*53.1*
925301	*AB2-191 C*	*1.59*
925302	*AB2-191 E*	*1.41*
925881	*AC1-067*	*171.92*
926311	*AC1-109 1*	*2.4*
926321	*AC1-109 2*	*2.4*
926331	*AC1-110 1*	*2.38*

926341	*AC1-110 2*	*2.38*
926351	*AC1-111 1*	*0.96*
926361	*AC1-111 2*	*0.96*
926371	*AC1-111 3*	*0.96*
926381	*AC1-111 4*	*0.96*
926391	*AC1-111 5*	*0.96*
926401	*AC1-111 6*	*0.96*
927511	*AC1-113 1*	*1.49*
927522	*AC1-113 2*	*1.49*
926431	*AC1-114*	*2.98*
927451	*AC1-142A 1*	*5.26*
927461	*AC1-142A 2*	*5.26*
926701	*AC1-153 C1*	*98.89*
926711	*AC1-153 C2*	*100.73*
926702	*AC1-153 E1*	*3.96*
926712	*AC1-153 E2*	*4.03*
927531	*AC1-185 1*	*0.02*
927541	*AC1-185 2*	*0.02*
927551	*AC1-185 3*	*0.02*
927561	*AC1-185 4*	*0.02*
927571	*AC1-185 5*	*0.02*
927581	*AC1-185 6*	*0.02*
927591	*AC1-185 7*	*0.02*
927601	*AC1-185 8*	*0.02*
927091	*AC1-204 1*	*91.32*
927101	*AC1-204 2*	*91.31*

Secondary Point of Interconnection (Option-2)

Under this option, the Interconnection Customer (IC) AD1-100, a 1,000 MW wind farm, proposes to interconnect with the ComEd transmission system by connecting to 345kV bus at Wilton Center TSS 112.

Attachment Facilities

The AD1-100 wind farm generator lead interconnection at Wilton Center TSS 112 would require one 345kV line MOD, a dead-end structure and revenue metering as shown in the one line diagram.

The cost for the attachment facilities is estimated at $1M.

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

Direct Connection Network Upgrades

In order to accommodate interconnection of AD1-100, the 345kV ring bus at Wilton Center TSS112 would need to be expanded.

The scope of work includes installation of one 345kV circuit breaker to expand ring bus at Wilton Center TSS112 to create line termination for generator lead together with relay/protection/scada, as shown in the one line diagram below.

The Interconnection Customer is responsible for constructing all of the facilities on the Interconnection Customer side of the point of interconnection outside of the substation. It will be Interconnection Customer's responsibility to obtain right-of-way for the generator lead.

ComEd would design, engineer and install the 345kV circuit breaker and tie-in the generator lead at Wilton Center TSS112.

The preliminary cost estimate for Direct Connection Network Upgrade is given in the following tables.

Scope of Work	Cost Estimate
Installation of a new 345kV circuit breaker and bus work at Wilton Center TSS112 as described above	$5,000,000
Total Cost Estimate (see notes below on cost estimate)	$5,000,000

ComEd would take approximately 24-months to construct after the ISA / ICSA are signed.

Non-Direct Connection Network Upgrades

None

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. Per the PJM Tariff, Interconnection Customer will be responsible for paying all actual costs of ComEd's work.

4) The Interconnection Customer is responsible for all engineering, procurement, testing and construction of all equipment on the Interconnection Customer's side of the Point of Interconnection (POI).

5)

Network Impacts

The Queue Project AD1-100 was evaluated as a 1000.0 MW (Capacity 176.0 MW) injection at the Wilton; B 345kV substation in the ComEd area. Project AD1-100 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-100 was studied with a commercial probability of 53%. Potential network impacts were as follows:

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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)

1. (CE - CE) The WILTON ; B-BLUE ISL ;BT 345 kV line (from bus 270926 to bus 270666 ckt 1) loads from 85.59% to 111.14% (**DC power flow**) of its load dump rating (1479 MVA) for the

line fault with failed breaker contingency outage of 'COMED_P4_112-45-BT6-7__'. This project contributes approximately 379.19 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-45-BT6-7__'
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
 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
```

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

2. (CE - CE) The WILTON ; B-BLUE ISL ;BT 345 kV line (from bus 270926 to bus 270666 ckt 1) loads from 90.5% to 110.85% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11614_'. This project contributes approximately 303.21 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L11614_'
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
 DISCONNECT BUS 270769                    / GOODI;2R 345
 END
```

3. (CE - CE) The WILTON ; B-BLUE ISL ;BT 345 kV line (from bus 270926 to bus 270666 ckt 1) loads from 89.67% to 110.53% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 308.26 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
```

4. (CE - CE) The WILTON ; B-BLUE ISL ;BT 345 kV line (from bus 270926 to bus 270666 ckt 1) loads from 87.58% to 107.95% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_076-45-BT1-2__'. This project contributes approximately 303.52 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_076-45-BT1-2__'
 TRIP BRANCH FROM BUS 270665 TO BUS 275160 CKT 1          / B ISL; R 345 B ISL;1M 138
 TRIP BRANCH FROM BUS 270677 TO BUS 270665 CKT 1          / BURNH;0R 345 B ISL; R 345
 TRIP BRANCH FROM BUS 275160 TO BUS 271101 CKT 1          / B ISL;1M 138 B ISL;1R 138
 TRIP BRANCH FROM BUS 275260 TO BUS 275160 CKT 1          / B ISL;1C 34.5 B ISL;1M 138
 TRIP BRANCH FROM BUS 270665 TO BUS 275161 CKT 1          / B ISL; R 345 B ISL;2M 138
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
 TRIP BRANCH FROM BUS 275161 TO BUS 271103 CKT 1          / B ISL;2M 138 B ISL;2R 138
 TRIP BRANCH FROM BUS 275261 TO BUS 275161 CKT 1          / B ISL;2C 34.5 B ISL;2M 138
 END
```

5. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 61.88% to 99.38% (**DC power flow**) of its load dump rating (1601 MVA) for the tower line contingency outage of 'COMED_P7_345-L11613AB-S_+_345-L11614AR-S'. This project contributes approximately 617.95 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11613AB-S_+_345-L11614AR-S'
 TRIP BRANCH FROM BUS 270666 TO BUS 270664 CKT 1          / B ISL;BT 345 B ISL; B 345
 TRIP BRANCH FROM BUS 270666 TO BUS 270926 CKT 1          / B ISL;BT 345 WILTO; B 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
 TRIP BRANCH FROM BUS 270770 TO BUS 270666 CKT 1          / GOODI;4B 345 B ISL;BT 345
 TRIP BRANCH FROM BUS 270926 TO BUS 270927 CKT 1          / WILTO; B 345 WILTO; R 345
 END
```

6. (CE - CE) The WILTON ; R-BLUE ISL ;RT 345 kV line (from bus 270927 to bus 270667 ckt 1) loads from 93.91% to 104.22% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 334.25 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
```

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

7. (CE - CE) The WILTON ; R-BLUE ISL ;RT 345 kV line (from bus 270927 to bus 270667 ckt 1) loads from 92.7% to 102.36% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11613_'. This project contributes approximately 318.76 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L11613_'
 TRIP BRANCH FROM BUS 270666 TO BUS 270664 CKT 1          / B ISL;BT 345 B ISL; B 345
 TRIP BRANCH FROM BUS 270666 TO BUS 270926 CKT 1          / B ISL;BT 345 WILTO; B 345
 TRIP BRANCH FROM BUS 270770 TO BUS 270666 CKT 1          / GOODI;4B 345 B ISL;BT 345
 DISCONNECT BUS 270770                    / GOODI;4B 345
 END
```

8. (CE - CE) The WILTON ; R-BLUE ISL ;RT 345 kV line (from bus 270927 to bus 270667 ckt 1) loads from 88.34% to 100.64% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-45-BT3-4__'. This project contributes approximately 401.77 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-45-BT3-4__'
 TRIP BRANCH FROM BUS 270666 TO BUS 270664 CKT 1          / B ISL;BT 345 B ISL; B 345
 TRIP BRANCH FROM BUS 270666 TO BUS 270926 CKT 1          / B ISL;BT 345 WILTO; B 345
 TRIP BRANCH FROM BUS 270770 TO BUS 270666 CKT 1          / GOODI;4B 345 B ISL;BT 345
 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
```

9. (CE - CE) The WILTON ; R-BLUE ISL ;RT 345 kV line (from bus 270927 to bus 270667 ckt 1) loads from 90.09% to 99.75% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_076-45-BT4-5__'. This project contributes approximately 318.54 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_076-45-BT4-5__'
 TRIP BRANCH FROM BUS 270664 TO BUS 275162 CKT 1          / B ISL; B 345 B ISL;3M 138
 TRIP BRANCH FROM BUS 270674 TO BUS 270664 CKT 1          / BURNH; B 345 B ISL; B 345
 TRIP BRANCH FROM BUS 275162 TO BUS 271100 CKT 1          / B ISL;3M 138 B ISL; B 138
 TRIP BRANCH FROM BUS 275262 TO BUS 275162 CKT 1          / B ISL;3C 34.5 B ISL;3M 138
 TRIP BRANCH FROM BUS 270664 TO BUS 275181 CKT 1          / B ISL; B 345 B ISL;4M 138
 TRIP BRANCH FROM BUS 270666 TO BUS 270664 CKT 1          / B ISL;BT 345 B ISL; B 345
 TRIP BRANCH FROM BUS 270666 TO BUS 270926 CKT 1          / B ISL;BT 345 WILTO; B 345
 TRIP BRANCH FROM BUS 270770 TO BUS 270666 CKT 1          / GOODI;4B 345 B ISL;BT 345
 TRIP BRANCH FROM BUS 275181 TO BUS 271100 CKT 1          / B ISL;4M 138 B ISL; B 138
 TRIP BRANCH FROM BUS 275281 TO BUS 275181 CKT 1          / B ISL;4C 34.5 B ISL;4M 138
 END
```

10. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 58.01% to 96.61% (**DC power flow**) of its load dump rating (1601 MVA) for the tower line contingency outage of 'COMED_P7_345-L11613AB-S_+_345-L11614AR-S'. This project contributes approximately 617.95 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11613AB-S_+_345-L11614AR-S'
 TRIP BRANCH FROM BUS 270666 TO BUS 270664 CKT 1          / B ISL;BT 345 B ISL; B 345
 TRIP BRANCH FROM BUS 270666 TO BUS 270926 CKT 1          / B ISL;BT 345 WILTO; B 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
 TRIP BRANCH FROM BUS 270770 TO BUS 270666 CKT 1          / GOODI;4B 345 B ISL;BT 345
 TRIP BRANCH FROM BUS 270926 TO BUS 270927 CKT 1          / WILTO; B 345 WILTO; R 345
 END
```

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)

1. (AEP - OVEC) The 05JEFRSO-06CLIFTY 345 kV line (from bus 242865 to bus 248000 ckt Z1) loads from 101.14% to 102.12% (**DC power flow**) of its emergency rating (2045 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#6189_05HANG R 765'. This project contributes approximately 94.56 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#6189_05HANG R 765'
 OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1          / 242921 05CORNU 765 242924 05HANG R 765 1
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1          / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 121.12% to 122.48% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 71.43 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

3. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.79% to 113.62% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 78.08 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
```

4. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.78% to 113.62% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 78.09 MW to the thermal violation.

```
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
```

5. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.71% to 113.55% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 78.28 MW to the thermal violation.

```
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
```

6. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 161.64% to 163.42% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 155.55 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

7. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.28% to 160.15% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 160.04 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
```

8. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.24% to 160.12% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 160.44 MW to the thermal violation.

```
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
```

9. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 114.8% to 115.7% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 28.13 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

10. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 130.3% to 132.3% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 140.36 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

11. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.85% to 131.92% (**DC power flow**) of its emergency rating

(1195 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 142.85 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
```

12. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.37% to 131.42% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 142.16 MW to the thermal violation.

```
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
```

13. (CE - CE) The GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 129.85% to 132.3% (**DC power flow**) of its load dump rating (1802 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11614_'. This project contributes approximately 96.06 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L11614_'
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
 DISCONNECT BUS 270769                    / GOODI;2R 345
 END
```

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

14. (CE - CE) The GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 101.72% to 102.23% (**DC power flow**) of its emergency rating (1802 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 19.67 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

15. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 140.53% to 152.66% (**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 303.11 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
```

Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

16. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 143.83% to 149.31% (**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 308.57 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
```

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

17. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 106.15% to 107.01% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 17.67 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

18. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 140.53% to 152.66% (**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 303.11 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
```

Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

19. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 143.82% to 149.31% (**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 308.57 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

Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements
(Results of the steady-state voltage studies should be inserted here)

To be determined

Short Circuit
(Summary of impacted circuit breakers)

No issues identified.

Affected System Analysis & Mitigation

MISO Impacts:

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

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.

1. (AEP - OVEC) The 05JEFRSO-06CLIFTY 345 kV line (from bus 242865 to bus 248000 ckt Z1) loads from 115.82% to 116.97% (**DC power flow**) of its normal rating (1756 MVA) for the single line contingency outage of 'AEP_P1-2_#709'. This project contributes approximately 94.81 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#709'
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1          / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

2. (AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 112.71% to 113.55% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 78.32 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

3. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 108.85% to 110.35% (**DC power flow**) of its emergency rating (1091 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 90.15 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

4. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 158.22% to 160.09% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 159.84 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

5. (CE - AEP) The WILTON ;-05DUMONT 765 kV line (from bus 270644 to bus 243206 ckt 1) loads from 99.72% to 101.5% (**DC power flow**) of its normal rating (4105 MVA) for the single line contingency outage of 'COMED_P1-2_697_B2'. This project contributes approximately 387.76 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_697_B2'
  OPEN BRANCH FROM BUS 243229 TO BUS 274804 CKT 1                / 243229 05OLIVE
345 274804 UPNOR;RP 345 1
  END
```

6. (CE - CE) The BLUE ISL ;RT-BLUE ISL ; R 345 kV line (from bus 270667 to bus 270665 ckt 1) loads from 100.19% to 104.49% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 151.3 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

7. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 129.34% to 131.36% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 141.25 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

8. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 108.64% to 110.16% (**DC power flow**) of its emergency rating (1399 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 121.7 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

9. (CE - CE) The GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 120.0% to 122.85% (**DC power flow**) of its emergency rating (1802 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 111.76 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

10. (CE - CE) The GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 101.5% to 103.79% (**DC power flow**) of its normal rating (1560 MVA) for non-contingency condition. This project contributes approximately 65.04 MW to the thermal violation.

11. (CE - AEP) The GREENACRE; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 108.95% to 110.4% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 87.89 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206
05DUMONT 765 270644 WILTO; 765 1
 END
```

12. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 108.85% to 110.35% (**DC power flow**) of its emergency rating (1091 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 90.15 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

13. (CE - CE) The WILTON ; B-BLUE ISL ;BT 345 kV line (from bus 270926 to bus 270666 ckt 1) loads from 87.2% to 107.59% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11614AR-S'. This project contributes approximately 303.75 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11614AR-S'
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1              / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1              / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1              / GOODI;2R 345 B ISL;RT 345
 END
```

14. (CE - CE) The WILTON ; R-BLUE ISL ;RT 345 kV line (from bus 270927 to bus 270667 ckt 1) loads from 89.89% to 99.55% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11613AB-S'. This project contributes approximately 318.65 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11613AB-S'
 TRIP BRANCH FROM BUS 270666 TO BUS 270664 CKT 1          / B ISL;BT 345 B ISL; B 345
 TRIP BRANCH FROM BUS 270666 TO BUS 270926 CKT 1          / B ISL;BT 345 WILTO; B 345
 TRIP BRANCH FROM BUS 270770 TO BUS 270666 CKT 1          / GOODI;4B 345 B ISL;BT 345
 END
```

15. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 126.36% to 127.89% (**DC power flow**) of its emergency rating (1399 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 120.16 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

16. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 130.86% to 132.83% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 100.38 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

Light Load Analysis - 2021

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(CE - CE) The WILTON ; B-BLUE ISL ;BT 345 kV line (from bus 270926 to bus 270666 ckt 1) loads from 85.59% to 111.14% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-45-BT6-7__'. This project contributes approximately 379.19 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-45-BT6-7__'
  TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
  TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
  TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
  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*
933391	*AC2-152 C*	*0.41*
933392	*AC2-152 E*	*0.68*
934721	*AD1-100 C O2*	*66.74*
934722	*AD1-100 E O2*	*312.45*
935001	*AD1-133 C O2*	*49.35*
935002	*AD1-133 E O2*	*32.9*
274890	*CAYUG;1U E*	*20.3*
274891	*CAYUG;2U E*	*20.3*
LTF	*CBM-N*	*0.14*
LTF	*CBM-S1*	*1.99*
LTF	*CBM-S2*	*1.73*
LTF	*CBM-W2*	*12.42*
LTF	*CIN*	*2.65*
LTF	*CPLE*	*0.43*
LTF	*EDWARDS*	*1.49*
LTF	*FARMERCITY*	*0.47*
LTF	*G-007A*	*1.55*
LTF	*IPL*	*1.62*
LTF	*LGEE*	*0.43*
274770	*LINCOLN ;1U*	*5.7*
274771	*LINCOLN ;2U*	*5.7*
274772	*LINCOLN ;3U*	*5.7*
274773	*LINCOLN ;4U*	*5.7*
274774	*LINCOLN ;5U*	*5.7*
274775	*LINCOLN ;6U*	*5.7*
274776	*LINCOLN ;7U*	*5.7*
274777	*LINCOLN ;8U*	*5.7*
LTF	*MECS*	*0.18*
LTF	*NYISO*	*2.07*
LTF	*O-066A*	*0.72*

296308	*R-030 C1*	*3.59*
296271	*R-030 C2*	*3.59*
296125	*R-030 C3*	*3.63*
296309	*R-030 E1*	*14.35*
296272	*R-030 E2*	*14.35*
296128	*R-030 E3*	*14.52*
LTF	*TATANKA*	*1.56*
274853	*TWINGROVE;U1*	*13.71*
274854	*TWINGROVE;U2*	*13.71*
299993	*U3-031C*	*15.1*
LTF	*VFT*	*4.17*
905082	*W4-005 E*	*21.3*
LTF	*X1-078*	*1.19*
916512	*Z1-107 E*	*1.35*
917501	*Z2-087 C*	*2.8*
917502	*Z2-087 E*	*18.74*
918972	*AA1-116 E*	*1.67*
918982	*AA1-117 E*	*1.67*
924041	*AB2-047 C O1*	*3.43*
924042	*AB2-047 E O1*	*22.95*

Appendix 2

(CE - CE) The WILTON ; R-BLUE ISL ;RT 345 kV line (from bus 270927 to bus 270667 ckt 1) loads from 93.91% to 104.22% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 334.25 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*
933391	*AC2-152 C*	*0.46*
933392	*AC2-152 E*	*0.75*
934721	*AD1-100 C O2*	*58.83*
934722	*AD1-100 E O2*	*275.42*
935001	*AD1-133 C O2*	*45.3*
935002	*AD1-133 E O2*	*30.2*
935141	*AD1-148*	*3.31*
LTF	*CARR*	*0.04*
274890	*CAYUG;1U E*	*20.29*
274891	*CAYUG;2U E*	*20.29*
LTF	*CBM-S1*	*2.15*
LTF	*CBM-S2*	*0.82*
LTF	*CBM-W2*	*23.73*
LTF	*CIN*	*2.07*
LTF	*CPLE*	*0.15*
LTF	*DEARBORN*	*0.54*
LTF	*G-007*	*0.06*
LTF	*IPL*	*1.16*
951151	*J474 C*	*1.61*
951152	*J474 E*	*6.42*
LTF	*LGEE*	*0.18*
274770	*LINCOLN ;1U*	*5.1*
274771	*LINCOLN ;2U*	*5.1*
274772	*LINCOLN ;3U*	*5.1*
274773	*LINCOLN ;4U*	*5.1*
274774	*LINCOLN ;5U*	*5.1*
274775	*LINCOLN ;6U*	*5.1*
274776	*LINCOLN ;7U*	*5.1*
274777	*LINCOLN ;8U*	*5.1*
LTF	*MEC*	*4.48*
LTF	*O-066*	*0.21*
296308	*R-030 C1*	*4.02*
296271	*R-030 C2*	*4.02*

296125	*R-030 C3*	*4.07*
296309	*R-030 E1*	*16.08*
296272	*R-030 E2*	*16.08*
296128	*R-030 E3*	*16.27*
LTF	*RENSSELAER*	*0.03*
LTF	*ROSETON*	*0.22*
884780	*S58 FTIR*	*93.61*
884781	*S58 NFTIR*	*280.84*
274853	*TWINGROVE;U1*	*15.79*
274854	*TWINGROVE;U2*	*15.79*
299993	*U3-031C*	*13.5*
276150	*W2-048 E*	*0.91*
905082	*W4-005 E*	*25.38*
909052	*X2-022 E*	*12.67*
917501	*Z2-087 C*	*3.14*
917502	*Z2-087 E*	*21.01*
919591	*AA2-035*	*70.14*
924041	*AB2-047 C O1*	*3.85*
924042	*AB2-047 E O1*	*25.8*
924261	*AB2-070 C O1*	*1.86*
924262	*AB2-070 E O1*	*12.48*
925771	*AC1-053 C*	*1.83*
925772	*AC1-053 E*	*12.25*

Appendix 3

(AEP - OVEC) The 05JEFRSO-06CLIFTY 345 kV line (from bus 242865 to bus 248000 ckt Z1) loads from 101.14% to 102.12% (**DC power flow**) of its emergency rating (2045 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#6189_05HANG R 765'. This project contributes approximately 94.56 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#6189_05HANG R 765'
 OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1          / 242921 05CORNU 765 242924 05HANG R 765 1
 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1          / 242924 05HANG R 765 243208 05JEFRSO 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
243859	*05FR-11G C*	*0.46*
247900	*05FR-11G E*	*9.33*
243862	*05FR-12G C*	*0.45*
247901	*05FR-12G E*	*9.17*
243864	*05FR-21G C*	*0.48*
247902	*05FR-21G E*	*9.8*
243866	*05FR-22G C*	*0.46*
247903	*05FR-22G E*	*9.39*
243870	*05FR-3G C*	*0.93*
247904	*05FR-3G E*	*19.01*
243873	*05FR-4G C*	*0.72*
247905	*05FR-4G E*	*14.29*
246909	*05MDL-1G C*	*0.97*
247906	*05MDL-1G E*	*19.69*
246910	*05MDL-2G C*	*0.48*
247907	*05MDL-2G E*	*9.77*
246976	*05MDL-3G C*	*0.48*
247912	*05MDL-3G E*	*10.21*
246979	*05MDL-4G C*	*0.97*
247913	*05MDL-4G E*	*9.74*
243442	*05RKG1*	*54.19*
243443	*05RKG2*	*53.37*
932601	*AC2-080 C*	*3.12*
932602	*AC2-080 E*	*20.91*
932931	*AC2-117*	*4.31*
933281	*AC2-140 C*	*3.76*
933441	*AC2-157 C*	*9.83*
933442	*AC2-157 E*	*16.04*
LTF	*AD1-092*	*9.24*
LTF	*AD1-093*	*15.84*
LTF	*AD1-094*	*3.03*
934721	*AD1-100 C O2*	*16.64*
934722	*AD1-100 E O2*	*77.92*

LTF	*BLUEG*	*32.99*
LTF	*CALDERWOOD*	*0.45*
LTF	*CARR*	*0.54*
LTF	*CATAWBA*	*0.46*
LTF	*CBM-W1*	*70.32*
LTF	*CBM-W2*	*75.09*
LTF	*CELEVELAND*	*1.31*
LTF	*CHEOAH*	*0.42*
LTF	*CHILHOWEE*	*0.15*
LTF	*CIN*	*10.38*
LTF	*CLIFTY*	*137.88*
LTF	*G-007*	*1.74*
LTF	*HAMLET*	*1.59*
LTF	*IPL*	*6.18*
LTF	*MEC*	*34.1*
LTF	*MECS*	*16.95*
LTF	*O-066*	*5.84*
LTF	*RENSSELAER*	*0.42*
LTF	*ROSETON*	*3.07*
LTF	*ROWAN*	*1.02*
884780	*S58 FTIR*	*38.46*
884781	*S58 NFTIR*	*115.39*
LTF	*SANTEETLA*	*0.12*
247556	*T-127 C*	*0.49*
247943	*T-127 E*	*9.99*
LTF	*TRIMBLE*	*7.12*
299993	*U3-031C*	*3.78*
LTF	*WEC*	*5.91*
907041	*X1-020 C*	*27.78*
907042	*X1-020 E*	*185.92*
910542	*X3-005 E*	*0.52*
900404	*X3-028 C*	*194.03*
900405	*X3-028 E*	*258.7*
913222	*Y1-054 E*	*-2.27*
LTF	*Y3-032*	*8.64*
915662	*Y3-099 E*	*0.24*
915672	*Y3-100 E*	*0.24*
LTF	*Z1-043*	*23.15*
916182	*Z1-065 E*	*0.64*
919591	*AA2-035*	*61.9*
930041	*AB1-006 C*	*3.21*
930042	*AB1-006 E*	*21.45*
930461	*AB1-087*	*71.14*
930471	*AB1-088*	*71.14*
930501	*AB1-091*	*51.38*

LTF	*AB2-013*	*13.2*
925242	*AB2-178 E*	*2.39*
927331	*AC1-040 C*	*9.21*
927332	*AC1-040 E*	*15.03*
925881	*AC1-067*	*102.33*

Appendix 4

(AEP - AEP) The X2-052 TAP-05DUMONT 345 kV line (from bus 247610 to bus 243219 ckt 2) loads from 121.12% to 122.48% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 71.43 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
247900	*05FR-11G E*	*6.84*
247901	*05FR-12G E*	*6.73*
247902	*05FR-21G E*	*7.19*
247903	*05FR-22G E*	*6.89*
247904	*05FR-3G E*	*13.95*
247905	*05FR-4G E*	*10.49*
247906	*05MDL-1G E*	*15.63*
247907	*05MDL-2G E*	*7.75*
247912	*05MDL-3G E*	*8.1*
247913	*05MDL-4G E*	*7.73*
932011	*AC2-007 C*	*0.5*
932012	*AC2-007 E*	*0.92*
932601	*AC2-080 C*	*3.73*
932602	*AC2-080 E*	*24.95*
932881	*AC2-115 1*	*1.41*
932891	*AC2-115 2*	*1.41*
932921	*AC2-116*	*0.49*
932931	*AC2-117*	*5.22*
933341	*AC2-147 C*	*0.52*
933342	*AC2-147 E*	*0.85*
933351	*AC2-148 C*	*0.52*
933352	*AC2-148 E*	*0.85*
933361	*AC2-149 C*	*0.55*
933362	*AC2-149 E*	*0.89*
933371	*AC2-150 C*	*0.52*
933372	*AC2-150 E*	*0.85*
933381	*AC2-151 C*	*0.57*
933382	*AC2-151 E*	*0.93*
933401	*AC2-153 C*	*0.27*
933402	*AC2-153 E*	*0.45*
933411	*AC2-154 C*	*1.44*
933412	*AC2-154 E*	*2.35*
933431	*AC2-156 C*	*0.56*

933432	*AC2-156 E*	*0.91*
933511	*AC2-166 C*	*1.37*
933512	*AC2-166 E*	*1.51*
933911	*AD1-013 C O2*	*1.09*
933912	*AD1-013 E O2*	*1.74*
933931	*AD1-016 C*	*0.55*
933932	*AD1-016 E*	*0.89*
934001	*AD1-024 C*	*1.44*
934002	*AD1-024 E*	*2.34*
934101	*AD1-039 1*	*4.54*
934111	*AD1-039 2*	*4.66*
934401	*AD1-064 C O2*	*1.89*
934402	*AD1-064 E O2*	*8.87*
934431	*AD1-067 C*	*0.08*
934432	*AD1-067 E*	*0.33*
LTF	*AD1-092*	*6.99*
LTF	*AD1-093*	*12.04*
LTF	*AD1-094*	*2.32*
934651	*AD1-096 C*	*0.53*
934652	*AD1-096 E*	*0.87*
934701	*AD1-098 C O2*	*4.09*
934702	*AD1-098 E O2*	*2.99*
934721	*AD1-100 C O2*	*12.57*
934722	*AD1-100 E O2*	*58.86*
934871	*AD1-116 C*	*0.57*
934872	*AD1-116 E*	*0.94*
934881	*AD1-117 C*	*3.23*
934882	*AD1-117 E*	*2.15*
934941	*AD1-126 C*	*3.44*
934942	*AD1-126 E*	*2.3*
934971	*AD1-129 C*	*0.53*
934972	*AD1-129 E*	*0.36*
935001	*AD1-133 C O2*	*12.41*
935002	*AD1-133 E O2*	*8.27*
LTF	*CARR*	*0.62*
LTF	*CATAWBA*	*0.04*
LTF	*CBM-S1*	*4.49*
LTF	*CBM-W1*	*39.49*
LTF	*CBM-W2*	*51.95*
LTF	*CELEVELAND*	*0.07*
LTF	*CIN*	*6.61*
LTF	*DEARBORN*	*1.71*
274859	*EASYR;U1 E*	*6.6*
274860	*EASYR;U2 E*	*6.6*
LTF	*G-007*	*1.62*

290051	*GSG-6; E*	*6.2*
LTF	*HAMLET*	*0.3*
LTF	*IPL*	*3.37*
275149	*KEMPTON ;1E*	*10.62*
290108	*LEEDK;1U E*	*14.32*
LTF	*LGEE*	*0.56*
LTF	*MEC*	*25.43*
274850	*MENDOTA H;RU*	*3.57*
293061	*N-015 E*	*9.13*
LTF	*O-066*	*5.46*
293644	*O22 E1*	*5.95*
293645	*O22 E2*	*11.55*
290021	*O50 E*	*11.51*
294392	*P-010 E*	*11.6*
294763	*P-046 E*	*5.59*
274888	*PILOT HIL;1E*	*10.62*
274830	*PWR VTREC;1U*	*3.6*
274831	*PWR VTREC;2U*	*3.6*
LTF	*RENSSELAER*	*0.49*
LTF	*ROSETON*	*3.55*
LTF	*ROWAN*	*0.17*
274722	*S-055 E*	*6.59*
884780	*S58 FTIR*	*29.26*
884781	*S58 NFTIR*	*87.78*
295111	*SUBLETTE E*	*1.61*
247943	*T-127 E*	*7.93*
299993	*U3-031C*	*2.86*
291984	*U4-033*	*0.8*
274814	*UNIV PK N;0U*	*0.65*
274808	*UNIV PK N;4U*	*0.65*
274809	*UNIV PK N;5U*	*0.65*
274810	*UNIV PK N;6U*	*0.65*
274811	*UNIV PK N;7U*	*0.65*
274812	*UNIV PK N;8U*	*0.65*
274813	*UNIV PK N;9U*	*0.65*
274815	*UNIV PK N;XU*	*0.65*
274816	*UNIV PK N;YU*	*0.65*
903433	*W3-046*	*14.47*
274874	*WALNR;2U*	*1.44*
294502	*WALNR;2U E*	*5.75*
LTF	*WEC*	*4.73*
295109	*WESTBROOK E*	*3.32*
274687	*WILL CNTY;4U*	*38.22*
247611	*X2-052*	*73.96*
914641	*Y2-103*	*26.35*

915011	*Y3-013 1*	*2.2*
915021	*Y3-013 2*	*2.2*
915031	*Y3-013 3*	*2.2*
LTF	*Z1-043*	*17.73*
916502	*Z1-106 E1*	*0.74*
916504	*Z1-106 E2*	*0.74*
916512	*Z1-107 E*	*1.52*
916522	*Z1-108 E*	*1.46*
916651	*Z1-127 1*	*0.97*
916652	*Z1-127 2*	*0.57*
917711	*Z2-114 C*	*0.08*
917712	*Z2-114 E*	*0.39*
918051	*AA1-018 C*	*1.47*
918052	*AA1-018 E*	*9.87*
918972	*AA1-116 E*	*1.52*
918982	*AA1-117 E*	*1.52*
919221	*AA1-146*	*0.86*
919581	*AA2-030*	*10.64*
919591	*AA2-035*	*75.4*
920112	*AA2-107 E*	*1.44*
920272	*AA2-123 E*	*1.44*
930041	*AB1-006 C*	*2.54*
930042	*AB1-006 E*	*17.03*
930391	*AB1-080*	*4.38*
930481	*AB1-089*	*38.97*
930491	*AB1-090*	*38.97*
930501	*AB1-091*	*41.42*
930761	*AB1-122 1*	*41.8*
930771	*AB1-122 2*	*42.9*
931221	*AB1-172*	*0.47*
LTF	*AB2-013*	*10.03*
924471	*AB2-096*	*25.01*
925161	*AB2-173*	*1.9*
925301	*AB2-191 C*	*0.75*
925302	*AB2-191 E*	*0.66*
926311	*AC1-109 1*	*1.11*
926321	*AC1-109 2*	*1.11*
926331	*AC1-110 1*	*1.11*
926341	*AC1-110 2*	*1.11*
926351	*AC1-111 1*	*0.44*
926361	*AC1-111 2*	*0.44*
926371	*AC1-111 3*	*0.44*
926381	*AC1-111 4*	*0.44*
926391	*AC1-111 5*	*0.44*
926401	*AC1-111 6*	*0.44*

927511	*AC1-113 1*	*0.71*
927522	*AC1-113 2*	*0.71*
926431	*AC1-114*	*1.41*
927451	*AC1-142A 1*	*2.44*
927461	*AC1-142A 2*	*2.43*
926701	*AC1-153 C1*	*45.44*
926711	*AC1-153 C2*	*46.63*
926702	*AC1-153 E1*	*1.82*
926712	*AC1-153 E2*	*1.87*
926821	*AC1-168 C*	*0.71*
926822	*AC1-168 E*	*4.78*
927531	*AC1-185 1*	*0.41*
927541	*AC1-185 2*	*0.41*
927551	*AC1-185 3*	*0.41*
927561	*AC1-185 4*	*0.41*
927571	*AC1-185 5*	*0.41*
927581	*AC1-185 6*	*0.41*
927591	*AC1-185 7*	*0.41*
927601	*AC1-185 8*	*0.41*
927091	*AC1-204 1*	*42.09*
927101	*AC1-204 2*	*42.09*

Appendix 5

(MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 161.64% to 163.42% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 155.55 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.99*
932012	*AC2-007 E*	*1.83*
932881	*AC2-115 1*	*2.79*
932891	*AC2-115 2*	*2.79*
932921	*AC2-116*	*0.98*
932931	*AC2-117*	*5.96*
933341	*AC2-147 C*	*1.02*
933342	*AC2-147 E*	*1.67*
933351	*AC2-148 C*	*1.01*
933352	*AC2-148 E*	*1.65*
933361	*AC2-149 C*	*1.09*
933362	*AC2-149 E*	*1.78*
933371	*AC2-150 C*	*1.01*
933372	*AC2-150 E*	*1.65*
933381	*AC2-151 C*	*1.14*
933382	*AC2-151 E*	*1.86*
933401	*AC2-153 C*	*0.55*
933402	*AC2-153 E*	*0.89*
933411	*AC2-154 C*	*3.13*
933412	*AC2-154 E*	*5.11*
933431	*AC2-156 C*	*1.12*
933432	*AC2-156 E*	*1.83*
933511	*AC2-166 C*	*2.73*
933512	*AC2-166 E*	*3.02*
933911	*AD1-013 C O2*	*2.15*
933912	*AD1-013 E O2*	*3.44*
933931	*AD1-016 C*	*1.09*
933932	*AD1-016 E*	*1.77*
934001	*AD1-024 C*	*3.04*
934002	*AD1-024 E*	*4.96*
934101	*AD1-039 1*	*9.01*
934111	*AD1-039 2*	*9.4*

934401	*AD1-064 C O2*	*3.76*
934402	*AD1-064 E O2*	*17.63*
934431	*AD1-067 C*	*0.15*
934432	*AD1-067 E*	*0.65*
LTF	*AD1-092*	*13.13*
LTF	*AD1-093*	*22.72*
LTF	*AD1-094*	*4.39*
934651	*AD1-096 C*	*1.04*
934652	*AD1-096 E*	*1.7*
934701	*AD1-098 C O2*	*8.08*
934702	*AD1-098 E O2*	*5.9*
934721	*AD1-100 C O2*	*27.38*
934722	*AD1-100 E O2*	*128.17*
934871	*AD1-116 C*	*1.11*
934872	*AD1-116 E*	*1.81*
934881	*AD1-117 C*	*6.3*
934882	*AD1-117 E*	*4.2*
934941	*AD1-126 C*	*6.85*
934942	*AD1-126 E*	*4.56*
934971	*AD1-129 C*	*1.06*
934972	*AD1-129 E*	*0.7*
935001	*AD1-133 C O2*	*25.59*
935002	*AD1-133 E O2*	*17.06*
LTF	*BLUEG*	*0.14*
LTF	*CARR*	*0.9*
LTF	*CATAWBA*	*0.17*
274890	*CAYUG;1U E*	*13.73*
274891	*CAYUG;2U E*	*13.73*
LTF	*CBM-S1*	*4.13*
LTF	*CBM-W1*	*73.28*
LTF	*CBM-W2*	*63.37*
LTF	*CELEVELAND*	*0.45*
LTF	*CIN*	*3.08*
LTF	*CLIFTY*	*7.9*
LTF	*DEARBORN*	*3.8*
274859	*EASYR;U1 E*	*12.89*
274860	*EASYR;U2 E*	*12.89*
LTF	*G-007*	*2.34*
290051	*GSG-6; E*	*12.24*
LTF	*HAMLET*	*0.78*
LTF	*IPL*	*1.33*
940531	*J351*	*434.79*
951131	*J643*	*25.99*
981291	*J740 C*	*5.55*
981292	*J740 E*	*22.19*

275149	*KEMPTON ;1E*	*23.06*
290108	*LEEDK;1U E*	*28.43*
LTF	*MEC*	*45.6*
274850	*MENDOTA H;RU*	*7.04*
293061	*N-015 E*	*18.07*
293516	*O-009 E1*	*10.68*
293517	*O-009 E2*	*5.43*
293518	*O-009 E3*	*5.98*
293715	*O-029 E*	*11.42*
293716	*O-029 E*	*6.26*
293717	*O-029 E*	*5.76*
LTF	*O-066*	*7.88*
293644	*O22 E1*	*12.17*
293645	*O22 E2*	*23.63*
290021	*O50 E*	*22.71*
294392	*P-010 E*	*22.95*
294763	*P-046 E*	*11.*
274888	*PILOT HIL;1E*	*23.06*
274830	*PWR VTREC;1U*	*7.15*
274831	*PWR VTREC;2U*	*7.15*
LTF	*RENSSELAER*	*0.71*
LTF	*ROSETON*	*5.11*
LTF	*ROWAN*	*0.46*
274722	*S-055 E*	*13.19*
884780	*S58 FTIR*	*60.92*
884781	*S58 NFTIR*	*182.76*
274789	*SE CHICAG;6U*	*1.48*
274790	*SE CHICAG;7U*	*1.48*
274791	*SE CHICAG;8U*	*1.48*
295111	*SUBLETTE E*	*3.19*
LTF	*TRIMBLE*	*0.05*
299993	*U3-031C*	*6.22*
903433	*W3-046*	*28.01*
274874	*WALNR;2U*	*2.8*
294502	*WALNR;2U E*	*11.19*
LTF	*WEC*	*9.38*
295109	*WESTBROOK E*	*6.55*
274687	*WILL CNTY;4U*	*80.24*
910542	*X3-005 E*	*1.01*
914641	*Y2-103*	*52.78*
915011	*Y3-013 1*	*4.4*
915021	*Y3-013 2*	*4.4*
915031	*Y3-013 3*	*4.4*
LTF	*Z1-043*	*33.58*
916502	*Z1-106 E1*	*1.48*

916504	*Z1-106 E2*	*1.48*
916512	*Z1-107 E*	*3.09*
916522	*Z1-108 E*	*2.91*
916651	*Z1-127 1*	*2.24*
916652	*Z1-127 2*	*1.03*
918051	*AA1-018 C*	*2.85*
918052	*AA1-018 E*	*19.05*
918972	*AA1-116 E*	*3.29*
918982	*AA1-117 E*	*3.29*
919221	*AA1-146*	*20.63*
919581	*AA2-030*	*20.63*
919591	*AA2-035*	*151.54*
920112	*AA2-107 E*	*2.87*
920272	*AA2-123 E*	*2.86*
930481	*AB1-089*	*77.07*
930491	*AB1-090*	*77.07*
930501	*AB1-091*	*91.53*
930761	*AB1-122 1*	*82.9*
930771	*AB1-122 2*	*86.52*
931221	*AB1-172*	*0.96*
LTF	*AB2-013*	*18.93*
924471	*AB2-096*	*49.63*
925161	*AB2-173*	*3.68*
925301	*AB2-191 C*	*1.48*
925302	*AB2-191 E*	*1.31*
925881	*AC1-067*	*202.57*
926311	*AC1-109 1*	*2.23*
926321	*AC1-109 2*	*2.23*
926331	*AC1-110 1*	*2.23*
926341	*AC1-110 2*	*2.23*
926351	*AC1-111 1*	*0.89*
926361	*AC1-111 2*	*0.89*
926371	*AC1-111 3*	*0.89*
926381	*AC1-111 4*	*0.89*
926391	*AC1-111 5*	*0.89*
926401	*AC1-111 6*	*0.89*
927511	*AC1-113 1*	*1.4*
927522	*AC1-113 2*	*1.4*
926431	*AC1-114*	*2.79*
927451	*AC1-142A 1*	*4.92*
927461	*AC1-142A 2*	*4.92*
926701	*AC1-153 C1*	*90.11*
926711	*AC1-153 C2*	*94.04*
926702	*AC1-153 E1*	*3.6*
926712	*AC1-153 E2*	*3.76*

926821	*AC1-168 C*	*1.36*
926822	*AC1-168 E*	*9.12*
927531	*AC1-185 1*	*0.81*
927541	*AC1-185 2*	*0.81*
927551	*AC1-185 3*	*0.81*
927561	*AC1-185 4*	*0.81*
927571	*AC1-185 5*	*0.81*
927581	*AC1-185 6*	*0.81*
927591	*AC1-185 7*	*0.81*
927601	*AC1-185 8*	*0.81*
927091	*AC1-204 1*	*84.67*
927101	*AC1-204 2*	*84.65*

Appendix 6

(CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 130.3% to 132.3% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 140.36 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.82*
932012	*AC2-007 E*	*1.53*
932881	*AC2-115 1*	*2.33*
932891	*AC2-115 2*	*2.33*
932921	*AC2-116*	*0.81*
932931	*AC2-117*	*5.41*
933341	*AC2-147 C*	*0.85*
933342	*AC2-147 E*	*1.39*
933351	*AC2-148 C*	*0.84*
933352	*AC2-148 E*	*1.37*
933361	*AC2-149 C*	*0.91*
933362	*AC2-149 E*	*1.49*
933371	*AC2-150 C*	*0.84*
933372	*AC2-150 E*	*1.37*
933381	*AC2-151 C*	*0.96*
933382	*AC2-151 E*	*1.56*
933401	*AC2-153 C*	*0.46*
933402	*AC2-153 E*	*0.75*
933411	*AC2-154 C*	*2.91*
933412	*AC2-154 E*	*4.75*
933431	*AC2-156 C*	*0.94*
933432	*AC2-156 E*	*1.54*
933511	*AC2-166 C*	*2.29*
933512	*AC2-166 E*	*2.53*
933911	*AD1-013 C O2*	*1.8*
933912	*AD1-013 E O2*	*2.87*
933931	*AD1-016 C*	*0.91*
933932	*AD1-016 E*	*1.48*
934001	*AD1-024 C*	*2.74*
934002	*AD1-024 E*	*4.48*
934101	*AD1-039 1*	*7.59*
934111	*AD1-039 2*	*7.79*

934401	*AD1-064 C O2*	*3.15*
934402	*AD1-064 E O2*	*14.75*
934431	*AD1-067 C*	*0.13*
934432	*AD1-067 E*	*0.54*
LTF	*AD1-092*	*10.73*
LTF	*AD1-093*	*18.58*
LTF	*AD1-094*	*3.61*
934651	*AD1-096 C*	*0.87*
934652	*AD1-096 E*	*1.42*
934701	*AD1-098 C O2*	*6.74*
934702	*AD1-098 E O2*	*4.92*
934721	*AD1-100 C O2*	*24.7*
934722	*AD1-100 E O2*	*115.66*
934871	*AD1-116 C*	*0.99*
934872	*AD1-116 E*	*1.62*
934881	*AD1-117 C*	*5.23*
934882	*AD1-117 E*	*3.49*
934941	*AD1-126 C*	*5.73*
934942	*AD1-126 E*	*3.82*
934971	*AD1-129 C*	*0.88*
934972	*AD1-129 E*	*0.59*
935001	*AD1-133 C O2*	*22.52*
935002	*AD1-133 E O2*	*15.01*
LTF	*BLUEG*	*1.77*
LTF	*CALDERWOOD*	*< 0.01*
LTF	*CANNELTON*	*0.09*
LTF	*CARR*	*0.71*
LTF	*CATAWBA*	*0.23*
274890	*CAYUG;1U E*	*13.18*
274891	*CAYUG;2U E*	*13.18*
LTF	*CBM-S1*	*1.61*
LTF	*CBM-W1*	*48.58*
LTF	*CBM-W2*	*39.56*
LTF	*CELEVELAND*	*0.65*
LTF	*CHEOAH*	*0.02*
LTF	*CHILHOWEE*	*< 0.01*
LTF	*CLIFTY*	*10.78*
LTF	*DEARBORN*	*2.82*
274859	*EASYR;U1 E*	*10.7*
274860	*EASYR;U2 E*	*10.7*
LTF	*ELMERSMITH*	*0.15*
LTF	*G-007*	*1.9*
LTF	*GIBSON*	*0.08*
290051	*GSG-6; E*	*10.22*
LTF	*HAMLET*	*0.92*

275149	*KEMPTON ;1E*	*21.43*
290108	*LEEDK;1U E*	*23.78*
LTF	*MEC*	*36.54*
274850	*MENDOTA H;RU*	*5.88*
293061	*N-015 E*	*15.07*
LTF	*O-066*	*6.39*
293644	*O22 E1*	*9.3*
293645	*O22 E2*	*18.05*
290021	*O50 E*	*18.73*
294392	*P-010 E*	*19.13*
294763	*P-046 E*	*9.16*
274888	*PILOT HIL;1E*	*21.43*
274830	*PWR VTREC;1U*	*5.98*
274831	*PWR VTREC;2U*	*5.98*
LTF	*RENSSELAER*	*0.56*
274723	*RIVER EC ;12*	*5.51*
LTF	*ROSETON*	*4.07*
LTF	*ROWAN*	*0.56*
274722	*S-055 E*	*11.06*
884780	*S58 FTIR*	*52.99*
884781	*S58 NFTIR*	*158.98*
LTF	*SANTEETLA*	*< 0.01*
274794	*SE CHICAG;1U*	*1.22*
274795	*SE CHICAG;2U*	*1.22*
295111	*SUBLETTE E*	*2.66*
LTF	*TRIMBLE*	*0.36*
299993	*U3-031C*	*5.63*
903433	*W3-046*	*23.03*
274874	*WALNR;2U*	*2.32*
294502	*WALNR;2U E*	*9.28*
LTF	*WEC*	*7.83*
295109	*WESTBROOK E*	*5.47*
274687	*WILL CNTY;4U*	*64.73*
910541	*X3-005 C*	*0.11*
910542	*X3-005 E*	*0.91*
914641	*Y2-103*	*44.25*
915011	*Y3-013 1*	*3.69*
915021	*Y3-013 2*	*3.69*
915031	*Y3-013 3*	*3.69*
LTF	*Z1-043*	*27.6*
916502	*Z1-106 E1*	*1.24*
916504	*Z1-106 E2*	*1.24*
916512	*Z1-107 E*	*2.62*
916522	*Z1-108 E*	*2.44*
916651	*Z1-127 1*	*1.81*

916652	*Z1-127 2*	*0.89*
918051	*AA1-018 C*	*2.55*
918052	*AA1-018 E*	*17.04*
918972	*AA1-116 E*	*3.06*
918982	*AA1-117 E*	*3.06*
919221	*AA1-146*	*17.07*
919581	*AA2-030*	*17.07*
919591	*AA2-035*	*129.99*
920112	*AA2-107 E*	*2.41*
920272	*AA2-123 E*	*2.39*
930481	*AB1-089*	*64.33*
930491	*AB1-090*	*64.33*
930501	*AB1-091*	*94.23*
930761	*AB1-122 1*	*69.82*
930771	*AB1-122 2*	*71.64*
931221	*AB1-172*	*0.81*
LTF	*AB2-013*	*15.49*
924471	*AB2-096*	*41.5*
925161	*AB2-173*	*3.04*
925301	*AB2-191 C*	*1.24*
925302	*AB2-191 E*	*1.1*
925881	*AC1-067*	*308.51*
926311	*AC1-109 1*	*1.88*
926321	*AC1-109 2*	*1.88*
926331	*AC1-110 1*	*1.87*
926341	*AC1-110 2*	*1.87*
926351	*AC1-111 1*	*0.75*
926361	*AC1-111 2*	*0.75*
926371	*AC1-111 3*	*0.75*
926381	*AC1-111 4*	*0.75*
926391	*AC1-111 5*	*0.75*
926401	*AC1-111 6*	*0.75*
927511	*AC1-113 1*	*1.16*
927522	*AC1-113 2*	*1.16*
926431	*AC1-114*	*2.33*
927451	*AC1-142A 1*	*4.13*
927461	*AC1-142A 2*	*4.13*
926701	*AC1-153 C1*	*75.89*
926711	*AC1-153 C2*	*77.87*
926702	*AC1-153 E1*	*3.04*
926712	*AC1-153 E2*	*3.11*
926821	*AC1-168 C*	*1.01*
926822	*AC1-168 E*	*6.77*
927531	*AC1-185 1*	*0.67*
927541	*AC1-185 2*	*0.67*

927551	*AC1-185 3*	*0.67*
927561	*AC1-185 4*	*0.67*
927571	*AC1-185 5*	*0.67*
927581	*AC1-185 6*	*0.67*
927591	*AC1-185 7*	*0.67*
927601	*AC1-185 8*	*0.67*
927091	*AC1-204 1*	*70.68*
927101	*AC1-204 2*	*70.73*

Appendix 7

(CE - CE) The GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 129.85% to 132.3% (**DC power flow**) of its load dump rating (1802 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11614_'. This project contributes approximately 96.06 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L11614_'
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1          / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1          / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1          / GOODI;2R 345 B ISL;RT 345
 DISCONNECT BUS 270769                        / GOODI;2R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.51*
932012	*AC2-007 E*	*0.95*
932881	*AC2-115 1*	*1.46*
932891	*AC2-115 2*	*1.46*
932921	*AC2-116*	*0.51*
933341	*AC2-147 C*	*0.56*
933342	*AC2-147 E*	*0.92*
933351	*AC2-148 C*	*0.57*
933352	*AC2-148 E*	*0.92*
933371	*AC2-150 C*	*0.57*
933372	*AC2-150 E*	*0.92*
933391	*AC2-152 C*	*0.32*
933392	*AC2-152 E*	*0.52*
933931	*AD1-016 C*	*0.55*
933932	*AD1-016 E*	*0.9*
934051	*AD1-031 C O2*	*1.97*
934052	*AD1-031 E O2*	*3.22*
934101	*AD1-039 1*	*7.15*
934111	*AD1-039 2*	*9.57*
934421	*AD1-066*	*0.75*
LTF	*AD1-092*	*11.92*
LTF	*AD1-093*	*20.73*
LTF	*AD1-094*	*2.37*
934651	*AD1-096 C*	*0.56*
934652	*AD1-096 E*	*0.91*
934721	*AD1-100 C O2*	*16.91*
934722	*AD1-100 E O2*	*79.15*
934871	*AD1-116 C*	*1.09*
934872	*AD1-116 E*	*1.77*
934881	*AD1-117 C*	*3.47*
934882	*AD1-117 E*	*2.32*
934971	*AD1-129 C*	*0.55*

934972	*AD1-129 E*	*0.37*
935001	*AD1-133 C O2*	*16.41*
935002	*AD1-133 E O2*	*10.94*
274832	*ANNAWAN ; 1U*	*7.92*
LTF	*BLUEG*	*0.49*
294401	*BSHIL;1U E*	*6.34*
294410	*BSHIL;2U E*	*6.34*
LTF	*CARR*	*0.3*
274890	*CAYUG;1U E*	*10.36*
274891	*CAYUG;2U E*	*10.36*
LTF	*CBM-S1*	*2.96*
LTF	*CBM-S2*	*0.35*
LTF	*CBM-W1*	*33.59*
LTF	*CBM-W2*	*41.21*
LTF	*CIN*	*0.39*
LTF	*CLIFTY*	*4.22*
274849	*CRESCENT ;1U*	*4.14*
LTF	*DEARBORN*	*1.76*
274859	*EASYR;U1 E*	*7.18*
274860	*EASYR;U2 E*	*7.18*
274733	*ELWOOD EC;3P*	*5.66*
274735	*ELWOOD EC;4P*	*5.66*
274728	*ELWOOD EC;5P*	*5.69*
274730	*ELWOOD EC;6P*	*5.69*
274732	*ELWOOD EC;7P*	*5.69*
274734	*ELWOOD EC;8P*	*5.69*
274736	*ELWOOD EC;9P*	*5.69*
LTF	*G-007*	*0.75*
LTF	*IPL*	*0.09*
990901	*L-005 E*	*9.55*
LTF	*MEC*	*29.33*
293516	*O-009 E1*	*6.26*
293517	*O-009 E2*	*3.18*
293518	*O-009 E3*	*3.5*
293715	*O-029 E*	*6.69*
293716	*O-029 E*	*3.67*
293717	*O-029 E*	*3.37*
293771	*O-035 E*	*4.51*
LTF	*O-066*	*2.52*
293644	*O22 E1*	*23.03*
293645	*O22 E2*	*44.71*
290021	*O50 E*	*24.11*
294763	*P-046 E*	*5.89*
274830	*PWR VTREC;1U*	*3.68*
274831	*PWR VTREC;2U*	*3.68*

296308	*R-030 C1*	*2.77*
296271	*R-030 C2*	*2.77*
296125	*R-030 C3*	*2.81*
296309	*R-030 E1*	*11.09*
296272	*R-030 E2*	*11.09*
296128	*R-030 E3*	*11.23*
LTF	*RENSSELAER*	*0.24*
LTF	*ROSETON*	*1.72*
274722	*S-055 E*	*6.79*
274861	*TOP CROP ;1U*	*1.13*
274862	*TOP CROP ;2U*	*2.19*
LTF	*TRIMBLE*	*0.11*
274853	*TWINGROVE;U1*	*11.81*
274854	*TWINGROVE;U2*	*11.81*
299993	*U3-031C*	*3.83*
903433	*W3-046*	*30.87*
274874	*WALNR;2U*	*1.59*
294502	*WALNR;2U E*	*6.37*
LTF	*WEC*	*4.97*
914641	*Y2-103*	*27.17*
915011	*Y3-013 1*	*2.26*
915021	*Y3-013 2*	*2.26*
915031	*Y3-013 3*	*2.26*
LTF	*Z1-043*	*18.14*
916522	*Z1-108 E*	*1.46*
917501	*Z2-087 C*	*2.17*
917502	*Z2-087 E*	*14.51*
918051	*AA1-018 C*	*2.79*
918052	*AA1-018 E*	*18.66*
918972	*AA1-116 E*	*1.5*
918982	*AA1-117 E*	*1.5*
919221	*AA1-146*	*11.87*
919581	*AA2-030*	*11.87*
919591	*AA2-035*	*81.53*
919621	*AA2-039 C*	*1.55*
919622	*AA2-039 E*	*10.35*
920272	*AA2-123 E*	*1.46*
930481	*AB1-089*	*40.37*
930491	*AB1-090*	*40.37*
930761	*AB1-122 1*	*65.77*
930771	*AB1-122 2*	*88.*
LTF	*AB2-013*	*17.28*
924041	*AB2-047 C O1*	*2.68*
924042	*AB2-047 E O1*	*17.94*
924471	*AB2-096*	*25.58*

925161	*AB2-173*	*2.12*
925581	*AC1-033 C*	*1.04*
925582	*AC1-033 E*	*6.96*
927511	*AC1-113 1*	*0.73*
927522	*AC1-113 2*	*0.73*
926431	*AC1-114*	*1.46*
927451	*AC1-142A 1*	*3.48*
927461	*AC1-142A 2*	*3.51*
926701	*AC1-153 C1*	*71.49*
926711	*AC1-153 C2*	*95.66*
926702	*AC1-153 E1*	*2.86*
926712	*AC1-153 E2*	*3.83*
926841	*AC1-171 C*	*0.83*
926842	*AC1-171 E*	*5.57*
927531	*AC1-185 1*	*0.45*
927541	*AC1-185 2*	*0.45*
927551	*AC1-185 3*	*0.45*
927561	*AC1-185 4*	*0.45*
927571	*AC1-185 5*	*0.45*
927581	*AC1-185 6*	*0.45*
927591	*AC1-185 7*	*0.45*
927601	*AC1-185 8*	*0.45*
927091	*AC1-204 1*	*107.91*
927101	*AC1-204 2*	*107.34*
927201	*AC1-214 C*	*1.45*
927202	*AC1-214 E*	*3.84*

Appendix 8

(CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 140.53% to 152.66% (**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 303.11 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*
932011	*AC2-007 C*	*0.99*
932012	*AC2-007 E*	*1.84*
933361	*AC2-149 C*	*1.09*
933362	*AC2-149 E*	*1.78*
933381	*AC2-151 C*	*1.13*
933382	*AC2-151 E*	*1.84*
933391	*AC2-152 C*	*0.64*
933392	*AC2-152 E*	*1.04*
933401	*AC2-153 C*	*0.55*
933402	*AC2-153 E*	*0.89*
933411	*AC2-154 C*	*2.77*
933412	*AC2-154 E*	*4.53*
933431	*AC2-156 C*	*1.11*
933432	*AC2-156 E*	*1.82*
933511	*AC2-166 C*	*2.73*
933512	*AC2-166 E*	*3.02*
933931	*AD1-016 C*	*1.09*
933932	*AD1-016 E*	*1.78*
934001	*AD1-024 C*	*2.8*
934002	*AD1-024 E*	*4.57*
934101	*AD1-039 1*	*9.52*
934111	*AD1-039 2*	*9.49*
934401	*AD1-064 C O2*	*3.77*
934402	*AD1-064 E O2*	*17.66*
LTF	*AD1-092*	*13.75*
LTF	*AD1-093*	*23.69*
LTF	*AD1-094*	*4.53*
934721	*AD1-100 C O2*	*53.35*
934722	*AD1-100 E O2*	*249.76*
934871	*AD1-116 C*	*1.14*
934872	*AD1-116 E*	*1.87*
934941	*AD1-126 C*	*6.86*

934942	*AD1-126 E*	*4.57*
934971	*AD1-129 C*	*1.06*
934972	*AD1-129 E*	*0.71*
935001	*AD1-133 C O2*	*45.13*
935002	*AD1-133 E O2*	*30.09*
LTF	*BLUEG*	*2.27*
LTF	*CANNELTON*	*0.05*
LTF	*CARR*	*0.88*
LTF	*CATAWBA*	*0.28*
274890	*CAYUG;1U E*	*23.81*
274891	*CAYUG;2U E*	*23.81*
LTF	*CBM-S1*	*2.55*
LTF	*CBM-W1*	*72.64*
LTF	*CBM-W2*	*57.86*
LTF	*CELEVELAND*	*0.77*
LTF	*CIN*	*0.27*
LTF	*CLIFTY*	*14.45*
LTF	*DEARBORN*	*2.69*
LTF	*ELMERSMITH*	*0.03*
LTF	*G-007*	*2.38*
LTF	*HAMLET*	*1.12*
275149	*KEMPTON ;1E*	*20.44*
290108	*LEEDK;1U E*	*28.49*
274770	*LINCOLN ;1U*	*4.57*
274771	*LINCOLN ;2U*	*4.57*
274772	*LINCOLN ;3U*	*4.57*
274773	*LINCOLN ;4U*	*4.57*
274774	*LINCOLN ;5U*	*4.57*
274775	*LINCOLN ;6U*	*4.57*
274776	*LINCOLN ;7U*	*4.57*
274777	*LINCOLN ;8U*	*4.57*
LTF	*MEC*	*46.38*
293061	*N-015 E*	*17.4*
LTF	*O-066*	*8.*
293644	*O22 E1*	*12.24*
293645	*O22 E2*	*23.77*
290021	*O50 E*	*23.19*
294392	*P-010 E*	*22.1*
274888	*PILOT HIL;1E*	*20.44*
274830	*PWR VTREC;1U*	*7.19*
274831	*PWR VTREC;2U*	*7.19*
296308	*R-030 C1*	*5.58*
296271	*R-030 C2*	*5.58*
296125	*R-030 C3*	*5.65*
296309	*R-030 E1*	*22.31*

296272	*R-030 E2*	*22.31*
296128	*R-030 E3*	*22.58*
LTF	*RENSSELAER*	*0.7*
LTF	*ROSETON*	*5.03*
LTF	*ROWAN*	*0.68*
274722	*S-055 E*	*13.25*
884780	*S58 FTIR*	*59.98*
884781	*S58 NFTIR*	*179.95*
LTF	*TRIMBLE*	*0.47*
274853	*TWINGROVE;U1*	*22.99*
274854	*TWINGROVE;U2*	*22.99*
299993	*U3-031C*	*12.09*
LTF	*WEC*	*9.43*
274687	*WILL CNTY;4U*	*78.94*
910542	*X3-005 E*	*0.87*
914641	*Y2-103*	*52.98*
915011	*Y3-013 1*	*4.42*
915021	*Y3-013 2*	*4.42*
915031	*Y3-013 3*	*4.42*
LTF	*Z1-043*	*34.61*
916502	*Z1-106 E1*	*1.48*
916504	*Z1-106 E2*	*1.48*
916512	*Z1-107 E*	*3.*
916522	*Z1-108 E*	*2.93*
916651	*Z1-127 1*	*1.97*
916652	*Z1-127 2*	*0.97*
917501	*Z2-087 C*	*4.36*
917502	*Z2-087 E*	*29.18*
918051	*AA1-018 C*	*2.94*
918052	*AA1-018 E*	*19.65*
918972	*AA1-116 E*	*2.92*
918982	*AA1-117 E*	*2.92*
919591	*AA2-035*	*156.37*
920112	*AA2-107 E*	*2.88*
920272	*AA2-123 E*	*2.87*
930481	*AB1-089*	*54.29*
930491	*AB1-090*	*77.56*
930501	*AB1-091*	*79.92*
930761	*AB1-122 1*	*87.62*
930771	*AB1-122 2*	*87.35*
931221	*AB1-172*	*0.93*
LTF	*AB2-013*	*19.74*
924041	*AB2-047 C O1*	*5.38*
924042	*AB2-047 E O1*	*35.99*
924471	*AB2-096*	*49.91*

925881	*AC1-067*	*158.43*
926311	*AC1-109 1*	*2.24*
926321	*AC1-109 2*	*2.24*
926331	*AC1-110 1*	*2.22*
926341	*AC1-110 2*	*2.22*
926351	*AC1-111 1*	*0.89*
926361	*AC1-111 2*	*0.89*
926371	*AC1-111 3*	*0.89*
926381	*AC1-111 4*	*0.89*
926391	*AC1-111 5*	*0.89*
926401	*AC1-111 6*	*0.89*
927451	*AC1-142A 1*	*4.95*
927461	*AC1-142A 2*	*4.95*
926701	*AC1-153 C1*	*95.24*
926711	*AC1-153 C2*	*94.94*
926702	*AC1-153 E1*	*3.81*
926712	*AC1-153 E2*	*3.8*
927091	*AC1-204 1*	*86.68*
927101	*AC1-204 2*	*86.69*

Appendix 9

(CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 143.83% to 149.31% (**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 308.57 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*
932011	*AC2-007 C*	*1.01*
932012	*AC2-007 E*	*1.88*
932881	*AC2-115 1*	*2.87*
932891	*AC2-115 2*	*2.87*
932921	*AC2-116*	*1.*
933361	*AC2-149 C*	*1.11*
933362	*AC2-149 E*	*1.82*
933381	*AC2-151 C*	*1.15*
933382	*AC2-151 E*	*1.88*
933391	*AC2-152 C*	*0.65*
933392	*AC2-152 E*	*1.06*
933401	*AC2-153 C*	*0.56*
933402	*AC2-153 E*	*0.91*
933411	*AC2-154 C*	*2.83*
933412	*AC2-154 E*	*4.62*
933431	*AC2-156 C*	*1.14*
933432	*AC2-156 E*	*1.86*
933511	*AC2-166 C*	*2.79*
933512	*AC2-166 E*	*3.08*
933911	*AD1-013 C O2*	*2.21*
933912	*AD1-013 E O2*	*3.53*
933931	*AD1-016 C*	*1.12*
933932	*AD1-016 E*	*1.82*
934001	*AD1-024 C*	*2.86*
934002	*AD1-024 E*	*4.67*
934101	*AD1-039 1*	*9.72*
934111	*AD1-039 2*	*9.7*
934401	*AD1-064 C O2*	*3.85*
934402	*AD1-064 E O2*	*18.03*
934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.66*
LTF	*AD1-092*	*14.04*

LTF	*AD1-093*	*24.18*
LTF	*AD1-094*	*4.62*
934701	*AD1-098 C O2*	*8.29*
934702	*AD1-098 E O2*	*6.05*
934721	*AD1-100 C O2*	*54.31*
934722	*AD1-100 E O2*	*254.26*
934871	*AD1-116 C*	*1.17*
934872	*AD1-116 E*	*1.91*
934941	*AD1-126 C*	*7.*
934942	*AD1-126 E*	*4.67*
934971	*AD1-129 C*	*1.09*
934972	*AD1-129 E*	*0.72*
935001	*AD1-133 C O2*	*45.96*
935002	*AD1-133 E O2*	*30.64*
LTF	*BLUEG*	*2.32*
LTF	*CANNELTON*	*0.05*
LTF	*CARR*	*0.9*
LTF	*CATAWBA*	*0.29*
274890	*CAYUG;1U E*	*24.26*
274891	*CAYUG;2U E*	*24.26*
LTF	*CBM-S1*	*2.6*
LTF	*CBM-W1*	*74.17*
LTF	*CBM-W2*	*59.01*
LTF	*CELEVELAND*	*0.79*
LTF	*CIN*	*0.27*
LTF	*CLIFTY*	*14.77*
LTF	*DEARBORN*	*2.74*
LTF	*ELMERSMITH*	*0.04*
LTF	*G-007*	*2.43*
290051	*GSG-6; E*	*12.56*
LTF	*HAMLET*	*1.14*
275149	*KEMPTON ;1E*	*20.88*
290108	*LEEDK;1U E*	*29.1*
274770	*LINCOLN ;1U*	*4.68*
274771	*LINCOLN ;2U*	*4.68*
274772	*LINCOLN ;3U*	*4.68*
274773	*LINCOLN ;4U*	*4.68*
274774	*LINCOLN ;5U*	*4.68*
274775	*LINCOLN ;6U*	*4.68*
274776	*LINCOLN ;7U*	*4.68*
274777	*LINCOLN ;8U*	*4.68*
LTF	*MEC*	*47.35*
274850	*MENDOTA H;RU*	*7.22*
293061	*N-015 E*	*17.77*
LTF	*O-066*	*8.18*

293644	*O22 E1*	*12.5*
293645	*O22 E2*	*24.27*
290021	*O50 E*	*23.68*
294392	*P-010 E*	*22.57*
274888	*PILOT HIL;1E*	*20.88*
274830	*PWR VTREC;1U*	*7.34*
274831	*PWR VTREC;2U*	*7.34*
296308	*R-030 C1*	*5.69*
296271	*R-030 C2*	*5.69*
296125	*R-030 C3*	*5.75*
296309	*R-030 E1*	*22.74*
296272	*R-030 E2*	*22.74*
296128	*R-030 E3*	*23.02*
LTF	*RENSSELAER*	*0.71*
LTF	*ROSETON*	*5.14*
LTF	*ROWAN*	*0.7*
274722	*S-055 E*	*13.53*
884780	*S58 FTIR*	*61.26*
884781	*S58 NFTIR*	*183.79*
295111	*SUBLETTE E*	*3.27*
LTF	*TRIMBLE*	*0.48*
274853	*TWINGROVE;U1*	*23.44*
274854	*TWINGROVE;U2*	*23.44*
299993	*U3-031C*	*12.4*
903433	*W3-046*	*12.74*
LTF	*WEC*	*9.63*
295109	*WESTBROOK E*	*6.72*
274687	*WILL CNTY;4U*	*80.62*
910542	*X3-005 E*	*0.89*
914641	*Y2-103*	*54.12*
915011	*Y3-013 1*	*4.51*
915021	*Y3-013 2*	*4.51*
915031	*Y3-013 3*	*4.51*
LTF	*Z1-043*	*35.33*
916502	*Z1-106 E1*	*1.51*
916504	*Z1-106 E2*	*1.51*
916512	*Z1-107 E*	*3.07*
916522	*Z1-108 E*	*2.99*
916651	*Z1-127 1*	*2.01*
916652	*Z1-127 2*	*0.99*
917501	*Z2-087 C*	*4.44*
917502	*Z2-087 E*	*29.74*
918051	*AA1-018 C*	*3.*
918052	*AA1-018 E*	*20.08*
918972	*AA1-116 E*	*2.98*

918982	*AA1-117 E*	*2.98*
919591	*AA2-035*	*159.68*
920112	*AA2-107 E*	*2.94*
920272	*AA2-123 E*	*2.94*
930481	*AB1-089*	*79.21*
930491	*AB1-090*	*79.21*
930501	*AB1-091*	*81.66*
930761	*AB1-122 1*	*89.47*
930771	*AB1-122 2*	*89.21*
931221	*AB1-172*	*0.95*
LTF	*AB2-013*	*20.15*
924041	*AB2-047 C O1*	*5.48*
924042	*AB2-047 E O1*	*36.68*
924471	*AB2-096*	*50.97*
925301	*AB2-191 C*	*1.52*
925302	*AB2-191 E*	*1.35*
925881	*AC1-067*	*161.98*
926311	*AC1-109 1*	*2.29*
926321	*AC1-109 2*	*2.29*
926331	*AC1-110 1*	*2.27*
926341	*AC1-110 2*	*2.27*
926351	*AC1-111 1*	*0.91*
926361	*AC1-111 2*	*0.91*
926371	*AC1-111 3*	*0.91*
926381	*AC1-111 4*	*0.91*
926391	*AC1-111 5*	*0.91*
926401	*AC1-111 6*	*0.91*
927511	*AC1-113 1*	*1.43*
927522	*AC1-113 2*	*1.43*
926431	*AC1-114*	*2.87*
927451	*AC1-142A 1*	*5.06*
927461	*AC1-142A 2*	*5.06*
926701	*AC1-153 C1*	*97.25*
926711	*AC1-153 C2*	*96.97*
926702	*AC1-153 E1*	*3.89*
926712	*AC1-153 E2*	*3.88*
927091	*AC1-204 1*	*88.53*
927101	*AC1-204 2*	*88.54*

Appendix 10

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 140.53% to 152.66% (**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 303.11 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*
932011	*AC2-007 C*	*0.99*
932012	*AC2-007 E*	*1.84*
933361	*AC2-149 C*	*1.09*
933362	*AC2-149 E*	*1.78*
933381	*AC2-151 C*	*1.13*
933382	*AC2-151 E*	*1.84*
933391	*AC2-152 C*	*0.64*
933392	*AC2-152 E*	*1.04*
933401	*AC2-153 C*	*0.55*
933402	*AC2-153 E*	*0.89*
933411	*AC2-154 C*	*2.77*
933412	*AC2-154 E*	*4.53*
933431	*AC2-156 C*	*1.11*
933432	*AC2-156 E*	*1.82*
933511	*AC2-166 C*	*2.73*
933512	*AC2-166 E*	*3.02*
933931	*AD1-016 C*	*1.09*
933932	*AD1-016 E*	*1.78*
934001	*AD1-024 C*	*2.8*
934002	*AD1-024 E*	*4.57*
934101	*AD1-039 1*	*9.52*
934111	*AD1-039 2*	*9.49*
934401	*AD1-064 C O2*	*3.77*
934402	*AD1-064 E O2*	*17.66*
LTF	*AD1-092*	*13.75*
LTF	*AD1-093*	*23.69*
LTF	*AD1-094*	*4.53*
934721	*AD1-100 C O2*	*53.35*
934722	*AD1-100 E O2*	*249.76*
934871	*AD1-116 C*	*1.14*
934872	*AD1-116 E*	*1.87*
934941	*AD1-126 C*	*6.86*

934942	*AD1-126 E*	*4.57*
934971	*AD1-129 C*	*1.06*
934972	*AD1-129 E*	*0.71*
935001	*AD1-133 C O2*	*45.13*
935002	*AD1-133 E O2*	*30.09*
LTF	*BLUEG*	*2.27*
LTF	*CANNELTON*	*0.05*
LTF	*CARR*	*0.88*
LTF	*CATAWBA*	*0.28*
274890	*CAYUG;1U E*	*23.81*
274891	*CAYUG;2U E*	*23.81*
LTF	*CBM-S1*	*2.55*
LTF	*CBM-W1*	*72.64*
LTF	*CBM-W2*	*57.86*
LTF	*CELEVELAND*	*0.77*
LTF	*CIN*	*0.27*
LTF	*CLIFTY*	*14.45*
LTF	*DEARBORN*	*2.69*
LTF	*ELMERSMITH*	*0.03*
LTF	*G-007*	*2.38*
LTF	*HAMLET*	*1.12*
275149	*KEMPTON ;1E*	*20.44*
290108	*LEEDK;1U E*	*28.49*
274770	*LINCOLN ;1U*	*4.57*
274771	*LINCOLN ;2U*	*4.57*
274772	*LINCOLN ;3U*	*4.57*
274773	*LINCOLN ;4U*	*4.57*
274774	*LINCOLN ;5U*	*4.57*
274775	*LINCOLN ;6U*	*4.57*
274776	*LINCOLN ;7U*	*4.57*
274777	*LINCOLN ;8U*	*4.57*
LTF	*MEC*	*46.38*
293061	*N-015 E*	*17.4*
LTF	*O-066*	*8.*
293644	*O22 E1*	*12.24*
293645	*O22 E2*	*23.77*
290021	*O50 E*	*23.19*
294392	*P-010 E*	*22.1*
274888	*PILOT HIL;1E*	*20.44*
274830	*PWR VTREC;1U*	*7.19*
274831	*PWR VTREC;2U*	*7.19*
296308	*R-030 C1*	*5.58*
296271	*R-030 C2*	*5.58*
296125	*R-030 C3*	*5.65*
296309	*R-030 E1*	*22.31*

296272	*R-030 E2*	*22.31*
296128	*R-030 E3*	*22.58*
LTF	*RENSSELAER*	*0.7*
LTF	*ROSETON*	*5.03*
LTF	*ROWAN*	*0.68*
274722	*S-055 E*	*13.25*
884780	*S58 FTIR*	*59.98*
884781	*S58 NFTIR*	*179.95*
LTF	*TRIMBLE*	*0.47*
274853	*TWINGROVE;U1*	*22.99*
274854	*TWINGROVE;U2*	*22.99*
299993	*U3-031C*	*12.09*
LTF	*WEC*	*9.43*
274687	*WILL CNTY;4U*	*78.94*
910542	*X3-005 E*	*0.87*
914641	*Y2-103*	*52.98*
915011	*Y3-013 1*	*4.42*
915021	*Y3-013 2*	*4.42*
915031	*Y3-013 3*	*4.42*
LTF	*Z1-043*	*34.61*
916502	*Z1-106 E1*	*1.48*
916504	*Z1-106 E2*	*1.48*
916512	*Z1-107 E*	*3.*
916522	*Z1-108 E*	*2.93*
916651	*Z1-127 1*	*1.97*
916652	*Z1-127 2*	*0.97*
917501	*Z2-087 C*	*4.36*
917502	*Z2-087 E*	*29.18*
918051	*AA1-018 C*	*2.94*
918052	*AA1-018 E*	*19.65*
918972	*AA1-116 E*	*2.92*
918982	*AA1-117 E*	*2.92*
919591	*AA2-035*	*156.37*
920112	*AA2-107 E*	*2.88*
920272	*AA2-123 E*	*2.87*
930481	*AB1-089*	*54.29*
930491	*AB1-090*	*77.56*
930501	*AB1-091*	*79.92*
930761	*AB1-122 1*	*87.62*
930771	*AB1-122 2*	*87.35*
931221	*AB1-172*	*0.93*
LTF	*AB2-013*	*19.74*
924041	*AB2-047 C O1*	*5.38*
924042	*AB2-047 E O1*	*35.99*
924471	*AB2-096*	*49.91*

925881	*AC1-067*	*158.43*
926311	*AC1-109 1*	*2.24*
926321	*AC1-109 2*	*2.24*
926331	*AC1-110 1*	*2.22*
926341	*AC1-110 2*	*2.22*
926351	*AC1-111 1*	*0.89*
926361	*AC1-111 2*	*0.89*
926371	*AC1-111 3*	*0.89*
926381	*AC1-111 4*	*0.89*
926391	*AC1-111 5*	*0.89*
926401	*AC1-111 6*	*0.89*
927451	*AC1-142A 1*	*4.95*
927461	*AC1-142A 2*	*4.95*
926701	*AC1-153 C1*	*95.24*
926711	*AC1-153 C2*	*94.94*
926702	*AC1-153 E1*	*3.81*
926712	*AC1-153 E2*	*3.8*
927091	*AC1-204 1*	*86.68*
927101	*AC1-204 2*	*86.69*

Appendix 11

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 143.82% to 149.31% (**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 308.57 MW to the thermal violation.

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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
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Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*1.01*
932012	*AC2-007 E*	*1.88*
932881	*AC2-115 1*	*2.87*
932891	*AC2-115 2*	*2.87*
932921	*AC2-116*	*1.*
933361	*AC2-149 C*	*1.11*
933362	*AC2-149 E*	*1.82*
933381	*AC2-151 C*	*1.15*
933382	*AC2-151 E*	*1.88*
933391	*AC2-152 C*	*0.65*
933392	*AC2-152 E*	*1.06*
933401	*AC2-153 C*	*0.56*
933402	*AC2-153 E*	*0.91*
933411	*AC2-154 C*	*2.83*
933412	*AC2-154 E*	*4.62*
933431	*AC2-156 C*	*1.14*
933432	*AC2-156 E*	*1.86*
933511	*AC2-166 C*	*2.79*
933512	*AC2-166 E*	*3.08*
933911	*AD1-013 C O2*	*2.21*
933912	*AD1-013 E O2*	*3.53*
933931	*AD1-016 C*	*1.12*
933932	*AD1-016 E*	*1.82*
934001	*AD1-024 C*	*2.86*
934002	*AD1-024 E*	*4.67*
934101	*AD1-039 1*	*9.72*
934111	*AD1-039 2*	*9.7*
934401	*AD1-064 C O2*	*3.85*
934402	*AD1-064 E O2*	*18.03*
934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.66*
LTF	*AD1-092*	*14.04*

LTF	*AD1-093*	*24.18*
LTF	*AD1-094*	*4.62*
934701	*AD1-098 C O2*	*8.29*
934702	*AD1-098 E O2*	*6.05*
934721	*AD1-100 C O2*	*54.31*
934722	*AD1-100 E O2*	*254.26*
934871	*AD1-116 C*	*1.17*
934872	*AD1-116 E*	*1.91*
934941	*AD1-126 C*	*7.*
934942	*AD1-126 E*	*4.67*
934971	*AD1-129 C*	*1.09*
934972	*AD1-129 E*	*0.72*
935001	*AD1-133 C O2*	*45.96*
935002	*AD1-133 E O2*	*30.64*
LTF	*BLUEG*	*2.32*
LTF	*CANNELTON*	*0.05*
LTF	*CARR*	*0.9*
LTF	*CATAWBA*	*0.29*
274890	*CAYUG;1U E*	*24.26*
274891	*CAYUG;2U E*	*24.26*
LTF	*CBM-S1*	*2.6*
LTF	*CBM-W1*	*74.17*
LTF	*CBM-W2*	*59.01*
LTF	*CELEVELAND*	*0.79*
LTF	*CIN*	*0.27*
LTF	*CLIFTY*	*14.77*
LTF	*DEARBORN*	*2.74*
LTF	*ELMERSMITH*	*0.04*
LTF	*G-007*	*2.43*
290051	*GSG-6; E*	*12.56*
LTF	*HAMLET*	*1.14*
275149	*KEMPTON ;1E*	*20.88*
290108	*LEEDK;1U E*	*29.1*
274770	*LINCOLN ;1U*	*4.68*
274771	*LINCOLN ;2U*	*4.68*
274772	*LINCOLN ;3U*	*4.68*
274773	*LINCOLN ;4U*	*4.68*
274774	*LINCOLN ;5U*	*4.68*
274775	*LINCOLN ;6U*	*4.68*
274776	*LINCOLN ;7U*	*4.68*
274777	*LINCOLN ;8U*	*4.68*
LTF	*MEC*	*47.35*
274850	*MENDOTA H;RU*	*7.22*
293061	*N-015 E*	*17.77*
LTF	*O-066*	*8.18*

293644	*O22 E1*	*12.5*
293645	*O22 E2*	*24.27*
290021	*O50 E*	*23.68*
294392	*P-010 E*	*22.57*
274888	*PILOT HIL;1E*	*20.88*
274830	*PWR VTREC;1U*	*7.34*
274831	*PWR VTREC;2U*	*7.34*
296308	*R-030 C1*	*5.69*
296271	*R-030 C2*	*5.69*
296125	*R-030 C3*	*5.75*
296309	*R-030 E1*	*22.74*
296272	*R-030 E2*	*22.74*
296128	*R-030 E3*	*23.02*
LTF	*RENSSELAER*	*0.71*
LTF	*ROSETON*	*5.14*
LTF	*ROWAN*	*0.7*
274722	*S-055 E*	*13.53*
884780	*S58 FTIR*	*61.26*
884781	*S58 NFTIR*	*183.79*
295111	*SUBLETTE E*	*3.27*
LTF	*TRIMBLE*	*0.48*
274853	*TWINGROVE;U1*	*23.44*
274854	*TWINGROVE;U2*	*23.44*
299993	*U3-031C*	*12.4*
903433	*W3-046*	*12.74*
LTF	*WEC*	*9.63*
295109	*WESTBROOK E*	*6.72*
274687	*WILL CNTY;4U*	*80.62*
910542	*X3-005 E*	*0.89*
914641	*Y2-103*	*54.12*
915011	*Y3-013 1*	*4.51*
915021	*Y3-013 2*	*4.51*
915031	*Y3-013 3*	*4.51*
LTF	*Z1-043*	*35.33*
916502	*Z1-106 E1*	*1.51*
916504	*Z1-106 E2*	*1.51*
916512	*Z1-107 E*	*3.07*
916522	*Z1-108 E*	*2.99*
916651	*Z1-127 1*	*2.01*
916652	*Z1-127 2*	*0.99*
917501	*Z2-087 C*	*4.44*
917502	*Z2-087 E*	*29.74*
918051	*AA1-018 C*	*3.*
918052	*AA1-018 E*	*20.08*
918972	*AA1-116 E*	*2.98*

918982	*AA1-117 E*	*2.98*
919591	*AA2-035*	*159.68*
920112	*AA2-107 E*	*2.94*
920272	*AA2-123 E*	*2.94*
930481	*AB1-089*	*79.21*
930491	*AB1-090*	*79.21*
930501	*AB1-091*	*81.66*
930761	*AB1-122 1*	*89.47*
930771	*AB1-122 2*	*89.21*
931221	*AB1-172*	*0.95*
LTF	*AB2-013*	*20.15*
924041	*AB2-047 C O1*	*5.48*
924042	*AB2-047 E O1*	*36.68*
924471	*AB2-096*	*50.97*
925301	*AB2-191 C*	*1.52*
925302	*AB2-191 E*	*1.35*
925881	*AC1-067*	*161.98*
926311	*AC1-109 1*	*2.29*
926321	*AC1-109 2*	*2.29*
926331	*AC1-110 1*	*2.27*
926341	*AC1-110 2*	*2.27*
926351	*AC1-111 1*	*0.91*
926361	*AC1-111 2*	*0.91*
926371	*AC1-111 3*	*0.91*
926381	*AC1-111 4*	*0.91*
926391	*AC1-111 5*	*0.91*
926401	*AC1-111 6*	*0.91*
927511	*AC1-113 1*	*1.43*
927522	*AC1-113 2*	*1.43*
926431	*AC1-114*	*2.87*
927451	*AC1-142A 1*	*5.06*
927461	*AC1-142A 2*	*5.06*
926701	*AC1-153 C1*	*97.25*
926711	*AC1-153 C2*	*96.97*
926702	*AC1-153 E1*	*3.89*
926712	*AC1-153 E2*	*3.88*
927091	*AC1-204 1*	*88.53*
927101	*AC1-204 2*	*88.54*