Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD1-039

Kendall—Tazewell, Dresden—Mole Creek

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 AD1-039 Kendall—Tazewell, Dresden—Mole Creek project is a proposal for an uprate of 125MW Energy (125 MW Capacity) to AB1-122 a natural gas fired combined cycle facility to be located in Grundy County, IL. The IC has proposed a service date for this project of June 1, 2021.

It is proposed in the AD1-039 Interconnection Request (Attachment N) that the customer is selecting the POI at the interconnection substation proposed for AB1-122.

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.

Point of Interconnection

The Interconnection Customer (IC) AD1-039 proposes 125 MW uprate to a prior generation interconnection request under PJM queue AB1-122, as shown in the one line diagram. The AB1-122 is a 1160MW (1150 MWC) generation request to be interconnected to a new interconnection substation looping Kendall-Tazewell and Dresden-Mole Creek 345kV lines.

It should be noted that in between the Queue Request AB1-122 and AD1-039, an RTEP baseline, namely b2732.1 will reconfigure the Kendall-Tazewell 93505 line.

Attachment Facilities

Included in AB1-122 request

Direct Connection Network Upgrades

Included in AB1-122 request

Non-Direct Connection Network Upgrades

Included in AB1-122 request

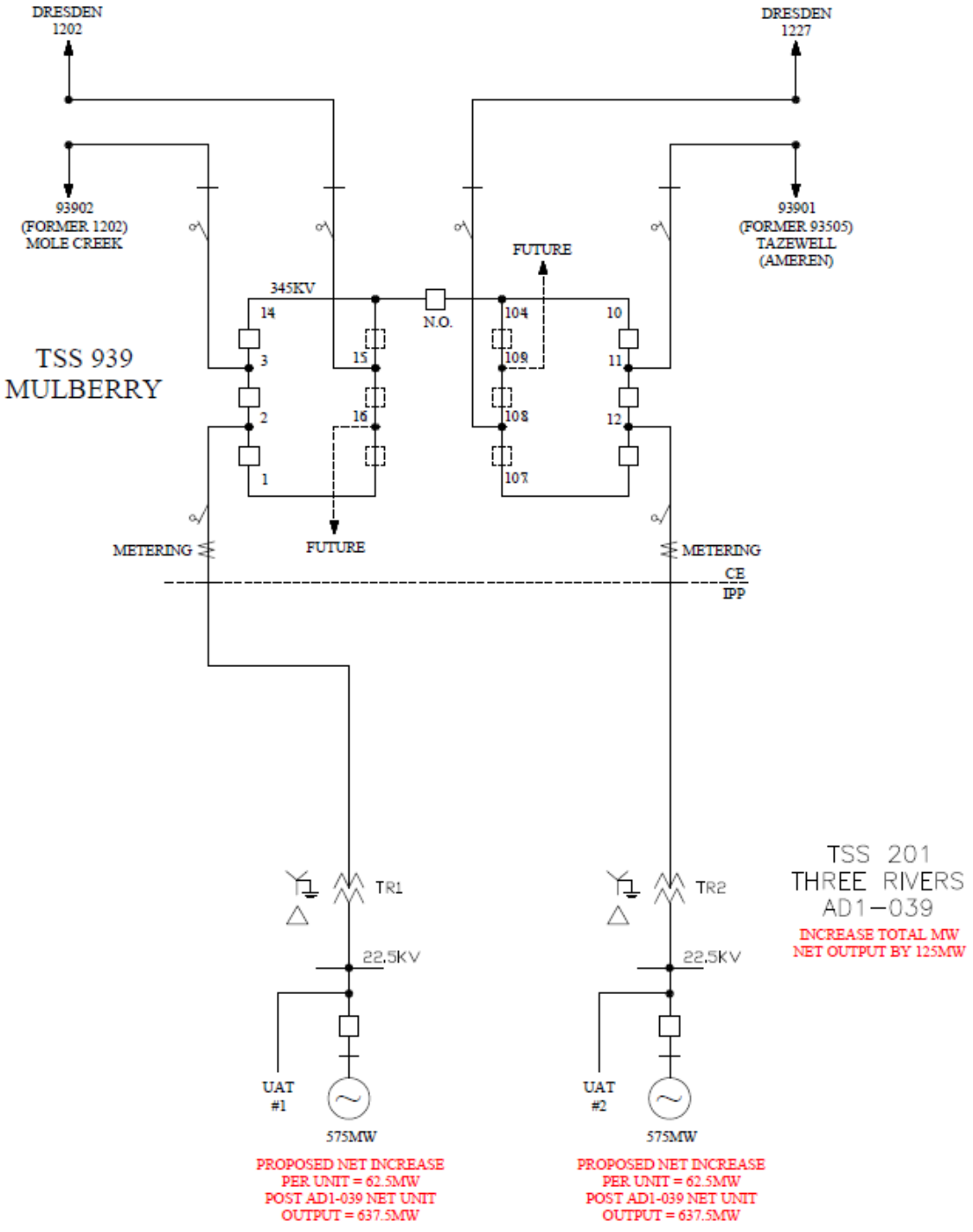

Figure 1. Single Line Diagram

Network Impacts

The Queue Project AD1-039 was evaluated as a 125.0 MW (Capacity 125.0 MW) injection tapping both the Kendall to Tazewell 345kV line at the AB1-122 Tap and the Dresden to Mole Creek 345kV line at the AB1-122 Tap in the ComEd area. Project AD1-039 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD1-039 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)

None

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

1. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 160.11% to 160.31% (**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 18.41 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.

2. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 156.84% to 157.05% (**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 18.91 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
```

3. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 156.64% to 156.85% (**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 18.86 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
```

4. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 111.01% to 111.61% (**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 18.91 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 - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 128.6% to 128.8% (**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 15.38 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 2 for a table containing the generators having contribution to this flowgate.

6. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 128.14% to 128.34% (**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 15.48 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
```

7. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 127.65% to 127.85% (**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 15.41 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
```

8. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 126.55% to 128.4% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 23.44 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

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

9. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 101.59% to 103.03% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1221__B-S'. This project contributes approximately 19.65 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1221__B-S'
 TRIP BRANCH FROM BUS 270716 TO BUS 270928 CKT 1          / DRESD; B 345 WOLFS; B 345
 END
```

10. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 101.21% to 102.65% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 19.65 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L14321TB-N'
 TRIP BRANCH FROM BUS 270928 TO BUS 270730 CKT 1          / WOLFS; B 345 ELECT; B 345
 TRIP BRANCH FROM BUS 270928 TO BUS 272794 TO BUS 275334 CKT 1   / WOLFS; B 345 WOLFS; B 138 WOLFS;1C 34.5
 END
```

11. (CE - CE) The DRESDEN ; B 345/138 kV transformer (from bus 270716 to bus 275179 ckt 1) loads from 154.79% to 158.24% (**DC power flow**) of its load dump rating (442 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT5-6__'. This project contributes approximately 13.98 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT5-6__'
 TRIP BRANCH FROM BUS 270716 TO BUS 270736 CKT 1          / DRESD; B 345 ELWOO; B 345
 TRIP BRANCH FROM BUS 270736 TO BUS 270737 CKT 1          / ELWOO; B 345 ELWOO; R 345
 TRIP BRANCH FROM BUS 274702 TO BUS 270716 CKT 1          / KENDA; B 345 DRESD; B 345
 END
```

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

12. (CE - CE) The DRESDEN ; B 345/138 kV transformer (from bus 270716 to bus 275179 ckt 1) loads from 118.5% to 120.05% (**DC power flow**) of its emergency rating (442 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 6.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L10805_B-S'
 TRIP BRANCH FROM BUS 270810 TO BUS 274702 CKT 1          / LOCKP; B 345 KENDA;BU 345
 END
```

13. (CE - CE) The DRESDEN ; R-ELWOOD ; R 345 kV line (from bus 270717 to bus 270737 ckt 1) loads from 112.46% to 113.89% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1223_TR-S'. This project contributes approximately 22.2 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1223_TR-S'
 TRIP BRANCH FROM BUS 270717 TO BUS 270731 CKT 1          / DRESD; R 345 ELECT;4R 345
 TRIP BRANCH FROM BUS 275180 TO BUS 270717 CKT 1          / DRESD;3M 138 DRESD; R 345
 TRIP BRANCH FROM BUS 275180 TO BUS 271336 CKT 1          / DRESD;3M 138 DRESD; B 138
 TRIP BRANCH FROM BUS 275180 TO BUS 275280 CKT 1          / DRESD;3M 138 DRESD;3C 34.5
 END
```

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

14. (CE - CE) The DRESDEN ; R 345/138 kV transformer (from bus 270717 to bus 275180 ckt 1) loads from 117.45% to 118.66% (**DC power flow**) of its emergency rating (480 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1222__R-S'. This project contributes approximately 5.83 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1222__R-S'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1          / DRESD; R 345 ELWOO; R 345
 END
```

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

15. (CE - CE) The DRESDEN ; R 345/138 kV transformer (from bus 270717 to bus 275180 ckt 1) loads from 110.04% to 110.59% (**DC power flow**) of its load dump rating (480 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_900-45-BT2-3__'. This project contributes approximately 5.82 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_900-45-BT2-3__'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1          / DRESD; R 345 ELWOO; R 345
 TRIP BRANCH FROM BUS 270737 TO BUS 274757 CKT 1          / ELWOO; R 345 ELWOO;1P 345
 TRIP BRANCH FROM BUS 274757 TO BUS 274729 CKT 1          / ELWOO;1P 345 ELWOO;1P 18
 TRIP BRANCH FROM BUS 274757 TO BUS 274731 CKT 1          / ELWOO;1P 345 ELWOO;2P 18
 TRIP BRANCH FROM BUS 274757 TO BUS 274733 CKT 1          / ELWOO;1P 345 ELWOO;3P 18
 TRIP BRANCH FROM BUS 274757 TO BUS 274735 CKT 1          / ELWOO;1P 345 ELWOO;4P 18
 REMOVE UNIT 1 FROM BUS 274729                  / ELWOO;1P 18
 REMOVE UNIT 2 FROM BUS 274731                  / ELWOO;2P 18
 REMOVE UNIT 3 FROM BUS 274733                  / ELWOO;3P 18
 REMOVE UNIT 4 FROM BUS 274735                  / ELWOO;4P 18
 END
```

16. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 130.65% to 131.84% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11622_R-S'. This project contributes approximately 17.15 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

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

17. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 119.62% to 120.77% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 16.45 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L10805_B-S'
 TRIP BRANCH FROM BUS 270810 TO BUS 274702 CKT 1          / LOCKP; B 345 KENDA;BU 345
 END
```

18. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 118.85% to 119.9% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 12.54 MW to the thermal violation.

19. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 130.58% to 131.8% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11620_B-S'. This project contributes approximately 17.56 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11620_B-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 END
```

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

20. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 115.09% to 116.21% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 13.22 MW to the thermal violation.

21. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 109.69% to 110.72% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1223_TR-S'. This project contributes approximately 14.87 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1223_TR-S'
 TRIP BRANCH FROM BUS 270717 TO BUS 270731 CKT 1          / DRESD; R 345 ELECT;4R 345
```

```
 TRIP BRANCH FROM BUS 275180 TO BUS 270717 CKT 1          / DRESD;3M 138 DRESD; R 345
 TRIP BRANCH FROM BUS 275180 TO BUS 271336 CKT 1          / DRESD;3M 138 DRESD; B 138
 TRIP BRANCH FROM BUS 275180 TO BUS 275280 CKT 1          / DRESD;3M 138 DRESD;3C 34.5
 END
```

22. (CE - MISO AMIL) The POWERTON ; R-7TAZEWELL 345 kV line (from bus 270855 to bus 349662 ckt 1) loads from 100.58% to 103.21% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1202__B-S-A'. This project contributes approximately 38.82 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1202__B-S-A'
 TRIP BRANCH FROM BUS 270716 TO BUS 930770 CKT 1          / DRESDEN ; B 345 AB1-122 TAP 345
 END
```

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

23. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 140.41% to 140.65% (**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 19.55 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.

24. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 143.39% to 143.64% (**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 19.96 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.

25. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 118.1% to 119.47% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1221__B-S'. This project contributes approximately 19.44 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1221__B-S'
```

```
 TRIP BRANCH FROM BUS 270716 TO BUS 270928 CKT 1              / DRESD; B 345 WOLFS; B 345
 END
```

26. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 117.86% to 119.22% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 19.45 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L14321TB-N'
 TRIP BRANCH FROM BUS 270928 TO BUS 270730 CKT 1              / WOLFS; B 345 ELECT; B 345
 TRIP BRANCH FROM BUS 270928 TO BUS 272794 TO BUS 275334 CKT 1    / WOLFS; B 345 WOLFS; B 138 WOLFS;1C 34.5
 END
```

27. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 116.95% to 118.25% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 14.98 MW to the thermal violation.

28. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 114.54% to 115.73% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 23.03 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1              / ELWOO; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1              / ELWOO; R 345 GOODI;1R 345
 END
```

29. (CE - CE) The DRESDEN ;1M-DRESDEN ; R 138 kV line (from bus 275179 to bus 271337 ckt 1) loads from 154.74% to 158.19% (**DC power flow**) of its load dump rating (442 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT5-6__'. This project contributes approximately 13.98 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT5-6__'
 TRIP BRANCH FROM BUS 270716 TO BUS 270736 CKT 1              / DRESD; B 345 ELWOO; B 345
 TRIP BRANCH FROM BUS 270736 TO BUS 270737 CKT 1              / ELWOO; B 345 ELWOO; R 345
 TRIP BRANCH FROM BUS 274702 TO BUS 270716 CKT 1              / KENDA; B 345 DRESD; B 345
 END
```

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

30. (CE - CE) The DRESDEN ;1M-DRESDEN ; R 138 kV line (from bus 275179 to bus 271337 ckt 1) loads from 118.46% to 120.01% (**DC power flow**) of its emergency rating (442 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 6.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L10805_B-S'
 TRIP BRANCH FROM BUS 270810 TO BUS 274702 CKT 1              / LOCKP; B 345 KENDA;BU 345
 END
```

31. (CE - CE) The DRESDEN ;1M-DRESDEN ; R 138 kV line (from bus 275179 to bus 271337 ckt 1) loads from 108.04% to 109.55% (**DC power flow**) of its emergency rating (442 MVA) for

the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 6.66 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L14321TB-N'
 TRIP BRANCH FROM BUS 270928 TO BUS 270730 CKT 1             / WOLFS; B 345 ELECT; B 345
 TRIP BRANCH FROM BUS 270928 TO BUS 272794 TO BUS 275334 CKT 1    / WOLFS; B 345 WOLFS; B 138 WOLFS;1C 34.5
 END
```

32. (CE - CE) The DRESDEN ;3M-DRESDEN ; B 138 kV line (from bus 275180 to bus 271336 ckt 1) loads from 117.4% to 118.62% (**DC power flow**) of its emergency rating (480 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1222__R-S'. This project contributes approximately 5.83 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1222__R-S'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1             / DRESD; R 345 ELWOO; R 345
 END
```

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

33. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 140.41% to 140.65% (**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 19.55 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.

34. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 143.39% to 143.64% (**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 19.96 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.

35. (CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 154.25% to 159.73% (**DC power flow**) of its emergency rating (1195 MVA)

for the single line contingency outage of 'COMED_P1-2_345-L1202__B-S-A'. This project contributes approximately 65.23 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1202__B-S-A'
 TRIP BRANCH FROM BUS 270716 TO BUS 930770 CKT 1              / DRESDEN ; B 345 AB1-122 TAP 345
 END
```

Please refer to Appendix 16 for a table containing the generators having contribution to this flowgate.

36. (CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 136.36% to 140.88% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L19601_B-S'. This project contributes approximately 53.69 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L19601_B-S'
 TRIP BRANCH FROM BUS 270790 TO BUS 270770 CKT 1              / KATYD; B 345 GOODI;4B 345
 END
```

37. (CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 125.98% to 130.47% (**DC power flow**) of its normal rating (1195 MVA) for non-contingency condition. This project contributes approximately 53.54 MW to the thermal violation.

38. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 134.75% to 139.33% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 56.48 MW to the thermal violation.

Please refer to Appendix 17 for a table containing the generators having contribution to this flowgate.

39. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 119.06% to 122.9% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L19601_B-S'. This project contributes approximately 56.53 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L19601_B-S'
 TRIP BRANCH FROM BUS 270790 TO BUS 270770 CKT 1              / KATYD; B 345 GOODI;4B 345
 END
```

40. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 118.17% to 122.02% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L19006__B-S'. This project contributes approximately 56.53 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L19006__B-S'                  /* CHANGED DUE TO W3-046 CONNECTION CHANGE
 TRIP BRANCH FROM BUS 270790 TO BUS 270854 CKT 1            / KATYDID;B 345 W3-046;B 345
 END
```

41. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 117.38% to 120.65% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L0301__B-S_+_345-L0303__R-S_W3-046-FSA_B'. This project contributes approximately 56.64 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L0301__B-S_+_345-L0303__R-S_W3-046-FSA_B'
 TRIP BRANCH FROM BUS 270854 TO BUS 270790 CKT 1          / POWER; B 345 KATYDID;B 345
 TRIP BRANCH FROM BUS 918050 TO BUS 270769 CKT 1          / POWERTON ; R 345 AA1-018 TAP 345
 END
```

42. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 115.22% to 118.5% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L0301__B-S_+_345-L0303__R-S_W3-046-FSA_A'. This project contributes approximately 56.64 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L0301__B-S_+_345-L0303__R-S_W3-046-FSA_A'
 TRIP BRANCH FROM BUS 270854 TO BUS 270790 CKT 1          / POWER; B 345 KATYDID;B 345
 TRIP BRANCH FROM BUS 270855 TO BUS 918050 CKT 1          / POWERTON ; R 345 AA1-018 TAP 345
 END
```

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)

Not applicable. No changes from AB1-122 proposed configuration.

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.

Not Applicable

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)

None

Stability and Reactive Power Requirement
(Results of the dynamic studies should be inserted here)

To be determined

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)

None

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

1. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 160.11% to 160.31% (**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 18.41 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.

2. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 156.84% to 157.05% (**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 18.91 MW to the thermal violation.

Same as Contribution to Previously Identified #1

3. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 156.64% to 156.85% (**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 18.86 MW to the thermal violation.

Same as Contribution to Previously Identified #1

4. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 111.01% to 111.61% (**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 18.91 MW to the thermal violation.

Same as Contribution to Previously Identified #1

5. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 128.6% to 128.8% (**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 15.38 MW to the thermal violation.

COMED:
The post contingency flow exceeds the rating therefore an upgrade is required. The upgrade will be to mitigate the sag on the line. Upon completion of this upgrade the ratings will be 1201/1479/1768 MVA, SN/SE/SLD. A preliminary estimate for the upgrade will be $8.6 M with an estimated construction timeline of 20 months.

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

6. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 128.14% to 128.34% (**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 15.48 MW to the thermal violation.

Same as Contribution to Previously Identified #5

7. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 127.65% to 127.85% (**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 15.41 MW to the thermal violation.

Same as Contribution to Previously Identified #5

8. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 126.55% to 128.4% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 23.44 MW to the thermal violation.

COMED:
The post contingency flow exceeds the ratings therefore an upgrade is required. Mitigate the sag on the line. A preliminary estimate for this work is $75.6 M with a timeline of 24 months. The preliminary estimate will require a detailed engineering review which may result in a reduced value. Upon completion of this work the SLD & ALDR ratings will become 1367 MVA & 1572 MVA respectively.

9. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 101.59% to 103.03% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1221__B-S'. This project contributes approximately 19.65 MW to the thermal violation.

Same as Contribution to Previously Identified #8

10. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 101.21% to 102.65% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 19.65 MW to the thermal violation.

Same as Contribution to Previously Identified #8

11. (CE - CE) The DRESDEN ; B 345/138 kV transformer (from bus 270716 to bus 275179 ckt 1) loads from 154.79% to 158.24% (**DC power flow**) of its load dump rating (442 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT5-6__'. This project contributes approximately 13.98 MW to the thermal violation.

COMED:
The post contingency flow above will exceed the ALDR rating. The resolution is a ComEd proposed plan for a cutover 345kV L93505 from TSS 935 Kendall to Dresden Station Bus 12. The plan would include a 345kV bus extension at Dresden. Upon completion of this work The preliminary estimate is $16M with a timeline of 24-30 months. Note, that the rating for Tr. 91 @ Dresden will remain current however the proposed ComEd Planning Sketch will connect 345kV L1224 and L2311 to the Red 345kV Bus at Dresden Station. The connectivity of the two lines will provide overload relief for Tr. 91.

12. (CE - CE) The DRESDEN ; B 345/138 kV transformer (from bus 270716 to bus 275179 ckt 1) loads from 118.5% to 120.05% (**DC power flow**) of its emergency rating (442 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 6.85 MW to the thermal violation.

Same as Contribution to Previously Identified #11

13. (CE - CE) The DRESDEN ; R-ELWOOD ; R 345 kV line (from bus 270717 to bus 270737 ckt 1) loads from 112.46% to 113.89% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1223_TR-S'. This project contributes approximately 22.2 MW to the thermal violation.

COMED:
The post contingency flow for this event exceeds the rating therefore an upgrade is required. A portion of the line will require re-conductoring. Upon completion of this

work the ratings will be 1334/1726/2084 MVA, SN/SE/SLD. A preliminary estimate for this upgrade is $12.4 M with an estimated construction timeline of 24-30 months.

14. (CE - CE) The DRESDEN ; R 345/138 kV transformer (from bus 270717 to bus 275180 ckt 1) loads from 117.45% to 118.66% (**DC power flow**) of its emergency rating (480 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1222__R-S'. This project contributes approximately 5.83 MW to the thermal violation.

COMED:
The post contingency flow for this event exceeds the rating therefore an upgrade is required. The resolution is a ComEd proposed plan for a cutover 345kV L93505 from TSS 935 Kendall to Dresden Station Bus 12. The plan would include a 345kV bus extension at Dresden. The preliminary estimate is $16M with a timeline of 24-30 months.

Note, that the rating for Tr. 93 @ Dresden will remain current however the proposed ComEd Planning Sketch will connect 345kV L1224 and L2311 to the Red 345kV Bus at Dresden Station. The connectivity of the two lines will provide overload relief for Tr. 93.

15. (CE - CE) The DRESDEN ; R 345/138 kV transformer (from bus 270717 to bus 275180 ckt 1) loads from 110.04% to 110.59% (**DC power flow**) of its load dump rating (480 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_900-45-BT2-3__'. This project contributes approximately 5.82 MW to the thermal violation.

Same as Contribution to Previously Identified #14

16. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 130.65% to 131.84% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11622_R-S'. This project contributes approximately 17.15 MW to the thermal violation.

COMED:
The post contingency flow exceeds the rating therefore an upgrade is required. The line will need to be reconductored. A preliminary estimate is $18.5M with an estimated construction timeline of 24-30 months. Upon completion of this upgrade the ratings will be 1448/1863/1975/2232 MVA, (SN/SLTE/SSTE/SLD).

17. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 119.62% to 120.77% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 16.45 MW to the thermal violation.

Same as Contribution to Previously Identified #16

18. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 118.85% to 119.9% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 12.54 MW to the thermal violation.

Same as Contribution to Previously Identified #16

19. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 130.58% to 131.8% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11620_B-S'. This project contributes approximately 17.56 MW to the thermal violation.

COMED:
The post contingency flow exceeds the rating therefore an upgrade is required. The line will need to be reconductored. A preliminary estimate is $18.5M with an estimated construction timeline of 24-30 months. Upon completion of this upgrade the ratings will be 1448/1863/1975/2232 MVA, (SN/SLTE/SSTE/SLD).

20. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 115.09% to 116.21% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 13.22 MW to the thermal violation.

Same as Contribution to Previously Identified #19

21. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 109.69% to 110.72% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1223_TR-S'. This project contributes approximately 14.87 MW to the thermal violation.

Same as Contribution to Previously Identified #19

22. (CE - MISO AMIL) The POWERTON ; R-7TAZEWELL 345 kV line (from bus 270855 to bus 349662 ckt 1) loads from 100.58% to 103.21% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1202__B-S-A'. This project contributes approximately 38.82 MW to the thermal violation.

COMED:
The post contingency flow for this event exceeds the rating therefore an upgrade is required. The line sag will need to be mitigated. A preliminary estimate for this upgrade is $9M with an estimated construction timeline of 20 months. Upon completion of this work the ratings will be 1461/1656/1909/1912 MVA, SN/SLTE/SSTE/SLD.

23. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 140.41% to 140.65% (**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 19.55 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.

24. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 143.39% to 143.64% (**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 19.96 MW to the thermal violation.

COMED:
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.

25. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 118.1% to 119.47% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1221__B-S'. This project contributes approximately 19.44 MW to the thermal violation.

COMED:
The post contingency flow for this event exceeds the rating therefore an upgrade is required. The line will require line upgrades and re-tensioning. A preliminary estimate for these upgrades is $11.1 M with a preliminary construction timeline of 24-30 months. Upon completion of the upgrades the ratings will be 1334/1726/1837/2084 MVA (SN/SLTE/SSTE/SLD).

26. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 117.86% to 119.22% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 19.45 MW to the thermal violation.

Same as Contribution to Previously Identified #25

27. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 116.95% to 118.25% (**DC power flow**) of its normal rating (1201

MVA) for non-contingency condition. This project contributes approximately 14.98 MW to the thermal violation.

Same as Contribution to Previously Identified #25

28. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 114.54% to 115.73% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 23.03 MW to the thermal violation.

Same as Contribution to Previously Identified #25

29. (CE - CE) The DRESDEN ;1M-DRESDEN ; R 138 kV line (from bus 275179 to bus 271337 ckt 1) loads from 154.74% to 158.19% (**DC power flow**) of its load dump rating (442 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT5-6__'. This project contributes approximately 13.98 MW to the thermal violation.

COMED:
ComEd Tr, 81 at Dresden Station, the post contingency flow for this event exceeds the applicable rating therefore an upgrade is required. ComEd Project Diagram-P.D. 0P180075 (PJM ID B2732.1) will add 2-345kV lines to the 345kV Red Bus at Dresden. Pending PJM modeling for verification, this project may alleviate this post contingency overload.

30. (CE - CE) The DRESDEN ;1M-DRESDEN ; R 138 kV line (from bus 275179 to bus 271337 ckt 1) loads from 118.46% to 120.01% (**DC power flow**) of its emergency rating (442 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 6.85 MW to the thermal violation.

Same as Contribution to Previously Identified #29

31. (CE - CE) The DRESDEN ;1M-DRESDEN ; R 138 kV line (from bus 275179 to bus 271337 ckt 1) loads from 108.04% to 109.55% (**DC power flow**) of its emergency rating (442 MVA) for the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 6.66 MW to the thermal violation.

Same as Contribution to Previously Identified #29

32. (CE - CE) The DRESDEN ;3M-DRESDEN ; B 138 kV line (from bus 275180 to bus 271336 ckt 1) loads from 117.4% to 118.62% (**DC power flow**) of its emergency rating (480 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1222__R-S'. This project contributes approximately 5.83 MW to the thermal violation.

COMED:
ComEd Tr. 83 at Dresden Station SSTE is 520 MVA. The post contingency flow for this event exceeds the applicable rating therefore an upgrade is required. ComEd

Project Diagram- P.D. 0P180075 (PJM ID B2732.1) will add 2-345kV lines to the 345kV Red Bus at Dresden. Pending PJM modeling for verification, this project may alleviate this post contingency overload.

33. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 140.41% to 140.65% (**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 19.55 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.

34. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 143.39% to 143.64% (**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 19.96 MW to the thermal violation.

Same as Contribution to Previously Identified #33

35. (CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 154.25% to 159.73% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1202__B-S-A'. This project contributes approximately 65.23 MW to the thermal violation.

COMED:
ComEd 345kV L93505 SN rating is 1199 MVA. The post contingency flow for this event exceeds the applicable rating therefore an upgrade is required. The upgrade will be to re-conductor the line, upgrade station conductor at the line terminals. The preliminary cost estimate for this work is $3M with an estimated construction timeline of 24-30 months. Upon completion of the work the new ratings will be 1572/1930/1965/2105 MVA, SN/SLTE/SSTE/SLD respectively.

36. (CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 136.36% to 140.88% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L19601_B-S'. This project contributes approximately 53.69 MW to the thermal violation.

Same as Contribution to Previously Identified #35

37. (CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 125.98% to 130.47% (**DC power flow**) of its normal rating (1195 MVA) for non-contingency condition. This project contributes approximately 53.54 MW to the thermal violation.

Same as Contribution to Previously Identified #35

38. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 134.75% to 139.33% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 56.48 MW to the thermal violation.

COMED:
ComEd 345kV L1202 SN rating is 1201 MVA. The post contingency flow for this event exceeds the line rating therefore an upgrade will be required. The upgrade will be to re-conductor the line, upgrade station conductor at both station line terminals, upgrade CT's on a Bus Tie Circuit Breaker at Dresden Station and upgrade 1-345kV Circuit Breaker at Dresden Station. A preliminary cost estimate is $10.7M with a preliminary construction timeline of 24-30 months. Upon completion of this work the new line ratings will be 1679/2058/2107/2280 MVA (SN/SLTE/SLTE/SLD) respectively.

39. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 119.06% to 122.9% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L19601_B-S'. This project contributes approximately 56.53 MW to the thermal violation.

Same as Contribution to Previously Identified #38

40. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 118.17% to 122.02% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L19006__B-S'. This project contributes approximately 56.53 MW to the thermal violation.

Same as Contribution to Previously Identified #38

41. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 117.38% to 120.65% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L0301__B-S_+_345-L0303__R-S_W3-046-FSA_B'. This project contributes approximately 56.64 MW to the thermal violation.

Same as Contribution to Previously Identified #38

42. (CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 115.22% to 118.5% (**DC power flow**) of its load dump rating (1768 MVA) for

the tower line contingency outage of 'COMED_P7_345-L0301__B-S_+_345-L0303__R-S_W3-046-FSA_A'. This project contributes approximately 56.64 MW to the thermal violation.

Same as Contribution to Previously Identified #38

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 - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 160.11% to 160.31% (**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 18.41 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 2

(CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 128.6% to 128.8% (**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 15.38 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 3

(CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 126.55% to 128.4% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 23.44 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934001	*AD1-024 C*	*1.32*
934002	*AD1-024 E*	*2.15*
934101	*AD1-039 1*	*5.01*
934111	*AD1-039 2*	*18.44*
274658	*DRESDEN ;2U*	*53.08*
274735	*ELWOOD EC;4P*	*5.54*
274728	*ELWOOD EC;5P*	*5.58*
274730	*ELWOOD EC;6P*	*5.58*
274732	*ELWOOD EC;7P*	*5.58*
274734	*ELWOOD EC;8P*	*5.58*
274736	*ELWOOD EC;9P*	*5.58*
290021	*O50 E*	*26.72*
903433	*W3-046*	*13.18*
930761	*AB1-122 1*	*46.06*
930771	*AB1-122 2*	*169.61*
926701	*AC1-153 C1*	*50.07*
926711	*AC1-153 C2*	*184.36*
926702	*AC1-153 E1*	*2.*
926712	*AC1-153 E2*	*7.37*
927091	*AC1-204 1*	*105.73*
927101	*AC1-204 2*	*105.02*

Appendix 4

(CE - CE) The DRESDEN ; B 345/138 kV transformer (from bus 270716 to bus 275179 ckt 1) loads from 154.79% to 158.24% (**DC power flow**) of its load dump rating (442 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT5-6__'. This project contributes approximately 13.98 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT5-6__'
 TRIP BRANCH FROM BUS 270716 TO BUS 270736 CKT 1          / DRESD; B 345 ELWOO; B 345
 TRIP BRANCH FROM BUS 270736 TO BUS 270737 CKT 1          / ELWOO; B 345 ELWOO; R 345
 TRIP BRANCH FROM BUS 274702 TO BUS 270716 CKT 1          / KENDA; B 345 DRESD; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934111	*AD1-039 2*	*13.98*
274658	*DRESDEN ;2U*	*40.27*
274879	*MINONK ;1U*	*0.96*
290021	*O50 E*	*19.53*
916512	*Z1-107 E*	*1.87*
930771	*AB1-122 2*	*128.57*
926711	*AC1-153 C2*	*139.75*
926712	*AC1-153 E2*	*5.59*

Appendix 5

(CE - CE) The DRESDEN ; R-ELWOOD ; R 345 kV line (from bus 270717 to bus 270737 ckt 1) loads from 112.46% to 113.89% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1223_TR-S'. This project contributes approximately 22.2 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1223_TR-S'
 TRIP BRANCH FROM BUS 270717 TO BUS 270731 CKT 1          / DRESD; R 345 ELECT;4R 345
 TRIP BRANCH FROM BUS 275180 TO BUS 270717 CKT 1          / DRESD;3M 138 DRESD; R 345
 TRIP BRANCH FROM BUS 275180 TO BUS 271336 CKT 1          / DRESD;3M 138 DRESD; B 138
 TRIP BRANCH FROM BUS 275180 TO BUS 275280 CKT 1          / DRESD;3M 138 DRESD;3C 34.5
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933391	*AC2-152 C*	*0.48*
934101	*AD1-039 1*	*22.2*
935001	*AD1-133 C O1*	*48.06*
935141	*AD1-148*	*3.59*
274863	*CAYUGA RI;1U*	*0.49*
274864	*CAYUGA RI;2U*	*0.49*
274659	*DRESDEN ;3U*	*68.47*
951151	*J474 C*	*1.93*
274708	*KENDALL ;3C*	*3.45*
274709	*KENDALL ;3S*	*2.3*
274710	*KENDALL ;4C*	*2.09*
274711	*KENDALL ;4S*	*2.15*
274650	*KINCAID ;1U*	*6.17*
274651	*KINCAID ;2U*	*6.15*
296308	*R-030 C1*	*4.24*
296271	*R-030 C2*	*4.24*
296125	*R-030 C3*	*4.29*
290261	*S-027 C*	*0.82*
290265	*S-028 C*	*0.82*
905081	*W4-005 C*	*0.79*
915621	*Y3-090*	*0.38*
915631	*Y3-091*	*0.38*
917501	*Z2-087 C*	*3.31*
919591	*AA2-035*	*221.66*
930761	*AB1-122 1*	*204.25*
924041	*AB2-047 C O1*	*4.07*
924261	*AB2-070 C O1*	*2.01*
925771	*AC1-053 C*	*1.98*
926701	*AC1-153 C1*	*222.01*

Appendix 6

(CE - CE) The DRESDEN ; R 345/138 kV transformer (from bus 270717 to bus 275180 ckt 1) loads from 117.45% to 118.66% (**DC power flow**) of its emergency rating (480 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1222__R-S'. This project contributes approximately 5.83 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1222__R-S'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1          / DRESD; R 345 ELWOO; R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934101	*AD1-039 1*	*5.83*
935001	*AD1-133 C O1*	*12.39*
274659	*DRESDEN ;3U*	*17.93*
919591	*AA2-035*	*59.61*
930761	*AB1-122 1*	*53.62*
926701	*AC1-153 C1*	*58.28*

Appendix 7

(CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 130.65% to 131.84% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11622_R-S'. This project contributes approximately 17.15 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933381	*AC2-151 C*	*0.43*
934101	*AD1-039 1*	*8.25*
934111	*AD1-039 2*	*8.9*
935001	*AD1-133 C O1*	*17.27*
274658	*DRESDEN ;2U*	*25.62*
274659	*DRESDEN ;3U*	*24.97*
274729	*ELWOOD EC;1P*	*9.55*
274731	*ELWOOD EC;2P*	*9.55*
274733	*ELWOOD EC;3P*	*9.55*
274735	*ELWOOD EC;4P*	*9.55*
274728	*ELWOOD EC;5P*	*9.62*
274730	*ELWOOD EC;6P*	*9.62*
274732	*ELWOOD EC;7P*	*9.62*
274734	*ELWOOD EC;8P*	*9.62*
274736	*ELWOOD EC;9P*	*9.62*
274836	*EQUISTAR ; R*	*1.37*
274704	*KENDALL ;1C*	*3.15*
274705	*KENDALL ;1S*	*2.1*
274706	*KENDALL ;2C*	*3.15*
274707	*KENDALL ;2S*	*2.1*
904211	*W3-135*	*0.22*
905493	*W4-086*	*0.04*
915601	*Y3-088*	*0.34*
915611	*Y3-089*	*0.34*
918111	*AA1-040 1*	*0.19*
919591	*AA2-035*	*82.72*
930761	*AB1-122 1*	*75.89*
930771	*AB1-122 2*	*81.9*
926701	*AC1-153 C1*	*82.49*
926711	*AC1-153 C2*	*89.03*
927091	*AC1-204 1*	*182.29*
927101	*AC1-204 2*	*181.05*

Appendix 8

(CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 130.58% to 131.8% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11620_B-S'. This project contributes approximately 17.56 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11620_B-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933381	*AC2-151 C*	*0.41*
934101	*AD1-039 1*	*8.09*
934111	*AD1-039 2*	*9.47*
935001	*AD1-133 C O1*	*16.88*
274658	*DRESDEN ;2U*	*27.25*
274659	*DRESDEN ;3U*	*24.43*
274729	*ELWOOD EC;1P*	*9.66*
274731	*ELWOOD EC;2P*	*9.66*
274733	*ELWOOD EC;3P*	*9.66*
274735	*ELWOOD EC;4P*	*9.66*
274728	*ELWOOD EC;5P*	*9.6*
274730	*ELWOOD EC;6P*	*9.6*
274732	*ELWOOD EC;7P*	*9.6*
274734	*ELWOOD EC;8P*	*9.6*
274736	*ELWOOD EC;9P*	*9.6*
274836	*EQUISTAR ; R*	*1.4*
274704	*KENDALL ;1C*	*3.83*
274705	*KENDALL ;1S*	*2.56*
274706	*KENDALL ;2C*	*3.83*
274707	*KENDALL ;2S*	*2.56*
274879	*MINONK ;1U*	*0.7*
904211	*W3-135*	*0.22*
905493	*W4-086*	*0.04*
915601	*Y3-088*	*0.42*
915611	*Y3-089*	*0.42*
918111	*AA1-040 1*	*0.19*
919591	*AA2-035*	*72.19*
930761	*AB1-122 1*	*74.44*
930771	*AB1-122 2*	*87.14*
926701	*AC1-153 C1*	*80.91*
926711	*AC1-153 C2*	*94.71*
927091	*AC1-204 1*	*181.99*
927101	*AC1-204 2*	*183.12*

Appendix 9

(CE - MISO AMIL) The POWERTON ; R-7TAZEWELL 345 kV line (from bus 270855 to bus 349662 ckt 1) loads from 100.58% to 103.21% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1202__B-S-A'. This project contributes approximately 38.82 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1202__B-S-A'
 TRIP BRANCH FROM BUS 270716 TO BUS 930770 CKT 1          / DRESDEN ; B 345 AB1-122 TAP 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934111	*AD1-039 2*	*38.82*
934871	*AD1-116 C*	*2.26*
274879	*MINONK ;1U*	*4.88*
274677	*POWERTON ;5U*	*93.76*
274678	*POWERTON ;6U*	*93.95*
274861	*TOP CROP ;1U*	*1.16*
274862	*TOP CROP ;2U*	*2.24*
903433	*W3-046*	*128.89*
918051	*AA1-018 C*	*5.8*
930771	*AB1-122 2*	*357.13*
926711	*AC1-153 C2*	*388.18*

Appendix 10

(CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 140.41% to 140.65% (**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 19.55 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 143.39% to 143.64% (**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 19.96 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 - CE) The DRESDEN ;1M-DRESDEN ; R 138 kV line (from bus 275179 to bus 271337 ckt 1) loads from 154.74% to 158.19% (**DC power flow**) of its load dump rating (442 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT5-6__'. This project contributes approximately 13.98 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT5-6__'
 TRIP BRANCH FROM BUS 270716 TO BUS 270736 CKT 1          / DRESD; B 345 ELWOO; B 345
 TRIP BRANCH FROM BUS 270736 TO BUS 270737 CKT 1          / ELWOO; B 345 ELWOO; R 345
 TRIP BRANCH FROM BUS 274702 TO BUS 270716 CKT 1          / KENDA; B 345 DRESD; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934111	*AD1-039 2*	*13.98*
274658	*DRESDEN ;2U*	*40.27*
274879	*MINONK ;1U*	*0.96*
290021	*O50 E*	*19.53*
916512	*Z1-107 E*	*1.87*
930771	*AB1-122 2*	*128.57*
926711	*AC1-153 C2*	*139.75*
926712	*AC1-153 E2*	*5.59*

Appendix 13

(CE - CE) The DRESDEN ;3M-DRESDEN ; B 138 kV line (from bus 275180 to bus 271336 ckt 1) loads from 117.4% to 118.62% (**DC power flow**) of its emergency rating (480 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1222__R-S'. This project contributes approximately 5.83 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1222__R-S'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1          / DRESD; R 345 ELWOO; R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934101	*AD1-039 1*	*5.83*
935001	*AD1-133 C O1*	*12.39*
274659	*DRESDEN ;3U*	*17.93*
919591	*AA2-035*	*59.61*
930761	*AB1-122 1*	*53.62*
926701	*AC1-153 C1*	*58.28*

Appendix 14

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 140.41% to 140.65% (**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 19.55 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 143.39% to 143.64% (**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 19.96 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 16

(CE - CE) The AB1-122 TAP-DRESDEN ; R 345 kV line (from bus 930760 to bus 270717 ckt 1) loads from 154.25% to 159.73% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1202__B-S-A'. This project contributes approximately 65.23 MW to the thermal violation.

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CONTINGENCY 'COMED_P1-2_345-L1202__B-S-A'
 TRIP BRANCH FROM BUS 270716 TO BUS 930770 CKT 1            / DRESDEN ; B 345 AB1-122 TAP 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934051	*AD1-031 C O1*	*1.82*
934101	*AD1-039 1*	*53.58*
934111	*AD1-039 2*	*11.66*
934421	*AD1-066*	*0.61*
934871	*AD1-116 C*	*0.56*
274877	*BISHOP HL;1U*	*0.27*
274878	*BISHOP HL;2U*	*0.27*
274848	*CAMPGROVE;RU*	*0.41*
274879	*MINONK ;1U*	*1.46*
274677	*POWERTON ;5U*	*28.16*
274678	*POWERTON ;6U*	*28.23*
274851	*PROVIDENC;RU*	*0.18*
274861	*TOP CROP ;1U*	*0.28*
274862	*TOP CROP ;2U*	*0.55*
903433	*W3-046*	*38.72*
916211	*Z1-072*	*0.12*
918051	*AA1-018 C*	*1.43*
919621	*AA2-039 C*	*1.33*
930761	*AB1-122 1*	*492.89*
930771	*AB1-122 2*	*107.25*
925581	*AC1-033 C*	*0.9*
926701	*AC1-153 C1*	*535.75*
926711	*AC1-153 C2*	*116.58*
926841	*AC1-171 C*	*0.76*
927201	*AC1-214 C*	*1.17*

Appendix 17

(CE - CE) The AB1-122 TAP-DRESDEN ; B 345 kV line (from bus 930770 to bus 270716 ckt 1) loads from 134.75% to 139.33% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 56.48 MW to the thermal violation.

Bus Number	*Bus Name*	*Full Contribution*
934111	*AD1-039 2*	*56.48*
934871	*AD1-116 C*	*0.52*
274879	*MINONK ;1U*	*3.93*
274677	*POWERTON ;5U*	*26.52*
274678	*POWERTON ;6U*	*26.28*
274861	*TOP CROP ;1U*	*0.26*
274862	*TOP CROP ;2U*	*0.51*
903433	*W3-046*	*36.46*
918051	*AA1-018 C*	*1.34*
930771	*AB1-122 2*	*519.66*
926711	*AC1-153 C2*	*564.84*