Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD2-100

Kincaid-Latham

January 18, 2019

Preface

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

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

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

An Interconnection Customer entering the New Services Queue on or after October 1, 2018 (except those regulated by the United States Nuclear Regulatory Commission) shall provide primary frequency response in accordance with Section 4.7.2 of Appendix 2 to the Interconnection Service Agreement. See PJM Manual 14D Section 7.1.1 for more information.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection

Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

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

General

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

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

Primary Point of Interconnection (Option-1)

The Interconnection Customer (IC) AD2-100, a 210MW solar facility, proposes to interconnect with the ComEd transmission system by tying into the Kincaid-Latham (Ameren) 345kV Line 2102, approximately 10 miles from Kincaid Station 21.

Attachment Facilities

The IC AD2-100 generator lead would interconnect to a new 345kV Interconnection Substation. This interconnection would require one 345kV line MOD, a dead-end structure and revenue metering as shown in the one-line diagram.

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

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

Direct Connection Network Upgrades

In order to accommodate interconnection of AD2-100, a new 345kV Interconnection Substation would need to be built close to the Kincaid-Latham (Ameren) 345kV Line 2102 approximately 10 miles from the Kincaid Sta 21.

The scope of work includes the installation of three 345kV circuit breakers in a “breaker-and-a-half” bus configuration and cutting in the Interconnection Substation to Kincaid-Latham (Ameren) 345kV Line 2102, as shown in the one-line diagram below.

The IC is responsible for constructing all of the facilities on the IC side of the point of interconnection outside of the substation. It is assumed for the purposes of this report that the IC will obtain the site for the Interconnection Substation and right-of-way between the Interconnection Substation and the 345kV transmission line.

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

ComEd would design, engineer and construct the tie in of the Interconnection Substation to the Kincaid-Latham (Ameren) 345kV Line 2102.

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

For Option to Build Direct Connection cost estimates:

Scope of Work	Cost Estimate
Installation of a new 345kV substation as described above	N/A
Transmission line tie in work (foundations, structures, conductors)	$ 3,000,000
ComEd oversight and testing	$ 1,500,000
Total Cost Estimate (see notes below on cost estimate)	$ 4,500,000

For ComEd building the interconnecting substation cost estimates:

Scope of Work	Cost Estimate
Installation of a new 345kV substation as described above	$ 20,000,000
Transmission line tie in work (foundations, structures, conductors)	$ 3,000,000
Total Cost Estimate (see notes below on cost estimate)	$ 23,000,000

ComEd would take approximately 24-months to construct the substation and transmission line work after the ISA / ICSA are signed.

Non-Direct Connection Network Upgrades

The integration of the new 345kV Interconnection Substation would require relay/communications/SCADA upgrades at the Kincaid Sta 21 and AMEREN's Latham substation. The ComEd cost is given below:

Scope of Work	Cost Estimate
Relay/communications/SCADA upgrades at Kincaid Sta 21 substation	$ 1,000,000
Total Cost Estimate (see notes below on cost estimate)	$ 1,000,000

Notes on Cost Estimate:

1) These estimates are Order-of-Magnitude estimates of the costs that ComEd would bill to the customer for this interconnection. These estimates are based on a one-line electrical diagram of the project and the information provided by the IC.

2) There were no site visits performed for these estimates. There may be costs related to specific site related issues that are not identified in these estimates. The site reviews will be performed during the Facilities Study or during detailed engineering.

3) These estimates are not a guarantee of the maximum amount payable by the IC and the actual costs of ComEd's work may differ significantly from these estimates. Per the PJM Tariff, IC will be responsible for paying all actual costs of ComEd's work.

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

5) These cost estimates do not include cost of acquiring right-of-way for the transmission line and purchasing any additional land, if needed, for the line terminations. The need and cost of acquiring property and associated legal costs will be investigated during Facilities Study for this project.

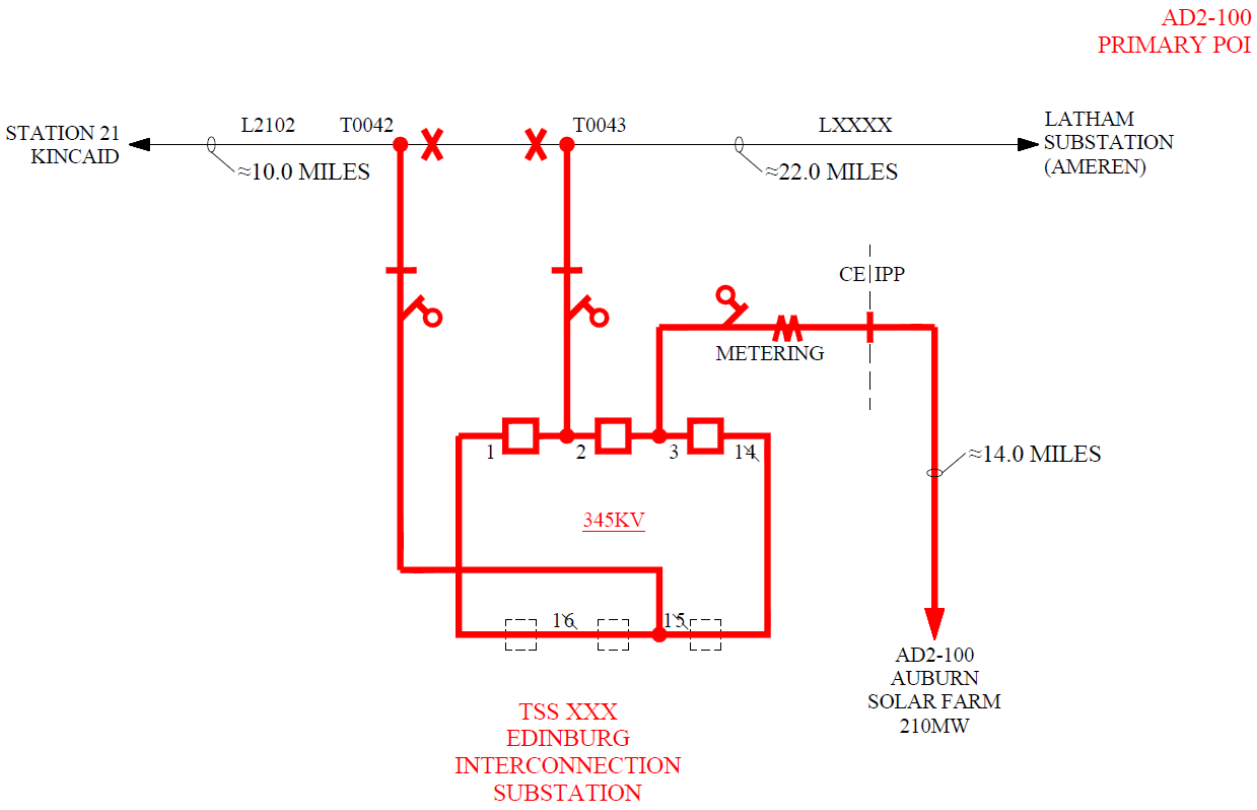

Figure 1. Single Line Diagram for Option 1

Network Impacts

The Queue Project AD2-100 was evaluated as a 210.0 MW (Capacity 126.0 MW) injection tapping the Latham; T to Kincaid; B 345 kV line in the ComEd area. Project AD2-100 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-100 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

Generator Deliverability

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

None

Multiple Facility Contingency

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

1. (AEP - AEP) The 05ROCKPT-05JEFRSO 765 kV line (from bus 243209 to bus 243208 ckt 1) loads from 99.78% to 100.27% (**DC power flow**) of its emergency rating (4571 MVA) for the tower line contingency outage of 'AEP_P7-1_#6484'. This project contributes approximately 22.27 MW to the thermal violation.

```
CONTINGENCY 'AEP_P7-1_#6484'
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 1          / 243217 05DEQUIN 345 243878 05MEADOW 345 1
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 2          / 243217 05DEQUIN 345 243878 05MEADOW 345 2
 END
```

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

Contribution to Previously Identified Overloads

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

1. (CE - CE) The LORETTO ; B-AD1-100 TAP 345 kV line (from bus 270704 to bus 934720 ckt 1) loads from 127.9% to 129.43% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 28.37 MW to the thermal violation.

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

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

2. (CE - CE) The LORETTO ; B-AD1-100 TAP 345 kV line (from bus 270704 to bus 934720 ckt 1) loads from 122.09% to 123.95% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"270853'. This project contributes approximately 28.37 MW to the thermal violation.

```
CONTINGENCY '270853'                    PONTIAC ; R 345 935000 AD1-133 TAP 345 1
 OPEN BRANCH FROM BUS 270853 TO BUS 935000 CKT 1
 END
```

3. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 124.78% to 126.51% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 28.41 MW to the thermal violation.

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

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

4. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 119.24% to 120.85% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"270853'. This project contributes approximately 28.41 MW to the thermal violation.

```
CONTINGENCY '270853'                    PONTIAC ; R 345 935000 AD1-133 TAP 345 1
 OPEN BRANCH FROM BUS 270853 TO BUS 935000 CKT 1
 END
```

5. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 191.76% to 191.99% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 6.97 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#363'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1          / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

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

6. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 130.71% to 133.12% (**DC power flow**) of its emergency rating (1466 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#3128_05EUGENE 345'. This project contributes approximately 35.28 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#3128_05EUGENE 345'
 OPEN BRANCH FROM BUS 243221 TO BUS 249504 CKT 1          / 243221 05EUGENE 345 249504 08CAYSUB 345 1
 OPEN BRANCH FROM BUS 243221 TO BUS 348885 CKT 1          / 243221 05EUGENE 345 348885 7BUNSONVILLE 345 1
 END
```

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

7. (MISO AMIL - CE) The 7BROKAW-AD2-153 TAP 345 kV line (from bus 348847 to bus 937160 ckt 1) loads from 123.25% to 124.94% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1             / PONTI; B 345 BLUEM; B 345
 END
```

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

8. (MISO AMIL - CE) The 7BROKAW-AD2-153 TAP 345 kV line (from bus 348847 to bus 937160 ckt 1) loads from 120.94% to 122.63% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L17802__-S'
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1             / BLUEM; B 345 W4-005
 END
```

9. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 125.12% to 126.18% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1             / PONTI; B 345 BLUEM; B 345
 END
```

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

10. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 122.82% to 123.89% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L17802__-S'
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1             / BLUEM; B 345 W4-005
 END
```

11. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 124.19% to 125.08% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
```

```
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

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

12. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 121.89% to 122.78% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L17802__-S'
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1              / BLUEM; B 345 W4-005
 END
```

13. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 120.63% to 122.0% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B'. This project contributes approximately 25.63 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B'
 TRIP BRANCH FROM BUS 934720 TO BUS 270704 CKT 1              / AD1-100 TAP 345 LORET; B 345
 END
```

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

14. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 118.95% to 120.52% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8012__B-S'. This project contributes approximately 25.65 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8012__B-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270704 CKT 1              / PONTI; B 345 LORET; B 345
 END
```

15. (CE - CE) The AD2-153 TAP-AB2-047 TAP 345 kV line (from bus 937160 to bus 924040 ckt 1) loads from 123.0% to 124.7% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

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

16. (CE - CE) The AD2-153 TAP-AB2-047 TAP 345 kV line (from bus 937160 to bus 924040 ckt 1) loads from 120.7% to 122.11% (**DC power flow**) of its emergency rating (1528 MVA) for

the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L17802__-S'
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1              / BLUEM; B 345 W4-005
 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)

No issues identified.

Affected System Analysis & Mitigation

MISO Impacts:

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

Delivery of Energy Portion of Interconnection Request
PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.
Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

1. (CE - CE) The BLUEMOUND; B-PONTIAC ; B 345 kV line (from bus 270668 to bus 270852 ckt 1) loads from 132.41% to 135.2% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8001___-S-A'. This project contributes approximately 42.67 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8001___-S-A'
 TRIP BRANCH FROM BUS 270853 TO BUS 917500 CKT 1              / PONTI; R 345 Z2-087 TAP 345
 END
```

2. (CE - CE) The LORETTO ; B-AD1-100 TAP 345 kV line (from bus 270704 to bus 934720 ckt 1) loads from 196.47% to 199.43% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 47.29 MW to the thermal violation.

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

```
 END
```

3. (CE - CE) The LORETTO ; B-AD1-100 TAP 345 kV line (from bus 270704 to bus 934720 ckt 1) loads from 147.36% to 149.67% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 33.0 MW to the thermal violation.

4. (CE - CE) The DRESDEN ; R-COLLINS ; R 345 kV line (from bus 270717 to bus 270697 ckt 1) loads from 100.44% to 100.92% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B'. This project contributes approximately 16.29 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B'
 TRIP BRANCH FROM BUS 934720 TO BUS 270704 CKT 1              / AD1-100 TAP 345 LORET; B 345
 END
```

5. (CE - CE) The DRESDEN ; R-ELWOOD ; R 345 kV line (from bus 270717 to bus 270737 ckt 1) loads from 111.62% to 112.13% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B'. This project contributes approximately 16.81 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B'
 TRIP BRANCH FROM BUS 934720 TO BUS 270704 CKT 1              / AD1-100 TAP 345 LORET; B 345
 END
```

6. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 100.77% to 107.72% (**DC power flow**) of its emergency rating (956 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8001___-S-A'. This project contributes approximately 70.47 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8001___-S-A'
 TRIP BRANCH FROM BUS 270853 TO BUS 917500 CKT 1              / PONTI; R 345 Z2-087 TAP 345
 END
```

7. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 98.06% to 106.48% (**DC power flow**) of its normal rating (797 MVA) for non-contingency condition. This project contributes approximately 67.13 MW to the thermal violation.

8. (CE - MISO AMIL) The LATHAM ; T-7LATHAM 345 kV line (from bus 270804 to bus 348856 ckt 1) loads from 104.56% to 111.33% (**DC power flow**) of its emergency rating (908 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 63.69 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

9. (CE - CE) The LATHAM ; T-W4-005 TAP 345 kV line (from bus 270804 to bus 905080 ckt 1) loads from 121.51% to 124.28% (**DC power flow**) of its emergency rating (1334 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8001___-S-A'. This project contributes approximately 42.8 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8001___-S-A'
 TRIP BRANCH FROM BUS 270853 TO BUS 917500 CKT 1              / PONTI; R 345 Z2-087 TAP 345
 END
```

10. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 183.75% to 186.79% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 47.36 MW to the thermal violation.

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

11. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 135.47% to 137.68% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 33.07 MW to the thermal violation.

12. (CE - CE) The PONTIAC ; R-AD1-133 TAP 345 kV line (from bus 270853 to bus 935000 ckt 1) loads from 171.94% to 174.49% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B'. This project contributes approximately 42.71 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B'
 TRIP BRANCH FROM BUS 934720 TO BUS 270704 CKT 1              / AD1-100 TAP 345 LORET; B 345
 END
```

13. (CE - CE) The PONTIAC ; R-AD1-133 TAP 345 kV line (from bus 270853 to bus 935000 ckt 1) loads from 114.82% to 116.49% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.0 MW to the thermal violation.

14. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 182.17% to 182.56% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 11.62 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#363'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1              / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

15. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 125.59% to 127.78% (**DC power flow**) of its normal rating (1451 MVA) for the single line contingency outage of 'AEP_P1-2_#286'. This project contributes approximately 34.82 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#286'
 OPEN BRANCH FROM BUS 243221 TO BUS 348885 CKT 1              / 243221 05EUGENE 345 348885 7BUNSONVILLE 345 1
 END
```

16. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 104.93% to 106.54% (**DC power flow**) of its normal rating (1451 MVA) for non-contingency condition. This project contributes approximately 28.03 MW to the thermal violation.

17. (MISO AMIL - CE) The 7BROKAW-AD2-153 TAP 345 kV line (from bus 348847 to bus 937160 ckt 1) loads from 149.46% to 152.28% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 43.09 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

18. (MISO AMIL - CE) The 7BROKAW-AD2-153 TAP 345 kV line (from bus 348847 to bus 937160 ckt 1) loads from 119.36% to 121.04% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.74 MW to the thermal violation.

19. (CE - CE) The W4-005 TAP-BLUEMOUND; B 345 kV line (from bus 905080 to bus 270668 ckt 1) loads from 134.13% to 137.06% (**DC power flow**) of its emergency rating (1334 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8001___-S-A'. This project contributes approximately 42.75 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8001___-S-A'
 TRIP BRANCH FROM BUS 270853 TO BUS 917500 CKT 1              / PONTI; R 345 Z2-087 TAP 345
 END
```

20. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 168.45% to 170.9% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 43.09 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

21. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 139.3% to 140.84% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.74 MW to the thermal violation.

22. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 159.98% to 162.36% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 43.09 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

23. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 131.31% to 132.75% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.74 MW to the thermal violation.

24. (CE - CE) The AB2-070 TAP-BROKAW ; T 345 kV line (from bus 924260 to bus 270673 ckt 1) loads from 109.46% to 114.66% (**DC power flow**) of its emergency rating (1327 MVA) for the single line contingency outage of 'COMED_P1-2_SPS-2102&2106_W4-005-FSA_A'. This project contributes approximately 68.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_SPS-2102&2106_W4-005-FSA_A'
 TRIP BRANCH FROM BUS 270804 TO BUS 905080 CKT 1          / LATHAM TAP W4-005
 TRIP BRANCH FROM BUS 270804 TO BUS 936770 CKT 1          / LATHA; T 345 AD2-100 TAP 345
 TRIP BRANCH FROM BUS 270804 TO BUS 348856 CKT 1          / LATHA; T 345 7LATHAM 345
 TRIP BRANCH FROM BUS 270796 TO BUS 347955 CKT 1          / KINCA; B 345 AUSTIN 345 (THE)
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1          / BLUEM; B 345 W4-005
 END
```

25. (CE - CE) The AC1-053 TAP-AB2-070 TAP 345 kV line (from bus 925770 to bus 924260 ckt 1) loads from 98.93% to 104.12% (**DC power flow**) of its emergency rating (1327 MVA) for the single line contingency outage of 'COMED_P1-2_SPS-2102&2106_W4-005-FSA_A'. This project contributes approximately 68.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_SPS-2102&2106_W4-005-FSA_A'
 TRIP BRANCH FROM BUS 270804 TO BUS 905080 CKT 1          / LATHAM TAP W4-005
 TRIP BRANCH FROM BUS 270804 TO BUS 936770 CKT 1          / LATHA; T 345 AD2-100 TAP 345
 TRIP BRANCH FROM BUS 270804 TO BUS 348856 CKT 1          / LATHA; T 345 7LATHAM 345
 TRIP BRANCH FROM BUS 270796 TO BUS 347955 CKT 1          / KINCA; B 345 AUSTIN 345 (THE)
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1          / BLUEM; B 345 W4-005
 END
```

26. (CE - CE) The AD1-100 TAP-AD2-137 TAP 345 kV line (from bus 934720 to bus 937030 ckt 1) loads from 154.24% to 156.06% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"934725'. This project contributes approximately 27.75 MW to the thermal violation.

```
CONTINGENCY '934725'                        AD1-100 JNT 345 934730 AD1-100 TAP 345 1
 OPEN BRANCH FROM BUS 934725 TO BUS 934730 CKT 1
 END
```

27. (CE - CE) The AD1-100 TAP-AD2-137 TAP 345 kV line (from bus 934720 to bus 937030 ckt 1) loads from 116.24% to 116.76% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 17.28 MW to the thermal violation.

28. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 183.56% to 186.23% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B'. This project contributes approximately 42.71 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B'
 TRIP BRANCH FROM BUS 934720 TO BUS 270704 CKT 1          / AD1-100 TAP 345 LORET; B 345
 END
```

29. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 126.37% to 128.15% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.0 MW to the thermal violation.

30. (CE - CE) The AD2-100 TAP-LATHAM ; T 345 kV line (from bus 936770 to bus 270804 ckt 1) loads from 100.2% to 106.4% (**DC power flow**) of its emergency rating (1334 MVA) for the single line contingency outage of 'COMED_P1-2_345-L9201___-S_W2-048-FSA-A'. This project contributes approximately 86.86 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L9201___-S_W2-048-FSA-A'
 TRIP BRANCH FROM BUS 270673 TO BUS 348847 CKT 1          / BROKA; T 345 7BROKAW T1 345
 TRIP BRANCH FROM BUS 270673 TO BUS 924260 CKT 1          / BROKA; T 345 AB2-070 TAP 345
 END
```

31. (CE - CE) The AD2-137 TAP-WILTON ; B 345 kV line (from bus 937030 to bus 270926 ckt 1) loads from 154.14% to 155.49% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"934725'. This project contributes approximately 27.75 MW to the thermal violation.

```
CONTINGENCY '934725'                                AD1-100 JNT 345 934730 AD1-100
TAP 345 1
  OPEN BRANCH FROM BUS 934725 TO BUS 934730 CKT 1
  END
```

32. (CE - CE) The AD2-137 TAP-WILTON ; B 345 kV line (from bus 937030 to bus 270926 ckt 1) loads from 116.1% to 116.62% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 17.28 MW to the thermal violation.

33. (CE - CE) The AD2-153 TAP-AB2-047 TAP 345 kV line (from bus 937160 to bus 924040 ckt 1) loads from 149.22% to 152.02% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 43.09 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1          / PONTI; B 345 BLUEM; B 345
 END
```

34. (CE - CE) The AD2-153 TAP-AB2-047 TAP 345 kV line (from bus 937160 to bus 924040 ckt 1) loads from 119.08% to 120.83% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.74 MW to the thermal violation.

Light Load Analysis - 2021

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

Summer Peak Load Flow Analysis Reinforcements

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

Multiple Facility Contingency

1. (AEP - AEP) The 05ROCKPT-05JEFRSO 765 kV line (from bus 243209 to bus 243208 ckt 1) loads from 99.78% to 100.27% (**DC power flow**) of its emergency rating (4571 MVA) for the tower line contingency outage of 'AEP_P7-1_#6484'. This project contributes approximately 22.27 MW to the thermal violation.

AEP:

1. **An engineering study will need to be conducted to determine if the Relay Thermal limit setting for Gen Aux Trf #3 can be adjusted to mitigate the overload, Estimated Cost for Study: $25,000. New relay packages will be required if the settings cannot be adjusted, Estimated Cost: $600,000.**
2. **An engineering study will need to be conducted to determine if the Relay Thermal limit setting for Rockport relay can be adjusted to mitigate the overload, Estimated Cost for Study: $25,000. New relay packages will be required if the settings cannot be adjusted, Estimated Cost: $600,000**
3. **Replace Rockport 3000A Wavetrap. Estimate Cost: $500,000**
4. **Replace Jefferson 3000A Wavetrap. Estimate Cost: $500,000**

An approximate construction time would be 12 to 24 months after signing an interconnection agreement.

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. (CE - CE) The LORETTO ; B-AD1-100 TAP 345 kV line (from bus 270704 to bus 934720 ckt 1) loads from 127.9% to 129.43% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 28.37 MW to the thermal violation.

COMED:
ComEd 345kV L11212 SSTE rating is 1846 MVA. The post contingency event exceeds the ALDR therefore an upgrade is required. Replace 345kV Circuit Breakers at TSS 112 Wilton Center. Upgrade the System 2 Aux. Relay Current Transformer. The preliminary estimate is $6.5 million with an estimated construction timeline of 24-30 months. Upon completion of the upgrades the SSTE rating will become 2083 MVA.

2. (CE - CE) The LORETTO ; B-AD1-100 TAP 345 kV line (from bus 270704 to bus 934720 ckt 1) loads from 122.09% to 123.95% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"270853'. This project contributes approximately 28.37 MW to the thermal violation.

Same as Contribution to Previously Identified #1

3. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 124.78% to 126.51% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 28.41 MW to the thermal violation.

COMED:
ComEd 345kV L8012 SSTE rating is 1846 MVA. The post contingency event exceeds the ALDR therefore an upgrade is required. Replace 345kV Circuit Breaker at TSS 80 Pontiac. Replace 345kV disconnect switches associated with the breaker. A preliminary estimate for upgrades is $3.8M with an estimated construction timeline of 24-30 months. Upon completion of the upgrades the new SSTE rating will become 2083 MVA.

4. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 119.24% to 120.85% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"270853'. This project contributes approximately 28.41 MW to the thermal violation.

Same as Contribution to Previously Identified #3

5. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 191.76% to 191.99% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 6.97 MW to the thermal violation.

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

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

6. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 130.71% to 133.12% (**DC power flow**) of its emergency rating (1466 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#3128_05EUGENE 345'. This project contributes approximately 35.28 MW to the thermal violation.

A**EP:**
1. **Rebuild 0.82 mile of the ACAR ~ 1024.5 ~ 30/7 ~ RAIL1 conductor section 5. Estimated Cost is $1.64 Million.**
2. **Rebuild 0.82 mile of the ACAR ~ 1024.5 ~ 30/7 ~ RAIL1 conductor section 6. Estimated Cost is $1.64 Million.**
3. **Rebuild 1.0 mile of the ACSR/PE ~ 1414 ~ 62/19 ~ conductor section 2. Estimated Cost is $2 Million.**

An approximate construction time would be 24 to 36 months after signing an interconnection agreement

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

7. (MISO AMIL - CE) The 7BROKAW-AD2-153 TAP 345 kV line (from bus 348847 to bus 937160 ckt 1) loads from 123.25% to 124.94% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

COMED:
ComEd 345kV L8001 SSTE rating is 1793 MVA. The post contingency flow for this event exceeds the rating therefore an upgrade will be required. At TSS 80 Pontiac perform the following upgrades-L8001 relay package for L8001, station conductor, replace 2-345kV circuit breakers and associated facilities and sag mitigation on

L8001. A preliminary estimate for the upgrades is $10.5M with a preliminary construction timeline of 30-36 months. Upon field completion of the upgrades, the new SSTE rating will become 1909 MVA.

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

8. (MISO AMIL - CE) The 7BROKAW-AD2-153 TAP 345 kV line (from bus 348847 to bus 937160 ckt 1) loads from 120.94% to 122.63% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

Same as Contribution to Previously Identified #7

9. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 125.12% to 126.18% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

Same as Contribution to Previously Identified #7

10. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 122.82% to 123.89% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

Same as Contribution to Previously Identified #7

11. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 124.19% to 125.08% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

Same as Contribution to Previously Identified #7

12. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 121.89% to 122.78% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

Same as Contribution to Previously Identified #7

13. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 120.63% to 122.0% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B'. This project contributes approximately 25.63 MW to the thermal violation.

COMED:
ComEd 345kV L8014 SSTE rating is 1797 MVA. The post contingency flow for this event exceeds the rating therefore an upgrade will be required. Resolution of the overloading will require the following upgrades-station conductor upgrades at Dresden & Pontiac along with sag mitigation on L8014 and replace 2-345kV circuit breakers and associated facilities at Pontiac substation. A preliminary estimate for the upgrades is $13.5M with a preliminary construction timeline of 30-36 months. Upon field completion of the upgrades, the new SSTE rating will become 1909 MVA.

14. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 118.95% to 120.52% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8012__B-S'. This project contributes approximately 25.65 MW to the thermal violation.

Same as Contribution to Previously Identified #13

15. (CE - CE) The AD2-153 TAP-AB2-047 TAP 345 kV line (from bus 937160 to bus 924040 ckt 1) loads from 123.0% to 124.7% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

Same as Contribution to Previously Identified #7

16. (CE - CE) The AD2-153 TAP-AB2-047 TAP 345 kV line (from bus 937160 to bus 924040 ckt 1) loads from 120.7% to 122.11% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 25.88 MW to the thermal violation.

Same as Contribution to Previously Identified #7

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

(AEP - AEP) The 05ROCKPT-05JEFRSO 765 kV line (from bus 243209 to bus 243208 ckt 1) loads from 99.78% to 100.27% (**DC power flow**) of its emergency rating (4571 MVA) for the tower line contingency outage of 'AEP_P7-1_#6484'. This project contributes approximately 22.27 MW to the thermal violation.

```
CONTINGENCY 'AEP_P7-1_#6484'
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 1          / 243217 05DEQUIN 345 243878 05MEADOW 345 1
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 2          / 243217 05DEQUIN 345 243878 05MEADOW 345 2
 END
```

Bus Number	*Bus Name*	*Full Contribution*
243859	*05FR-11G C*	*0.61*
247900	*05FR-11G E*	*13.11*
243862	*05FR-12G C*	*0.6*
247901	*05FR-12G E*	*12.89*
243864	*05FR-21G C*	*0.64*
247902	*05FR-21G E*	*13.78*
243866	*05FR-22G C*	*0.61*
247903	*05FR-22G E*	*13.19*
243870	*05FR-3G C*	*1.24*
247904	*05FR-3G E*	*26.72*
243873	*05FR-4G C*	*0.96*
247905	*05FR-4G E*	*20.09*
243442	*05RKG1*	*118.52*
243443	*05RKG2*	*116.72*
933441	*AC2-157 C*	*21.45*
933442	*AC2-157 E*	*35.01*
LTF	*AD1-092*	*6.27*
LTF	*AD1-093*	*10.52*
LTF	*AD1-094*	*1.9*
935271	*AD1-137 C*	*10.88*
935272	*AD1-137 E*	*72.82*
936771	*AD2-100 C*	*13.36*
936772	*AD2-100 E*	*8.91*
936972	*AD2-131 E*	*5.3*
LTF	*CARR*	*0.61*
LTF	*CBM-S1*	*19.46*
LTF	*CBM-S2*	*3.51*
LTF	*CBM-W1*	*38.62*
LTF	*CBM-W2*	*185.83*
LTF	*CIN*	*35.35*
LTF	*CLIFTY*	*28.72*
LTF	*CPLE*	*0.36*

LTF	*DEARBORN*	*0.76*
LTF	*G-007*	*1.66*
LTF	*IPL*	*23.1*
981181	*J708*	*50.89*
981521	*J759*	*12.03*
981531	*J762*	*30.*
981571	*J783*	*11.91*
938921	*J842 C*	*5.*
938922	*J842 E*	*20.*
938931	*J843 C*	*5.09*
938932	*J843 E*	*20.35*
939021	*J856*	*11.29*
274650	*KINCAID ;1U*	*11.29*
274651	*KINCAID ;2U*	*11.25*
LTF	*LGEE*	*2.01*
LTF	*MEC*	*33.11*
LTF	*O-066*	*10.63*
LTF	*RENSSELAER*	*0.49*
LTF	*ROSETON*	*3.51*
LTF	*WEC*	*2.78*
900404	*X3-028 C*	*423.45*
900405	*X3-028 E*	*564.6*
LTF	*Z1-043*	*14.5*
930461	*AB1-087*	*155.27*
930471	*AB1-088*	*155.27*
LTF	*AB2-013*	*8.77*
927331	*AC1-040 C*	*23.3*
927332	*AC1-040 E*	*38.01*

Appendix 2

(CE - CE) The LORETTO ; B-AD1-100 TAP 345 kV line (from bus 270704 to bus 934720 ckt 1) loads from 127.9% to 129.43% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 28.37 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.32*
935001	*AD1-133 C O1*	*90.71*
935141	*AD1-148*	*13.56*
936771	*AD2-100 C*	*28.37*
937161	*AD2-153 C O1*	*10.75*
937171	*AD2-154 C O1*	*10.75*
937211	*AD2-159 C*	*11.3*
274863	*CAYUGA RI;1U*	*3.41*
274864	*CAYUGA RI;2U*	*3.41*
LTF	*CBM-N*	*0.14*
LTF	*CBM-S1*	*10.21*
LTF	*CBM-S2*	*5.31*
LTF	*CBM-W2*	*99.02*
LTF	*CIN*	*10.75*
LTF	*CPLE*	*1.15*
LTF	*DEARBORN*	*0.89*
LTF	*G-007A*	*1.85*
LTF	*IPL*	*6.2*
983101	*J339*	*12.74*
938571	*J467 C*	*2.31*
951151	*J474 C*	*6.67*
951661	*J644*	*13.53*
981031	*J734*	*10.7*
939811	*J750 C*	*4.65*
981361	*J756 C*	*6.14*
981581	*J757 C*	*7.37*
938791	*J815*	*37.31*
938841	*J826*	*20.36*
938891	*J835 C*	*4.85*
938941	*J845 C*	*3.97*
938971	*J848 C*	*7.36*
939171	*J872 C*	*5.66*
939261	*J884*	*26.68*
939481	*J912*	*14.14*

274650	*KINCAID ;1U*	*21.16*
274651	*KINCAID ;2U*	*21.07*
LTF	*LGEE*	*1.21*
LTF	*MEC*	*9.14*
LTF	*NYISO*	*2.03*
296308	*R-030 C1*	*16.73*
296271	*R-030 C2*	*16.73*
296125	*R-030 C3*	*16.93*
290261	*S-027 C*	*3.03*
290265	*S-028 C*	*3.03*
LTF	*VFT*	*4.97*
905081	*W4-005 C*	*2.9*
900404	*X3-028 C*	*85.19*
917501	*Z2-087 C*	*13.07*
930461	*AB1-087*	*31.23*
930471	*AB1-088*	*31.23*
924041	*AB2-047 C O1*	*16.04*
924261	*AB2-070 C O1*	*7.66*
925771	*AC1-053 C*	*7.51*
926841	*AC1-171 C*	*0.92*

Appendix 3

(CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 124.78% to 126.51% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 28.41 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.34*
935001	*AD1-133 C O1*	*90.77*
935141	*AD1-148*	*13.57*
936771	*AD2-100 C*	*28.41*
937161	*AD2-153 C O1*	*10.76*
937171	*AD2-154 C O1*	*10.76*
937211	*AD2-159 C*	*11.31*
LTF	*CBM-N*	*0.14*
LTF	*CBM-S1*	*10.31*
LTF	*CBM-S2*	*5.39*
LTF	*CBM-W2*	*99.59*
LTF	*CIN*	*10.82*
LTF	*CPLE*	*1.17*
LTF	*DEARBORN*	*0.86*
LTF	*G-007A*	*1.93*
LTF	*IPL*	*6.25*
983101	*J339*	*12.74*
938571	*J467 C*	*2.31*
951151	*J474 C*	*6.67*
951661	*J644*	*13.53*
981031	*J734*	*10.7*
939811	*J750 C*	*4.65*
981361	*J756 C*	*6.14*
981581	*J757 C*	*7.37*
938411	*J811*	*10.79*
938791	*J815*	*37.31*
938841	*J826*	*20.36*
938891	*J835 C*	*4.85*
938941	*J845 C*	*3.97*
938971	*J848 C*	*7.36*
939171	*J872 C*	*5.66*
939261	*J884*	*26.68*
939481	*J912*	*14.14*
274650	*KINCAID ;1U*	*21.19*

274651	*KINCAID ;2U*	*21.11*
LTF	*LGEE*	*1.23*
LTF	*MEC*	*9.29*
LTF	*NYISO*	*2.13*
296308	*R-030 C1*	*16.74*
296271	*R-030 C2*	*16.74*
296125	*R-030 C3*	*16.94*
290261	*S-027 C*	*3.04*
290265	*S-028 C*	*3.04*
LTF	*VFT*	*5.18*
905081	*W4-005 C*	*2.91*
900404	*X3-028 C*	*85.65*
917501	*Z2-087 C*	*13.08*
930461	*AB1-087*	*31.41*
930471	*AB1-088*	*31.41*
924041	*AB2-047 C O1*	*16.05*
924261	*AB2-070 C O1*	*7.67*
925771	*AC1-053 C*	*7.52*
926841	*AC1-171 C*	*0.92*

Appendix 4

(LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 191.76% to 191.99% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 6.97 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#363'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1          / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
247287	*05AND G3*	*0.76*
243442	*05RKG1*	*37.19*
243443	*05RKG2*	*36.63*
342900	*1COOPER1 G*	*2.98*
342903	*1COOPER2 G*	*5.78*
342918	*1JKCT 1G*	*2.34*
342921	*1JKCT 2G*	*2.34*
342924	*1JKCT 3G*	*2.34*
342927	*1JKCT 4G*	*1.55*
342930	*1JKCT 5G*	*1.54*
342933	*1JKCT 6G*	*1.55*
342936	*1JKCT 7G*	*1.55*
342939	*1JKCT 9G*	*1.59*
342942	*1JKCT 10G*	*1.59*
342945	*1LAUREL 1G*	*1.68*
932551	*AC2-075 C*	*1.08*
933441	*AC2-157 C*	*8.16*
LTF	*AD1-092*	*3.63*
LTF	*AD1-093*	*6.12*
LTF	*AD1-094*	*1.1*
935011	*AD1-134*	*8.34*
935141	*AD1-148*	*2.47*
936281	*AD2-036 C*	*3.24*
936381	*AD2-048 C*	*3.93*
936571	*AD2-072 C O1*	*12.29*
936771	*AD2-100 C*	*6.97*
936821	*AD2-105 C O1*	*3.75*
936831	*AD2-106 C O1*	*1.99*
936841	*AD2-107 C O1*	*1.29*
LTF	*CARR*	*0.33*
LTF	*CBM-S1*	*40.52*
LTF	*CBM-S2*	*6.89*
LTF	*CBM-W1*	*21.42*
LTF	*CBM-W2*	*141.33*

LTF	*CIN*	*25.73*
LTF	*CLIFTY*	*95.03*
LTF	*CPLE*	*1.18*
LTF	*DEARBORN*	*0.51*
LTF	*IPL*	*15.7*
981181	*J708*	*40.82*
981521	*J759*	*9.35*
981531	*J762*	*29.43*
981571	*J783*	*9.25*
938311	*J795*	*3.66*
938731	*J800*	*15.73*
938861	*J829*	*12.54*
938921	*J842 C*	*3.98*
938931	*J843 C*	*4.32*
939021	*J856*	*9.32*
274650	*KINCAID ;1U*	*5.91*
274651	*KINCAID ;2U*	*5.89*
LTF	*LGEE*	*19.02*
LTF	*MEC*	*21.85*
LTF	*RENSSELAER*	*0.26*
LTF	*ROSETON*	*1.87*
LTF	*WEC*	*1.74*
900404	*X3-028 C*	*161.12*
LTF	*Z1-043*	*8.38*
930461	*AB1-087*	*59.08*
930471	*AB1-088*	*59.08*
LTF	*AB2-013*	*5.1*
927331	*AC1-040 C*	*9.43*
925981	*AC1-074 C*	*4.53*

Appendix 5

(MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 130.71% to 133.12% (**DC power flow**) of its emergency rating (1466 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#3128_05EUGENE 345'. This project contributes approximately 35.28 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#3128_05EUGENE 345'
 OPEN BRANCH FROM BUS 243221 TO BUS 249504 CKT 1          / 243221 05EUGENE 345 249504 08CAYSUB 345 1
 OPEN BRANCH FROM BUS 243221 TO BUS 348885 CKT 1          / 243221 05EUGENE 345 348885 7BUNSONVILLE 345 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933341	*AC2-147 C*	*0.54*
933342	*AC2-147 E*	*0.89*
934051	*AD1-031 C O1*	*2.37*
934052	*AD1-031 E O1*	*3.87*
934421	*AD1-066*	*0.87*
LTF	*AD1-092*	*9.6*
LTF	*AD1-093*	*16.1*
LTF	*AD1-094*	*2.91*
934881	*AD1-117 C*	*3.34*
934882	*AD1-117 E*	*2.23*
935001	*AD1-133 C O1*	*14.35*
935002	*AD1-133 E O1*	*9.57*
935141	*AD1-148*	*7.48*
936771	*AD2-100 C*	*21.17*
936772	*AD2-100 E*	*14.11*
936972	*AD2-131 E*	*8.4*
937161	*AD2-153 C O1*	*3.24*
937162	*AD2-153 E O1*	*15.15*
937171	*AD2-154 C O1*	*3.24*
937172	*AD2-154 E O1*	*15.15*
937211	*AD2-159 C*	*4.63*
937212	*AD2-159 E*	*21.69*
937531	*AD2-214 C*	*3.23*
937532	*AD2-214 E*	*1.52*
274832	*ANNAWAN ; 1U*	*8.72*
LTF	*BLUEG*	*5.63*
294401	*BSHIL;1U E*	*7.13*
294410	*BSHIL;2U E*	*7.13*
LTF	*CANNELTON*	*1.2*
LTF	*CARR*	*0.33*
274890	*CAYUG;1U E*	*10.29*
274891	*CAYUG;2U E*	*10.29*
LTF	*CBM-S1*	*9.31*

LTF	*CBM-S2*	*2.76*
LTF	*CBM-W1*	*56.04*
LTF	*CBM-W2*	*138.78*
LTF	*CLIFTY*	*18.96*
LTF	*CPLE*	*0.38*
274849	*CRESCENT ;1U*	*3.95*
LTF	*DEARBORN*	*0.59*
274859	*EASYR;U1 E*	*6.86*
274860	*EASYR;U2 E*	*6.86*
LTF	*ELMERSMITH*	*3.21*
LTF	*G-007*	*0.83*
960018	*G997 E*	*-2.86*
LTF	*GIBSON*	*1.43*
960026	*J196 E*	*5.39*
940291	*J291*	*3.23*
983101	*J339*	*6.2*
938571	*J467 C*	*3.57*
938572	*J467 E*	*14.26*
940541	*J468 C*	*7.15*
940542	*J468 E*	*28.62*
951151	*J474 C*	*2.63*
951152	*J474 E*	*10.54*
951641	*J641 C*	*8.28*
951642	*J641 E*	*2.16*
951661	*J644*	*9.66*
981031	*J734*	*5.2*
939811	*J750 C*	*2.74*
939812	*J750 E*	*10.97*
981361	*J756 C*	*3.21*
981362	*J756 E*	*12.84*
981581	*J757 C*	*5.26*
981582	*J757 E*	*21.02*
938331	*J797*	*18.82*
938391	*J808*	*8.79*
938411	*J811*	*17.92*
939761	*J813*	*43.43*
938791	*J815*	*32.44*
938811	*J817*	*10.29*
938841	*J826*	*10.81*
938891	*J835 C*	*3.46*
938892	*J835 E*	*13.85*
938941	*J845 C*	*2.27*
938942	*J845 E*	*9.07*
938971	*J848 C*	*6.82*
938972	*J848 E*	*27.27*

939171	*J872 C*	*5.75*
939172	*J872 E*	*22.99*
939261	*J884*	*7.9*
939481	*J912*	*14.37*
939741	*J949*	*39.25*
274650	*KINCAID ;1U*	*17.96*
274651	*KINCAID ;2U*	*17.89*
990901	*L-005 E*	*11.23*
LTF	*MEC*	*44.96*
293516	*O-009 E1*	*6.44*
293517	*O-009 E2*	*3.27*
293518	*O-009 E3*	*3.6*
293715	*O-029 E*	*6.89*
293716	*O-029 E*	*3.78*
293717	*O-029 E*	*3.47*
293771	*O-035 E*	*5.23*
LTF	*O-066*	*5.35*
296308	*R-030 C1*	*3.34*
296271	*R-030 C2*	*3.34*
296125	*R-030 C3*	*3.38*
296309	*R-030 E1*	*13.35*
296272	*R-030 E2*	*13.35*
296128	*R-030 E3*	*13.51*
LTF	*RENSSELAER*	*0.26*
LTF	*ROSETON*	*1.86*
290261	*S-027 C*	*0.91*
290265	*S-028 C*	*0.91*
LTF	*TRIMBLE*	*1.09*
274853	*TWINGROVE;U1*	*19.52*
274854	*TWINGROVE;U2*	*19.52*
276150	*W2-048 E*	*2.06*
903433	*W3-046*	*16.12*
905081	*W4-005 C*	*1.19*
905082	*W4-005 E*	*42.87*
905471	*W4-084*	*0.29*
274874	*WALNR;2U*	*1.53*
294502	*WALNR;2U E*	*6.11*
LTF	*WEC*	*4.2*
909052	*X2-022 E*	*28.64*
LTF	*Z1-043*	*22.26*
917501	*Z2-087 C*	*2.62*
917502	*Z2-087 E*	*17.54*
919221	*AA1-146*	*11.73*
919581	*AA2-030*	*11.73*
919621	*AA2-039 C*	*1.74*

919622	*AA2-039 E*	*11.64*
LTF	*AB2-013*	*13.42*
924041	*AB2-047 C O1*	*3.34*
924042	*AB2-047 E O1*	*22.37*
924261	*AB2-070 C O1*	*3.86*
924262	*AB2-070 E O1*	*25.84*
925161	*AB2-173*	*2.09*
925581	*AC1-033 C*	*1.17*
925582	*AC1-033 E*	*7.82*
925771	*AC1-053 C*	*3.9*
925772	*AC1-053 E*	*26.07*
926821	*AC1-168 C*	*0.84*
926822	*AC1-168 E*	*5.65*
926841	*AC1-171 C*	*1.14*
926842	*AC1-171 E*	*7.61*
927531	*AC1-185 1*	*0.43*
927541	*AC1-185 2*	*0.43*
927551	*AC1-185 3*	*0.43*
927561	*AC1-185 4*	*0.43*
927571	*AC1-185 5*	*0.43*
927581	*AC1-185 6*	*0.43*
927591	*AC1-185 7*	*0.43*
927601	*AC1-185 8*	*0.43*
927201	*AC1-214 C*	*1.68*
927202	*AC1-214 E*	*4.46*

Appendix 6

(MISO AMIL - CE) The 7BROKAW-AD2-153 TAP 345 kV line (from bus 348847 to bus 937160 ckt 1) loads from 123.25% to 124.94% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.46*
935141	*AD1-148*	*15.52*
936771	*AD2-100 C*	*25.85*
937211	*AD2-159 C*	*7.49*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*10.25*
LTF	*CBM-S2*	*5.52*
LTF	*CBM-W2*	*98.14*
LTF	*CIN*	*11.31*
LTF	*CPLE*	*1.22*
LTF	*DEARBORN*	*0.72*
LTF	*G-007A*	*2.21*
LTF	*IPL*	*6.52*
940291	*J291*	*4.04*
983101	*J339*	*15.17*
938571	*J467 C*	*2.36*
940541	*J468 C*	*4.29*
951151	*J474 C*	*7.44*
951641	*J641 C*	*10.12*
951661	*J644*	*13.07*
981031	*J734*	*12.74*
939811	*J750 C*	*4.61*
981361	*J756 C*	*5.84*
981581	*J757 C*	*7.07*
938411	*J811*	*10.81*
938791	*J815*	*36.69*
938841	*J826*	*23.87*
938891	*J835 C*	*4.65*
938941	*J845 C*	*4.67*
938971	*J848 C*	*7.25*
939171	*J872 C*	*5.6*
939261	*J884*	*32.56*
939481	*J912*	*13.99*
939741	*J949*	*18.89*

274650	*KINCAID ;1U*	*20.33*
274651	*KINCAID ;2U*	*20.22*
LTF	*LGEE*	*1.3*
LTF	*MEC*	*6.*
LTF	*NYISO*	*2.54*
290261	*S-027 C*	*1.67*
290265	*S-028 C*	*1.67*
LTF	*TATANKA*	*0.02*
LTF	*VFT*	*5.95*
905081	*W4-005 C*	*1.92*
900404	*X3-028 C*	*88.04*
917501	*Z2-087 C*	*-8.13*
930461	*AB1-087*	*32.28*
930471	*AB1-088*	*32.28*
924261	*AB2-070 C O1*	*9.*
925771	*AC1-053 C*	*8.75*
926841	*AC1-171 C*	*0.97*

Appendix 7

(CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 125.12% to 126.18% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

CONTINGENCY 'COMED_P1-2_345-L8002___-S'
TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1 / PONTI; B 345 BLUEM; B 345
END

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.46*
935141	*AD1-148*	*15.52*
936771	*AD2-100 C*	*25.85*
937161	*AD2-153 C O1*	*14.02*
937171	*AD2-154 C O1*	*14.02*
937211	*AD2-159 C*	*7.49*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*10.25*
LTF	*CBM-S2*	*5.52*
LTF	*CBM-W2*	*98.14*
LTF	*CIN*	*11.31*
LTF	*CPLE*	*1.22*
LTF	*DEARBORN*	*0.72*
LTF	*G-007A*	*2.21*
LTF	*IPL*	*6.52*
983101	*J339*	*15.17*
938571	*J467 C*	*2.36*
940541	*J468 C*	*4.29*
951151	*J474 C*	*7.44*
951661	*J644*	*13.07*
981031	*J734*	*12.74*
939811	*J750 C*	*4.61*
981361	*J756 C*	*5.84*
981581	*J757 C*	*7.07*
938411	*J811*	*10.81*
938791	*J815*	*36.69*
938841	*J826*	*23.87*
938891	*J835 C*	*4.65*
938941	*J845 C*	*4.67*
938971	*J848 C*	*7.25*
939171	*J872 C*	*5.6*
939261	*J884*	*32.56*

939481	*J912*	*13.99*
274650	*KINCAID ;1U*	*20.33*
274651	*KINCAID ;2U*	*20.22*
LTF	*LGEE*	*1.3*
LTF	*MEC*	*6.*
LTF	*NYISO*	*2.54*
290261	*S-027 C*	*1.67*
290265	*S-028 C*	*1.67*
LTF	*TATANKA*	*0.02*
LTF	*VFT*	*5.95*
905081	*W4-005 C*	*1.92*
900404	*X3-028 C*	*88.04*
917501	*Z2-087 C*	*17.87*
930461	*AB1-087*	*32.28*
930471	*AB1-088*	*32.28*
924041	*AB2-047 C O1*	*21.85*
924261	*AB2-070 C O1*	*9.*
925771	*AC1-053 C*	*8.75*
926841	*AC1-171 C*	*0.97*

Appendix 8

(CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 124.19% to 125.08% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.46*
935141	*AD1-148*	*15.52*
936771	*AD2-100 C*	*25.85*
937161	*AD2-153 C O1*	*14.02*
937171	*AD2-154 C O1*	*14.02*
937211	*AD2-159 C*	*7.49*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*10.25*
LTF	*CBM-S2*	*5.52*
LTF	*CBM-W2*	*98.14*
LTF	*CIN*	*11.31*
LTF	*CPLE*	*1.22*
LTF	*DEARBORN*	*0.72*
LTF	*G-007A*	*2.21*
LTF	*IPL*	*6.52*
940291	*J291*	*4.04*
983101	*J339*	*15.17*
938571	*J467 C*	*2.36*
940541	*J468 C*	*4.29*
951151	*J474 C*	*7.44*
951661	*J644*	*13.07*
981031	*J734*	*12.74*
939811	*J750 C*	*4.61*
981361	*J756 C*	*5.84*
981581	*J757 C*	*7.07*
938411	*J811*	*10.81*
938791	*J815*	*36.69*
938841	*J826*	*23.87*
938891	*J835 C*	*4.65*
938941	*J845 C*	*4.67*
938971	*J848 C*	*7.25*
939171	*J872 C*	*5.6*
939261	*J884*	*32.56*
939481	*J912*	*13.99*

274650	*KINCAID ;1U*	*20.33*
274651	*KINCAID ;2U*	*20.22*
LTF	*LGEE*	*1.3*
LTF	*MEC*	*6.*
LTF	*NYISO*	*2.54*
290261	*S-027 C*	*1.67*
290265	*S-028 C*	*1.67*
LTF	*TATANKA*	*0.02*
LTF	*VFT*	*5.95*
905081	*W4-005 C*	*1.92*
900404	*X3-028 C*	*88.04*
917501	*Z2-087 C*	*-8.13*
930461	*AB1-087*	*32.28*
930471	*AB1-088*	*32.28*
924041	*AB2-047 C O1*	*21.85*
924261	*AB2-070 C O1*	*9.*
925771	*AC1-053 C*	*8.75*
926841	*AC1-171 C*	*0.97*

Appendix 9

(CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 120.63% to 122.0% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B'. This project contributes approximately 25.63 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B'
 TRIP BRANCH FROM BUS 934720 TO BUS 270704 CKT 1          / AD1-100 TAP 345 LORET; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.*
935001	*AD1-133 C O1*	*120.35*
935141	*AD1-148*	*12.36*
936771	*AD2-100 C*	*25.63*
937161	*AD2-153 C O1*	*9.91*
937171	*AD2-154 C O1*	*9.91*
937211	*AD2-159 C*	*10.35*
274863	*CAYUGA RI;1U*	*2.6*
274864	*CAYUGA RI;2U*	*2.6*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*9.14*
LTF	*CBM-S2*	*5.01*
LTF	*CBM-W2*	*86.08*
LTF	*CIN*	*10.12*
LTF	*CPLE*	*1.11*
LTF	*DEARBORN*	*0.55*
LTF	*EDWARDS*	*0.14*
LTF	*G-007A*	*2.14*
LTF	*IPL*	*5.87*
983101	*J339*	*12.07*
938571	*J467 C*	*2.21*
951151	*J474 C*	*6.23*
951661	*J644*	*12.2*
981031	*J734*	*10.13*
939811	*J750 C*	*4.24*
981361	*J756 C*	*5.54*
981581	*J757 C*	*6.63*
938791	*J815*	*34.77*
938841	*J826*	*19.21*
938891	*J835 C*	*4.37*
938941	*J845 C*	*3.78*
938971	*J848 C*	*6.88*
939171	*J872 C*	*5.3*
939261	*J884*	*24.96*

939481	*J912*	*13.26*
274650	*KINCAID ;1U*	*19.02*
274651	*KINCAID ;2U*	*18.94*
LTF	*LGEE*	*1.18*
LTF	*MEC*	*2.5*
LTF	*NYISO*	*2.51*
296308	*R-030 C1*	*15.48*
296271	*R-030 C2*	*15.48*
296125	*R-030 C3*	*15.67*
290261	*S-027 C*	*2.79*
290265	*S-028 C*	*2.79*
LTF	*TATANKA*	*0.45*
LTF	*VFT*	*5.75*
905081	*W4-005 C*	*2.66*
900404	*X3-028 C*	*78.95*
917501	*Z2-087 C*	*12.09*
930461	*AB1-087*	*28.95*
930471	*AB1-088*	*28.95*
924041	*AB2-047 C O1*	*14.84*
924261	*AB2-070 C O1*	*7.*
925771	*AC1-053 C*	*6.86*
926841	*AC1-171 C*	*0.71*

Appendix 10

(CE - CE) The AD2-153 TAP-AB2-047 TAP 345 kV line (from bus 937160 to bus 924040 ckt 1) loads from 123.0% to 124.7% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 25.85 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1            / PONTI; B 345 BLUEM; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.46*
935141	*AD1-148*	*15.52*
936771	*AD2-100 C*	*25.85*
937161	*AD2-153 C O1*	*14.02*
937171	*AD2-154 C O1*	*14.02*
937211	*AD2-159 C*	*7.49*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*10.25*
LTF	*CBM-S2*	*5.52*
LTF	*CBM-W2*	*98.14*
LTF	*CIN*	*11.31*
LTF	*CPLE*	*1.22*
LTF	*DEARBORN*	*0.72*
LTF	*G-007A*	*2.21*
LTF	*IPL*	*6.52*
940291	*J291*	*4.04*
983101	*J339*	*15.17*
938571	*J467 C*	*2.36*
940541	*J468 C*	*4.29*
951151	*J474 C*	*7.44*
951641	*J641 C*	*10.12*
951661	*J644*	*13.07*
981031	*J734*	*12.74*
939811	*J750 C*	*4.61*
981361	*J756 C*	*5.84*
981581	*J757 C*	*7.07*
938411	*J811*	*10.81*
938791	*J815*	*36.69*
938841	*J826*	*23.87*
938891	*J835 C*	*4.65*
938941	*J845 C*	*4.67*
938971	*J848 C*	*7.25*
939171	*J872 C*	*5.6*
939261	*J884*	*32.56*

939481	*J912*	*13.99*
939741	*J949*	*18.89*
274650	*KINCAID ;1U*	*20.33*
274651	*KINCAID ;2U*	*20.22*
LTF	*LGEE*	*1.3*
LTF	*MEC*	*6.*
LTF	*NYISO*	*2.54*
290261	*S-027 C*	*1.67*
290265	*S-028 C*	*1.67*
LTF	*TATANKA*	*0.02*
LTF	*VFT*	*5.95*
905081	*W4-005 C*	*1.92*
900404	*X3-028 C*	*88.04*
917501	*Z2-087 C*	*-8.13*
930461	*AB1-087*	*32.28*
930471	*AB1-088*	*32.28*
924261	*AB2-070 C O1*	*9.*
925771	*AC1-053 C*	*8.75*
926841	*AC1-171 C*	*0.97*

Secondary Point of Interconnection (Option-2)

Under this option, the IC AD2-100, a 210MW solar facility, proposes to interconnect with the ComEd transmission system by tying into the Kincaid-Pana (Ameren) 345kV Line 2105.

Attachment Facilities

The IC AD2-100 generator lead would interconnect to a new 345kV Interconnection Substation. This interconnection would require one 345kV line MOD, a dead-end structure and revenue metering as shown in the one-line diagram.

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

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

Direct Connection Network Upgrades

In order to accommodate interconnection of AD2-100, a new 345kV Interconnection Substation would need to be built close to the Kincaid-Pana (Ameren) 345kV Line 2105 approximately 14 miles from the Kincaid Sta 21.

The scope of work includes the installation of three 345kV circuit breakers in a "breaker-and-a-half" bus configuration and cutting in the Interconnection Substation to Kincaid-Pana (Ameren) 345kV Line 2105, as shown in the one-line diagram below.

The IC is responsible for constructing all of the facilities on the IC side of the point of interconnection outside of the substation. It is assumed for the purposes of this report that the IC will obtain the site for the Interconnection Substation and right-of-way between the Interconnection Substation and the 345kV transmission line.

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

ComEd would design, engineer and construct the tie in of the Interconnection Substation to the Kincaid-Pana (Ameren) 345kV Line 2105.

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

For Option to Build Direct Connection cost estimates:

Scope of Work	Cost Estimate
Installation of a new 345kV substation as described above	N/A
Transmission line tie in work (foundations, structures, conductors)	$ 3,000,000

ComEd oversight and testing	$ 1,500,000
Total Cost Estimate (see notes below on cost estimate)	$ 4,500,000

For ComEd building the interconnecting substation cost estimates:

Scope of Work	Cost Estimate
Installation of a new 345kV substation as described above	$ 20,000,000
Transmission line tie in work (foundations, structures, conductors)	$ 3,000,000
Total Cost Estimate (see notes below on cost estimate)	$ 23,000,000

ComEd would take approximately 24-months to construct the substation and transmission line work after the ISA / ICSA are signed.

Non-Direct Connection Network Upgrades

The integration of the new 345kV Interconnection Substation would require relay/communications/SCADA upgrades at the Kincaid Sta 21 and AMEREN's Pana substation. The ComEd cost is given below:

Scope of Work	Cost Estimate
Relay/communications/SCADA upgrades at Kincaid Sta 21 substation	$ 1,000,000
Total Cost Estimate (see notes below on cost estimate)	$ 1,000,000

Notes on Cost Estimate:

1) These estimates are Order-of-Magnitude estimates of the costs that ComEd would bill to the customer for this interconnection. These estimates are based on a one-line electrical diagram of the project and the information provided by the IC.

2) There were no site visits performed for these estimates. There may be costs related to specific site related issues that are not identified in these estimates. The site reviews will be performed during the Facilities Study or during detailed engineering.

3) These estimates are not a guarantee of the maximum amount payable by the IC and the actual costs of ComEd's work may differ significantly from these estimates. Per the PJM Tariff, IC will be responsible for paying all actual costs of ComEd's work.

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

5) These cost estimates do not include cost of acquiring right-of-way for the transmission line and purchasing any additional land, if needed, for the line terminations. The need and cost of acquiring property and associated legal costs will be investigated during Facilities Study for this project.

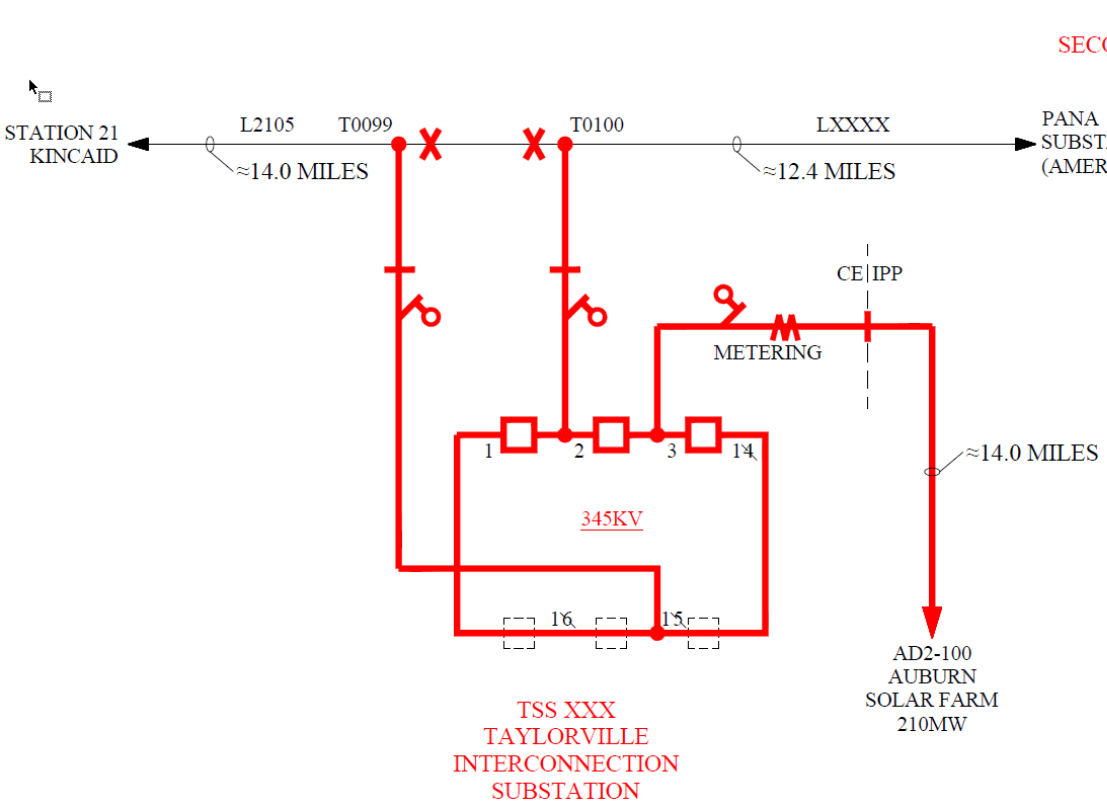

Figure 2. Single Line Diagram for Option 2

Network Impacts

The Queue Project AD2-100 was evaluated as a 210.0 MW (Capacity 126.0 MW) injection tapping the Kincaid; R to Pana (Ameren) 345kV line in the ComEd area. Project AD2-100 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-100 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

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

None

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

1. (AEP - AEP) The 05ROCKPT-05JEFRSO 765 kV line (from bus 243209 to bus 243208 ckt 1) loads from 99.78% to 100.32% (**DC power flow**) of its emergency rating (4571 MVA) for the tower line contingency outage of 'AEP_P7-1_#6484'. This project contributes approximately 24.5 MW to the thermal violation.

```
CONTINGENCY 'AEP_P7-1_#6484'
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 1          / 243217 05DEQUIN 345 243878 05MEADOW 345 1
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 2          / 243217 05DEQUIN 345 243878 05MEADOW 345 2
 END
```

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

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

1. (CE - CE) The LORETTO ; B-AD2-148 TAP 345 kV line (from bus 270704 to bus 937120 ckt 1) loads from 127.9% to 129.07% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 23.17 MW to the thermal violation.

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

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

2. (CE - CE) The LORETTO ; B-AD2-148 TAP 345 kV line (from bus 270704 to bus 937120 ckt 1) loads from 122.08% to 123.6% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"270853'. This project contributes approximately 23.17 MW to the thermal violation.

```
CONTINGENCY '270853'                    PONTIAC ; R 345 935000 AD1-133 TAP 345 1
 OPEN BRANCH FROM BUS 270853 TO BUS 935000 CKT 1
 END
```

3. (CE - CE) The KINCAID ; B-LATHAM ; T 345 kV line (from bus 270796 to bus 270804 ckt 1) loads from 101.13% to 105.16% (**DC power flow**) of its load dump rating (1334 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_LAN-45-BT1-3__'. This project contributes approximately 53.78 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_LAN-45-BT1-3__'
 TRIP BRANCH FROM BUS 925770 TO BUS 276150 CKT 1        / AC1-053 TAP 345 7LANSVLAM 345
 TRIP BRANCH FROM BUS 349700 TO BUS 349701 CKT 1        / 7LANSVLAM 345 4LANVL AM 138
 END
```

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

4. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 124.78% to 126.16% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 23.21 MW to the thermal violation.

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

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

5. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 119.23% to 120.49% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"270853'. This project contributes approximately 23.21 MW to the thermal violation.

```
CONTINGENCY '270853'                    PONTIAC ; R 345 935000 AD1-133
TAP 345 1
 OPEN BRANCH FROM BUS 270853 TO BUS 935000 CKT 1
 END
```

6. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 191.74% to 192.3% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 7.66 MW to the thermal violation.

CONTINGENCY 'AEP_P1-2_#363'
OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
END

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

7. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 131.05% to 133.74% (**DC power flow**) of its emergency rating (1466 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#3128_05EUGENE 345'. This project contributes approximately 39.38 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#3128_05EUGENE 345'
 OPEN BRANCH FROM BUS 243221 TO BUS 249504 CKT 1          / 243221 05EUGENE 345 249504 08CAYSUB 345 1
 OPEN BRANCH FROM BUS 243221 TO BUS 348885 CKT 1          / 243221 05EUGENE 345 348885 7BUNSONVILLE 345 1
 END
```

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

8. (MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 123.24% to 124.7% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 22.37 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1          / PONTI; B 345 BLUEM; B 345
 END
```

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

9. (MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 120.93% to 122.4% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 22.4 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L17802__-S'
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1          / BLUEM; B 345 W4-005
 END
```

10. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 125.12% to 125.88% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 22.37 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1          / PONTI; B 345 BLUEM; B 345
 END
```

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

11. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 122.81% to 123.58% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 22.4 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L17802__-S'
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1              / BLUEM; B 345 W4-005
 END
```

12. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 124.18% to 125.65% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 22.37 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
  TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1                / PONTI; B 345
BLUEM; B 345
  END
```

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

13. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 121.88% to 123.35% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L17802__-S'. This project contributes approximately 22.4 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L17802__-S'
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1              / BLUEM; B 345 W4-005
 END
```

14. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 120.51% to 121.47% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B_A'. This project contributes approximately 20.81 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B_A'
 TRIP BRANCH FROM BUS 934720 TO BUS 937120 CKT 1              / AD1-100 TAP 345 AD2-148 TAP 345
 END
```

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

15. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 120.63% to 121.99% (**DC power flow**) of its emergency rating (1528 MVA)

for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B_B'. This project contributes approximately 20.81 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B_B'
 TRIP BRANCH FROM BUS 937120 TO BUS 270704 CKT 1              / AD2-148 TAP 345 LORET; B 345
 END
```

16. (CE - CE) The AD2-148 TAP-AD1-100 TAP 345 kV line (from bus 937120 to bus 934720 ckt 1) loads from 127.67% to 128.64% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 23.17 MW to the thermal violation.

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

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

17. (CE - CE) The AD2-148 TAP-AD1-100 TAP 345 kV line (from bus 937120 to bus 934720 ckt 1) loads from 121.87% to 122.84% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"270853'. This project contributes approximately 23.17 MW to the thermal violation.

```
CONTINGENCY '270853'                          PONTIAC ; R 345 935000 AD1-133 TAP 345 1
 OPEN BRANCH FROM BUS 270853 TO BUS 935000 CKT 1
 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)

To be determined

Affected System Analysis & Mitigation

MISO Impacts:

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

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

1. (AEP - AEP) The 05ROCKPT-05JEFRSO 765 kV line (from bus 243209 to bus 243208 ckt 1) loads from 99.88% to 100.43% (**DC power flow**) of its normal rating (4047 MVA) for the single line contingency outage of '247851 05ROCKPT 340563 7COLEMAN 1 345/345'. This project contributes approximately 22.34 MW to the thermal violation.

```
CONTINGENCY '247851 05ROCKPT 340563 7COLEMAN 1 345/345'
 OPEN BRANCH FROM BUS 247851 TO BUS 340563 CKT 1
 END
```

2. (CE - CE) The BLUEMOUND; B-PONTIAC ; B 345 kV line (from bus 270668 to bus 270852 ckt 1) loads from 132.41% to 134.5% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8001___-S-A'. This project contributes approximately 31.95 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8001___-S-A'
 TRIP BRANCH FROM BUS 270853 TO BUS 917500 CKT 1              / PONTI; R 345 Z2-087 TAP 345
 END
```

3. (CE - CE) The LORETTO ; B-AD2-148 TAP 345 kV line (from bus 270704 to bus 937120 ckt 1) loads from 196.47% to 198.85% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 38.62 MW to the thermal violation.

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

4. (CE - CE) The LORETTO ; B-AD2-148 TAP 345 kV line (from bus 270704 to bus 937120 ckt 1) loads from 147.36% to 149.23% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 27.13 MW to the thermal violation.

5. (CE - CE) The KINCAID ; B-LATHAM ; T 345 kV line (from bus 270796 to bus 270804 ckt 1) loads from 100.26% to 104.01% (**DC power flow**) of its emergency rating (1334 MVA) for the single line contingency outage of 'COMED_P1-2_345-L9201___-S_W2-048-FSA-A'. This project contributes approximately 49.99 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L9201___-S_W2-048-FSA-A'
 TRIP BRANCH FROM BUS 270673 TO BUS 348847 CKT 1              / BROKA; T 345 7BROKAW T1 345
 TRIP BRANCH FROM BUS 270673 TO BUS 924260 CKT 1              / BROKA; T 345 AB2-070 TAP 345
 END
```

6. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 100.64% to 104.25% (**DC power flow**) of its emergency rating (956 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B_A'. This project contributes approximately 34.48 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B_A'
 TRIP BRANCH FROM BUS 934720 TO BUS 937120 CKT 1             / AD1-100 TAP 345 AD2-148 TAP 345
 END
```

7. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 98.07% to 101.96% (**DC power flow**) of its normal rating (797 MVA) for non-contingency condition. This project contributes approximately 30.99 MW to the thermal violation.

8. (CE - MISO AMIL) The LATHAM ; T-7LATHAM 345 kV line (from bus 270804 to bus 348856 ckt 1) loads from 104.55% to 107.95% (**DC power flow**) of its emergency rating (908 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 30.35 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1             / PONTI; B 345 BLUEM; B 345
 END
```

9. (CE - CE) The LATHAM ; T-W4-005 TAP 345 kV line (from bus 270804 to bus 905080 ckt 1) loads from 121.51% to 123.39% (**DC power flow**) of its emergency rating (1334 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8001___-S-A'. This project contributes approximately 32.09 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8001___-S-A'
 TRIP BRANCH FROM BUS 270853 TO BUS 917500 CKT 1             / PONTI; R 345 Z2-087 TAP 345
 END
```

10. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 183.74% to 186.21% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 38.69 MW to the thermal violation.

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

11. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 135.47% to 137.23% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 27.19 MW to the thermal violation.

12. (CE - CE) The PONTIAC ; R-AD1-133 TAP 345 kV line (from bus 270853 to bus 935000 ckt 1) loads from 171.81% to 173.9% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B_A'. This project contributes approximately 34.68 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B_A'
 TRIP BRANCH FROM BUS 934720 TO BUS 937120 CKT 1             / AD1-100 TAP 345 AD2-148 TAP 345
 END
```

13. (CE - CE) The PONTIAC ; R-AD1-133 TAP 345 kV line (from bus 270853 to bus 935000 ckt 1) loads from 114.81% to 115.39% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 20.12 MW to the thermal violation.

14. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 182.16% to 182.58% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 12.77 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#363'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1              / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

15. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 125.36% to 127.76% (**DC power flow**) of its normal rating (1451 MVA) for the single line contingency outage of 'AEP_P1-2_#286'. This project contributes approximately 38.84 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#286'
 OPEN BRANCH FROM BUS 243221 TO BUS 348885 CKT 1              / 243221 05EUGENE 345 348885 7BUNSONVILLE 345 1
 END
```

16. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 104.95% to 106.88% (**DC power flow**) of its normal rating (1451 MVA) for non-contingency condition. This project contributes approximately 32.6 MW to the thermal violation.

17. (MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 149.45% to 151.89% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 37.28 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

18. (MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 119.34% to 121.27% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.66 MW to the thermal violation.

19. (CE - CE) The W4-005 TAP-BLUEMOUND; B 345 kV line (from bus 905080 to bus 270668 ckt 1) loads from 134.13% to 136.51% (**DC power flow**) of its emergency rating (1334 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8001___-S-A'. This project contributes approximately 32.04 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8001___-S-A'
 TRIP BRANCH FROM BUS 270853 TO BUS 917500 CKT 1              / PONTI; R 345 Z2-087 TAP 345
 END
```

20. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 168.44% to 170.51% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 37.28 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1          / PONTI; B 345 BLUEM; B 345
 END
```

21. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 139.29% to 140.68% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.66 MW to the thermal violation.

22. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 159.97% to 162.36% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 37.28 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1          / PONTI; B 345 BLUEM; B 345
 END
```

23. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 131.3% to 133.23% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 25.66 MW to the thermal violation.

24. (CE - CE) The AB2-070 TAP-BROKAW ; T 345 kV line (from bus 924260 to bus 270673 ckt 1) loads from 109.47% to 113.18% (**DC power flow**) of its emergency rating (1327 MVA) for the single line contingency outage of 'COMED_P1-2_SPS-2102&2106_W4-005-FSA'. This project contributes approximately 49.19 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_SPS-2102&2106_W4-005-FSA'
 TRIP BRANCH FROM BUS 270804 TO BUS 905080 CKT 1          / LATHAM TAP W4-005
 TRIP BRANCH FROM BUS 270804 TO BUS 270796 CKT 1          / LATHA; T 345 KINCA; B 345
 TRIP BRANCH FROM BUS 270804 TO BUS 348856 CKT 1          / LATHA; T 345 7LATHAM 345
 TRIP BRANCH FROM BUS 270796 TO BUS 347955 CKT 1          / KINCA; B 345 AUSTIN 345 (THE)
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1          / BLUEM; B 345 W4-005
 END
```

25. (CE - CE) The AC1-053 TAP-AB2-070 TAP 345 kV line (from bus 925770 to bus 924260 ckt 1) loads from 98.94% to 102.64% (**DC power flow**) of its emergency rating (1327 MVA) for the single line contingency outage of 'COMED_P1-2_SPS-2102&2106_W4-005-FSA'. This project contributes approximately 49.19 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_SPS-2102&2106_W4-005-FSA'
 TRIP BRANCH FROM BUS 270804 TO BUS 905080 CKT 1          / LATHAM TAP W4-005
 TRIP BRANCH FROM BUS 270804 TO BUS 270796 CKT 1          / LATHA; T 345 KINCA; B 345
 TRIP BRANCH FROM BUS 270804 TO BUS 348856 CKT 1          / LATHA; T 345 7LATHAM 345
 TRIP BRANCH FROM BUS 270796 TO BUS 347955 CKT 1          / KINCA; B 345 AUSTIN 345 (THE)
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1          / BLUEM; B 345 W4-005
 END
```

26. (CE - CE) The AD1-100 TAP-AD2-140 TAP 345 kV line (from bus 934720 to bus 937050 ckt 1) loads from 154.14% to 155.2% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"934725'. This project contributes approximately 22.84 MW to the thermal violation.

```
CONTINGENCY '934725'                    AD1-100 JNT 345 934730 AD1-100 TAP 345 1
 OPEN BRANCH FROM BUS 934725 TO BUS 934730 CKT 1
 END
```

27. (CE - CE) The AD1-100 TAP-AD2-140 TAP 345 kV line (from bus 934720 to bus 937050 ckt 1) loads from 116.29% to 116.72% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 14.29 MW to the thermal violation.

28. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 183.44% to 185.23% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B_A'. This project contributes approximately 34.68 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B_A'
 TRIP BRANCH FROM BUS 934720 TO BUS 937120 CKT 1          / AD1-100 TAP 345 AD2-148 TAP 345
 END
```

29. (CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 126.36% to 126.99% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 20.12 MW to the thermal violation.

30. (CE - CE) The AD2-140 TAP-WILTON ; B 345 kV line (from bus 937050 to bus 270926 ckt 1) loads from 154.11% to 155.3% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '"934725'. This project contributes approximately 22.84 MW to the thermal violation.

```
CONTINGENCY '934725'                    AD1-100 JNT 345 934730 AD1-100 TAP 345 1
 OPEN BRANCH FROM BUS 934725 TO BUS 934730 CKT 1
 END
```

31. (CE - CE) The AD2-148 TAP-AD1-100 TAP 345 kV line (from bus 937120 to bus 934720 ckt 1) loads from 196.25% to 198.29% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 38.62 MW to the thermal violation.

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

32. (CE - CE) The AD2-148 TAP-AD1-100 TAP 345 kV line (from bus 937120 to bus 934720 ckt 1) loads from 147.11% to 148.71% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 27.13 MW to the thermal violation.

Light Load Analysis - 2021

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

Appendices

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

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

Appendix 1

(AEP - AEP) The 05ROCKPT-05JEFRSO 765 kV line (from bus 243209 to bus 243208 ckt 1) loads from 99.78% to 100.32% (**DC power flow**) of its emergency rating (4571 MVA) for the tower line contingency outage of 'AEP_P7-1_#6484'. This project contributes approximately 24.5 MW to the thermal violation.

```
CONTINGENCY 'AEP_P7-1_#6484'
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 1          / 243217 05DEQUIN 345 243878 05MEADOW 345 1
 OPEN BRANCH FROM BUS 243217 TO BUS 243878 CKT 2          / 243217 05DEQUIN 345 243878 05MEADOW 345 2
 END
```

Bus Number	*Bus Name*	*Full Contribution*
243859	*05FR-11G C*	*0.61*
247900	*05FR-11G E*	*13.11*
243862	*05FR-12G C*	*0.6*
247901	*05FR-12G E*	*12.89*
243864	*05FR-21G C*	*0.64*
247902	*05FR-21G E*	*13.78*
243866	*05FR-22G C*	*0.61*
247903	*05FR-22G E*	*13.19*
243870	*05FR-3G C*	*1.24*
247904	*05FR-3G E*	*26.72*
243873	*05FR-4G C*	*0.96*
247905	*05FR-4G E*	*20.09*
243442	*05RKG1*	*118.52*
243443	*05RKG2*	*116.72*
933441	*AC2-157 C*	*21.45*
933442	*AC2-157 E*	*35.01*
LTF	*AD1-092*	*6.27*
LTF	*AD1-093*	*10.52*
LTF	*AD1-094*	*1.9*
935271	*AD1-137 C*	*10.88*
935272	*AD1-137 E*	*72.82*
936771	*AD2-100 C*	*14.7*
936772	*AD2-100 E*	*9.8*
936972	*AD2-131 E*	*5.83*
LTF	*CARR*	*0.61*
LTF	*CBM-S1*	*19.46*
LTF	*CBM-S2*	*3.51*
LTF	*CBM-W1*	*38.62*
LTF	*CBM-W2*	*185.83*
LTF	*CIN*	*35.35*
LTF	*CLIFTY*	*28.72*
LTF	*CPLE*	*0.36*
LTF	*DEARBORN*	*0.76*

LTF	*G-007*	*1.66*
LTF	*IPL*	*23.1*
981181	*J708*	*50.89*
981521	*J759*	*12.03*
981531	*J762*	*30.*
981571	*J783*	*11.91*
938921	*J842 C*	*5.*
938922	*J842 E*	*20.*
938931	*J843 C*	*5.09*
938932	*J843 E*	*20.35*
939021	*J856*	*11.29*
274650	*KINCAID ;1U*	*11.29*
274651	*KINCAID ;2U*	*11.25*
LTF	*LGEE*	*2.01*
LTF	*MEC*	*33.11*
LTF	*O-066*	*10.63*
LTF	*RENSSELAER*	*0.49*
LTF	*ROSETON*	*3.51*
LTF	*WEC*	*2.78*
900404	*X3-028 C*	*423.45*
900405	*X3-028 E*	*564.6*
LTF	*Z1-043*	*14.5*
930461	*AB1-087*	*155.27*
930471	*AB1-088*	*155.27*
LTF	*AB2-013*	*8.77*
927331	*AC1-040 C*	*23.3*
927332	*AC1-040 E*	*38.01*

Appendix 2

(CE - CE) The LORETTO ; B-AD2-148 TAP 345 kV line (from bus 270704 to bus 937120 ckt 1) loads from 127.9% to 129.07% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 23.17 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.32*
935001	*AD1-133 C O1*	*90.71*
935141	*AD1-148*	*13.56*
936771	*AD2-100 C*	*23.17*
937171	*AD2-154 C O2*	*13.27*
937211	*AD2-159 C*	*11.3*
274863	*CAYUGA RI;1U*	*3.41*
274864	*CAYUGA RI;2U*	*3.41*
LTF	*CBM-N*	*0.14*
LTF	*CBM-S1*	*10.21*
LTF	*CBM-S2*	*5.31*
LTF	*CBM-W2*	*99.02*
LTF	*CIN*	*10.75*
LTF	*CPLE*	*1.15*
LTF	*DEARBORN*	*0.89*
LTF	*G-007A*	*1.85*
LTF	*IPL*	*6.2*
983101	*J339*	*12.74*
938571	*J467 C*	*2.31*
951151	*J474 C*	*6.67*
951661	*J644*	*13.53*
981031	*J734*	*10.7*
939811	*J750 C*	*4.65*
981361	*J756 C*	*6.14*
981581	*J757 C*	*7.37*
938791	*J815*	*37.31*
938841	*J826*	*20.36*
938891	*J835 C*	*4.85*
938941	*J845 C*	*3.97*
938971	*J848 C*	*7.36*
939171	*J872 C*	*5.66*
939261	*J884*	*26.68*
939481	*J912*	*14.14*
274650	*KINCAID ;1U*	*21.16*

274651	*KINCAID ;2U*	*21.07*
LTF	*LGEE*	*1.21*
LTF	*MEC*	*9.14*
LTF	*NYISO*	*2.03*
296308	*R-030 C1*	*16.73*
296271	*R-030 C2*	*16.73*
296125	*R-030 C3*	*16.93*
290261	*S-027 C*	*3.03*
290265	*S-028 C*	*3.03*
LTF	*VFT*	*4.97*
905081	*W4-005 C*	*2.9*
900404	*X3-028 C*	*85.19*
917501	*Z2-087 C*	*13.07*
930461	*AB1-087*	*31.23*
930471	*AB1-088*	*31.23*
924041	*AB2-047 C O1*	*16.04*
924261	*AB2-070 C O1*	*7.66*
925771	*AC1-053 C*	*7.51*
926841	*AC1-171 C*	*0.92*

Appendix 3

(CE - CE) The KINCAID ; B-LATHAM ; T 345 kV line (from bus 270796 to bus 270804 ckt 1) loads from 101.13% to 105.16% (**DC power flow**) of its load dump rating (1334 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_LAN-45-BT1-3__'. This project contributes approximately 53.78 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_LAN-45-BT1-3__'
 TRIP BRANCH FROM BUS 925770 TO BUS 276150 CKT 1          / AC1-053 TAP 345 7LANSVLAM 345
 TRIP BRANCH FROM BUS 349700 TO BUS 349701 CKT 1          / 7LANSVLAM 345 4LANVL AM 138
 END
```

Bus Number	*Bus Name*	*Full Contribution*
935141	*AD1-148*	*15.84*
936771	*AD2-100 C*	*32.27*
936772	*AD2-100 E*	*21.51*
936972	*AD2-131 E*	*12.8*
LTF	*CBM-N*	*0.02*
LTF	*CBM-S1*	*6.79*
LTF	*CBM-S2*	*3.14*
LTF	*CBM-W1*	*3.56*
LTF	*CBM-W2*	*58.9*
LTF	*CIN*	*1.23*
LTF	*CPLE*	*0.64*
LTF	*DEARBORN*	*0.67*
LTF	*EDWARDS*	*0.05*
LTF	*G-007A*	*0.45*
LTF	*IPL*	*1.08*
960026	*J196 E*	*-2.16*
940291	*J291*	*5.21*
951041	*J456 C*	*1.75*
951042	*J456 E*	*6.98*
951641	*J641 C*	*13.1*
951642	*J641 E*	*3.42*
951661	*J644*	*17.55*
939811	*J750 C*	*2.54*
939812	*J750 E*	*10.14*
981581	*J757 C*	*11.14*
981582	*J757 E*	*44.58*
938331	*J797*	*8.83*
938391	*J808*	*5.16*
938411	*J811*	*10.12*
939761	*J813*	*14.62*
938791	*J815*	*43.87*
938811	*J817*	*7.75*
938431	*J823*	*2.81*

938891	*J835 C*	*7.34*
938892	*J835 E*	*29.36*
938971	*J848 C*	*8.78*
938972	*J848 E*	*35.13*
939041	*J859*	*14.29*
939171	*J872 C*	*5.9*
939172	*J872 E*	*23.59*
939481	*J912*	*14.74*
274650	*KINCAID ;1U*	*33.58*
274651	*KINCAID ;2U*	*33.54*
LTF	*LGEE*	*0.31*
LTF	*MEC*	*14.9*
LTF	*NYISO*	*0.27*
LTF	*TILTON*	*2.14*
LTF	*VFT*	*1.2*
276150	*W2-048 E*	*4.36*
909052	*X2-022 E*	*60.59*
917501	*Z2-087 C*	*-3.08*

Appendix 4

(CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 124.78% to 126.16% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 23.21 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.34*
935001	*AD1-133 C O1*	*90.76*
935141	*AD1-148*	*13.57*
936771	*AD2-100 C*	*23.21*
937171	*AD2-154 C O2*	*13.28*
937211	*AD2-159 C*	*11.31*
LTF	*CBM-N*	*0.14*
LTF	*CBM-S1*	*10.31*
LTF	*CBM-S2*	*5.39*
LTF	*CBM-W2*	*99.59*
LTF	*CIN*	*10.82*
LTF	*CPLE*	*1.17*
LTF	*DEARBORN*	*0.86*
LTF	*G-007A*	*1.93*
LTF	*IPL*	*6.25*
983101	*J339*	*12.74*
938571	*J467 C*	*2.31*
951151	*J474 C*	*6.67*
951661	*J644*	*13.53*
981031	*J734*	*10.7*
939811	*J750 C*	*4.65*
981361	*J756 C*	*6.14*
981581	*J757 C*	*7.37*
938411	*J811*	*10.79*
938791	*J815*	*37.31*
938841	*J826*	*20.36*
938891	*J835 C*	*4.85*
938941	*J845 C*	*3.97*
938971	*J848 C*	*7.36*
939171	*J872 C*	*5.66*
939261	*J884*	*26.68*
939481	*J912*	*14.14*
274650	*KINCAID ;1U*	*21.19*
274651	*KINCAID ;2U*	*21.11*

LTF	*LGEE*	*1.23*
LTF	*MEC*	*9.29*
LTF	*NYISO*	*2.13*
296308	*R-030 C1*	*16.74*
296271	*R-030 C2*	*16.74*
296125	*R-030 C3*	*16.94*
290261	*S-027 C*	*3.04*
290265	*S-028 C*	*3.04*
LTF	*VFT*	*5.18*
905081	*W4-005 C*	*2.91*
900404	*X3-028 C*	*85.65*
917501	*Z2-087 C*	*13.08*
930461	*AB1-087*	*31.41*
930471	*AB1-088*	*31.41*
924041	*AB2-047 C O1*	*16.05*
924261	*AB2-070 C O1*	*7.67*
925771	*AC1-053 C*	*7.52*
926841	*AC1-171 C*	*0.92*

Appendix 5

(LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 191.74% to 192.3% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP_P1-2_#363'. This project contributes approximately 7.66 MW to the thermal violation.

```
CONTINGENCY 'AEP_P1-2_#363'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1          / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
247287	*05AND G3*	*0.76*
243442	*05RKG1*	*37.19*
243443	*05RKG2*	*36.63*
342900	*1COOPER1 G*	*2.98*
342903	*1COOPER2 G*	*5.78*
342918	*1JKCT 1G*	*2.34*
342921	*1JKCT 2G*	*2.34*
342924	*1JKCT 3G*	*2.34*
342927	*1JKCT 4G*	*1.55*
342930	*1JKCT 5G*	*1.54*
342933	*1JKCT 6G*	*1.55*
342936	*1JKCT 7G*	*1.55*
342939	*1JKCT 9G*	*1.59*
342942	*1JKCT 10G*	*1.59*
342945	*1LAUREL 1G*	*1.68*
932551	*AC2-075 C*	*1.08*
933441	*AC2-157 C*	*8.16*
LTF	*AD1-092*	*3.63*
LTF	*AD1-093*	*6.12*
LTF	*AD1-094*	*1.1*
935011	*AD1-134*	*8.34*
935141	*AD1-148*	*2.47*
936281	*AD2-036 C*	*3.24*
936381	*AD2-048 C*	*3.93*
936571	*AD2-072 C O2*	*12.19*
936771	*AD2-100 C*	*7.66*
936821	*AD2-105 C O2*	*3.71*
936831	*AD2-106 C O2*	*1.96*
936841	*AD2-107 C O2*	*1.3*
LTF	*CARR*	*0.33*
LTF	*CBM-S1*	*40.52*
LTF	*CBM-S2*	*6.89*
LTF	*CBM-W1*	*21.42*
LTF	*CBM-W2*	*141.33*

LTF	*CIN*	*25.73*
LTF	*CLIFTY*	*95.03*
LTF	*CPLE*	*1.18*
LTF	*DEARBORN*	*0.51*
LTF	*IPL*	*15.7*
981181	*J708*	*40.82*
981521	*J759*	*9.35*
981531	*J762*	*29.43*
981571	*J783*	*9.25*
938311	*J795*	*3.66*
938731	*J800*	*15.73*
938861	*J829*	*12.54*
938921	*J842 C*	*3.98*
938931	*J843 C*	*4.32*
939021	*J856*	*9.32*
274650	*KINCAID ;1U*	*5.91*
274651	*KINCAID ;2U*	*5.89*
LTF	*LGEE*	*19.02*
LTF	*MEC*	*21.85*
LTF	*RENSSELAER*	*0.26*
LTF	*ROSETON*	*1.87*
LTF	*WEC*	*1.74*
900404	*X3-028 C*	*161.12*
LTF	*Z1-043*	*8.38*
930461	*AB1-087*	*59.08*
930471	*AB1-088*	*59.08*
LTF	*AB2-013*	*5.1*
927331	*AC1-040 C*	*9.43*
925981	*AC1-074 C*	*4.53*

Appendix 6

(MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 131.05% to 133.74% (**DC power flow**) of its emergency rating (1466 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#3128_05EUGENE 345'. This project contributes approximately 39.38 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#3128_05EUGENE 345'
 OPEN BRANCH FROM BUS 243221 TO BUS 249504 CKT 1          / 243221 05EUGENE 345 249504 08CAYSUB 345 1
 OPEN BRANCH FROM BUS 243221 TO BUS 348885 CKT 1          / 243221 05EUGENE 345 348885 7BUNSONVILLE 345 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933341	*AC2-147 C*	*0.54*
933342	*AC2-147 E*	*0.89*
934051	*AD1-031 C O1*	*2.37*
934052	*AD1-031 E O1*	*3.87*
934421	*AD1-066*	*0.87*
LTF	*AD1-092*	*9.6*
LTF	*AD1-093*	*16.1*
LTF	*AD1-094*	*2.91*
934881	*AD1-117 C*	*3.34*
934882	*AD1-117 E*	*2.23*
935001	*AD1-133 C O1*	*14.35*
935002	*AD1-133 E O1*	*9.57*
935141	*AD1-148*	*7.48*
936291	*AD2-038 C O2*	*1.44*
936292	*AD2-038 E O2*	*9.62*
936771	*AD2-100 C*	*23.63*
936772	*AD2-100 E*	*15.75*
936972	*AD2-131 E*	*9.38*
937171	*AD2-154 C O2*	*2.66*
937172	*AD2-154 E O2*	*12.46*
937211	*AD2-159 C*	*4.63*
937212	*AD2-159 E*	*21.69*
937531	*AD2-214 C*	*3.23*
937532	*AD2-214 E*	*1.52*
274832	*ANNAWAN ; 1U*	*8.72*
LTF	*BLUEG*	*5.63*
294401	*BSHIL;1U E*	*7.13*
294410	*BSHIL;2U E*	*7.13*
LTF	*CANNELTON*	*1.2*
LTF	*CARR*	*0.33*
274890	*CAYUG;1U E*	*10.29*
274891	*CAYUG;2U E*	*10.29*
LTF	*CBM-S1*	*9.31*

LTF	*CBM-S2*	*2.76*
LTF	*CBM-W1*	*56.04*
LTF	*CBM-W2*	*138.78*
LTF	*CLIFTY*	*18.96*
LTF	*CPLE*	*0.38*
274849	*CRESCENT ;1U*	*3.95*
LTF	*DEARBORN*	*0.59*
274859	*EASYR;U1 E*	*6.86*
274860	*EASYR;U2 E*	*6.86*
LTF	*ELMERSMITH*	*3.21*
LTF	*G-007*	*0.83*
960018	*G997 E*	*-2.86*
LTF	*GIBSON*	*1.43*
960026	*J196 E*	*5.39*
940291	*J291*	*3.23*
983101	*J339*	*6.2*
938571	*J467 C*	*3.57*
938572	*J467 E*	*14.26*
940541	*J468 C*	*7.15*
940542	*J468 E*	*28.62*
951151	*J474 C*	*2.63*
951152	*J474 E*	*10.54*
951641	*J641 C*	*8.28*
951642	*J641 E*	*2.16*
951661	*J644*	*9.66*
981031	*J734*	*5.2*
939811	*J750 C*	*2.74*
939812	*J750 E*	*10.97*
981361	*J756 C*	*3.21*
981362	*J756 E*	*12.84*
981581	*J757 C*	*5.26*
981582	*J757 E*	*21.02*
938331	*J797*	*18.82*
938391	*J808*	*8.79*
938411	*J811*	*17.92*
939761	*J813*	*43.43*
938791	*J815*	*32.44*
938811	*J817*	*10.29*
938841	*J826*	*10.81*
938891	*J835 C*	*3.46*
938892	*J835 E*	*13.85*
938941	*J845 C*	*2.27*
938942	*J845 E*	*9.07*
938971	*J848 C*	*6.82*
938972	*J848 E*	*27.27*

939171	*J872 C*	*5.75*
939172	*J872 E*	*22.99*
939261	*J884*	*7.9*
939481	*J912*	*14.37*
939741	*J949*	*39.25*
274650	*KINCAID ;1U*	*17.96*
274651	*KINCAID ;2U*	*17.89*
990901	*L-005 E*	*11.23*
LTF	*MEC*	*44.96*
293516	*O-009 E1*	*6.44*
293517	*O-009 E2*	*3.27*
293518	*O-009 E3*	*3.6*
293715	*O-029 E*	*6.89*
293716	*O-029 E*	*3.78*
293717	*O-029 E*	*3.47*
293771	*O-035 E*	*5.23*
LTF	*O-066*	*5.35*
296308	*R-030 C1*	*3.34*
296271	*R-030 C2*	*3.34*
296125	*R-030 C3*	*3.38*
296309	*R-030 E1*	*13.35*
296272	*R-030 E2*	*13.35*
296128	*R-030 E3*	*13.51*
LTF	*RENSSELAER*	*0.26*
LTF	*ROSETON*	*1.86*
290261	*S-027 C*	*0.91*
290265	*S-028 C*	*0.91*
LTF	*TRIMBLE*	*1.09*
274853	*TWINGROVE;U1*	*19.52*
274854	*TWINGROVE;U2*	*19.52*
276150	*W2-048 E*	*2.06*
903433	*W3-046*	*16.12*
905081	*W4-005 C*	*1.19*
905082	*W4-005 E*	*42.87*
905471	*W4-084*	*0.29*
274874	*WALNR;2U*	*1.53*
294502	*WALNR;2U E*	*6.11*
LTF	*WEC*	*4.2*
909052	*X2-022 E*	*28.64*
LTF	*Z1-043*	*22.26*
917501	*Z2-087 C*	*2.62*
917502	*Z2-087 E*	*17.54*
919221	*AA1-146*	*11.73*
919581	*AA2-030*	*11.73*
919621	*AA2-039 C*	*1.74*

919622	*AA2-039 E*	*11.64*
LTF	*AB2-013*	*13.42*
924041	*AB2-047 C O1*	*3.34*
924042	*AB2-047 E O1*	*22.37*
924261	*AB2-070 C O1*	*3.86*
924262	*AB2-070 E O1*	*25.84*
925161	*AB2-173*	*2.09*
925581	*AC1-033 C*	*1.17*
925582	*AC1-033 E*	*7.82*
925771	*AC1-053 C*	*3.9*
925772	*AC1-053 E*	*26.07*
926821	*AC1-168 C*	*0.84*
926822	*AC1-168 E*	*5.65*
926841	*AC1-171 C*	*1.14*
926842	*AC1-171 E*	*7.61*
927531	*AC1-185 1*	*0.43*
927541	*AC1-185 2*	*0.43*
927551	*AC1-185 3*	*0.43*
927561	*AC1-185 4*	*0.43*
927571	*AC1-185 5*	*0.43*
927581	*AC1-185 6*	*0.43*
927591	*AC1-185 7*	*0.43*
927601	*AC1-185 8*	*0.43*
927201	*AC1-214 C*	*1.68*
927202	*AC1-214 E*	*4.46*

Appendix 7

(MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 123.24% to 124.7% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 22.37 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.46*
935141	*AD1-148*	*15.52*
936771	*AD2-100 C*	*22.37*
937211	*AD2-159 C*	*7.49*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*10.25*
LTF	*CBM-S2*	*5.52*
LTF	*CBM-W2*	*98.16*
LTF	*CIN*	*11.31*
LTF	*CPLE*	*1.22*
LTF	*DEARBORN*	*0.72*
LTF	*G-007A*	*2.22*
LTF	*IPL*	*6.52*
940291	*J291*	*4.04*
983101	*J339*	*15.17*
938571	*J467 C*	*2.36*
940541	*J468 C*	*4.29*
951151	*J474 C*	*7.44*
951641	*J641 C*	*10.12*
951661	*J644*	*13.07*
981031	*J734*	*12.74*
939811	*J750 C*	*4.61*
981361	*J756 C*	*5.84*
981581	*J757 C*	*7.07*
938411	*J811*	*10.81*
938791	*J815*	*36.69*
938841	*J826*	*23.87*
938891	*J835 C*	*4.65*
938941	*J845 C*	*4.67*
938971	*J848 C*	*7.25*
939171	*J872 C*	*5.6*
939261	*J884*	*32.56*
939481	*J912*	*13.99*
939741	*J949*	*18.89*

274650	*KINCAID ;1U*	*20.33*
274651	*KINCAID ;2U*	*20.22*
LTF	*LGEE*	*1.3*
LTF	*MEC*	*6.*
LTF	*NYISO*	*2.55*
290261	*S-027 C*	*1.67*
290265	*S-028 C*	*1.67*
LTF	*TATANKA*	*0.02*
LTF	*VFT*	*5.95*
905081	*W4-005 C*	*1.92*
900404	*X3-028 C*	*88.04*
917501	*Z2-087 C*	*-8.13*
930461	*AB1-087*	*32.28*
930471	*AB1-088*	*32.28*
924261	*AB2-070 C O1*	*9.*
925771	*AC1-053 C*	*8.76*
926841	*AC1-171 C*	*0.97*

Appendix 8

(CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 917500 to bus 270853 ckt 1) loads from 125.12% to 125.88% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 22.37 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1            / PONTI; B 345 BLUEM; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.46*
935141	*AD1-148*	*15.52*
936771	*AD2-100 C*	*22.37*
937171	*AD2-154 C O2*	*18.14*
937211	*AD2-159 C*	*7.49*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*10.25*
LTF	*CBM-S2*	*5.52*
LTF	*CBM-W2*	*98.16*
LTF	*CIN*	*11.31*
LTF	*CPLE*	*1.22*
LTF	*DEARBORN*	*0.72*
LTF	*G-007A*	*2.22*
LTF	*IPL*	*6.52*
983101	*J339*	*15.17*
938571	*J467 C*	*2.36*
940541	*J468 C*	*4.29*
951151	*J474 C*	*7.44*
951661	*J644*	*13.07*
981031	*J734*	*12.74*
939811	*J750 C*	*4.61*
981361	*J756 C*	*5.84*
981581	*J757 C*	*7.07*
938411	*J811*	*10.81*
938791	*J815*	*36.69*
938841	*J826*	*23.87*
938891	*J835 C*	*4.65*
938941	*J845 C*	*4.67*
938971	*J848 C*	*7.25*
939171	*J872 C*	*5.6*
939261	*J884*	*32.56*
939481	*J912*	*13.99*
274650	*KINCAID ;1U*	*20.33*
274651	*KINCAID ;2U*	*20.22*

LTF	*LGEE*	*1.3*
LTF	*MEC*	*6.*
LTF	*NYISO*	*2.55*
290261	*S-027 C*	*1.67*
290265	*S-028 C*	*1.67*
LTF	*TATANKA*	*0.02*
LTF	*VFT*	*5.95*
905081	*W4-005 C*	*1.92*
900404	*X3-028 C*	*88.04*
917501	*Z2-087 C*	*17.87*
930461	*AB1-087*	*32.28*
930471	*AB1-088*	*32.28*
924041	*AB2-047 C O1*	*21.85*
924261	*AB2-070 C O1*	*9.*
925771	*AC1-053 C*	*8.76*
926841	*AC1-171 C*	*0.97*

Appendix 9

(CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 917500 ckt 1) loads from 124.18% to 125.65% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8002___-S'. This project contributes approximately 22.37 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L8002___-S'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1              / PONTI; B 345 BLUEM; B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.46*
935141	*AD1-148*	*15.52*
936771	*AD2-100 C*	*22.37*
937211	*AD2-159 C*	*7.49*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*10.25*
LTF	*CBM-S2*	*5.52*
LTF	*CBM-W2*	*98.16*
LTF	*CIN*	*11.31*
LTF	*CPLE*	*1.22*
LTF	*DEARBORN*	*0.72*
LTF	*G-007A*	*2.22*
LTF	*IPL*	*6.52*
940291	*J291*	*4.04*
983101	*J339*	*15.17*
938571	*J467 C*	*2.36*
940541	*J468 C*	*4.29*
951151	*J474 C*	*7.44*
951641	*J641 C*	*10.12*
951661	*J644*	*13.07*
981031	*J734*	*12.74*
939811	*J750 C*	*4.61*
981361	*J756 C*	*5.84*
981581	*J757 C*	*7.07*
938411	*J811*	*10.81*
938791	*J815*	*36.69*
938841	*J826*	*23.87*
938891	*J835 C*	*4.65*
938941	*J845 C*	*4.67*
938971	*J848 C*	*7.25*
939171	*J872 C*	*5.6*
939261	*J884*	*32.56*
939481	*J912*	*13.99*
939741	*J949*	*18.89*

274650	*KINCAID ;1U*	*20.33*
274651	*KINCAID ;2U*	*20.22*
LTF	*LGEE*	*1.3*
LTF	*MEC*	*6.*
LTF	*NYISO*	*2.55*
290261	*S-027 C*	*1.67*
290265	*S-028 C*	*1.67*
LTF	*TATANKA*	*0.02*
LTF	*VFT*	*5.95*
905081	*W4-005 C*	*1.92*
900404	*X3-028 C*	*88.04*
917501	*Z2-087 C*	*-8.13*
930461	*AB1-087*	*32.28*
930471	*AB1-088*	*32.28*
924041	*AB2-047 C O1*	*21.85*
924261	*AB2-070 C O1*	*9.*
925771	*AC1-053 C*	*8.76*
926841	*AC1-171 C*	*0.97*

Appendix 10

(CE - CE) The AD1-133 TAP-DRESDEN ; R 345 kV line (from bus 935000 to bus 270717 ckt 1) loads from 120.51% to 121.47% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11212_B-S-B_A'. This project contributes approximately 20.81 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B_A'
 TRIP BRANCH FROM BUS 934720 TO BUS 937120 CKT 1          / AD1-100 TAP 345 AD2-148 TAP 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.*
935001	*AD1-133 C O1*	*120.35*
935141	*AD1-148*	*12.36*
936771	*AD2-100 C*	*20.81*
937121	*AD2-148 C O2*	*12.3*
937131	*AD2-149 C O2*	*12.3*
937141	*AD2-150 C O2*	*12.3*
937171	*AD2-154 C O2*	*12.28*
937211	*AD2-159 C*	*10.35*
274863	*CAYUGA RI;1U*	*2.6*
274864	*CAYUGA RI;2U*	*2.6*
LTF	*CBM-N*	*0.17*
LTF	*CBM-S1*	*9.14*
LTF	*CBM-S2*	*5.01*
LTF	*CBM-W2*	*86.08*
LTF	*CIN*	*10.12*
LTF	*CPLE*	*1.11*
LTF	*DEARBORN*	*0.55*
LTF	*EDWARDS*	*0.14*
LTF	*G-007A*	*2.14*
LTF	*IPL*	*5.87*
983101	*J339*	*12.07*
951151	*J474 C*	*6.23*
951661	*J644*	*12.2*
981031	*J734*	*10.13*
939811	*J750 C*	*4.24*
981361	*J756 C*	*5.54*
938791	*J815*	*34.77*
938841	*J826*	*19.21*
938941	*J845 C*	*3.78*
938971	*J848 C*	*6.88*
939171	*J872 C*	*5.3*
939261	*J884*	*24.96*
939481	*J912*	*13.26*

274650	*KINCAID ;1U*	*19.02*
274651	*KINCAID ;2U*	*18.94*
LTF	*LGEE*	*1.18*
LTF	*MEC*	*2.5*
LTF	*NYISO*	*2.51*
296308	*R-030 C1*	*15.48*
296271	*R-030 C2*	*15.48*
296125	*R-030 C3*	*15.67*
290261	*S-027 C*	*2.79*
290265	*S-028 C*	*2.79*
LTF	*TATANKA*	*0.45*
LTF	*VFT*	*5.75*
905081	*W4-005 C*	*2.66*
900404	*X3-028 C*	*78.95*
917501	*Z2-087 C*	*12.09*
930461	*AB1-087*	*28.95*
930471	*AB1-088*	*28.95*
924041	*AB2-047 C O1*	*14.84*
924261	*AB2-070 C O1*	*7.*
925771	*AC1-053 C*	*6.86*
926841	*AC1-171 C*	*0.71*

Appendix 11

(CE - CE) The AD2-148 TAP-AD1-100 TAP 345 kV line (from bus 937120 to bus 934720 ckt 1) loads from 127.67% to 128.64% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of 'COMED_P1-2_345-L8014_T_-S-B'. This project contributes approximately 23.17 MW to the thermal violation.

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

Bus Number	*Bus Name*	*Full Contribution*
933441	*AC2-157 C*	*4.32*
935001	*AD1-133 C O1*	*90.71*
935141	*AD1-148*	*13.56*
936771	*AD2-100 C*	*23.17*
937121	*AD2-148 C O2*	*20.11*
937131	*AD2-149 C O2*	*20.11*
937141	*AD2-150 C O2*	*20.11*
937171	*AD2-154 C O2*	*13.27*
937211	*AD2-159 C*	*11.3*
274863	*CAYUGA RI;1U*	*3.41*
274864	*CAYUGA RI;2U*	*3.41*
LTF	*CBM-N*	*0.14*
LTF	*CBM-S1*	*10.21*
LTF	*CBM-S2*	*5.31*
LTF	*CBM-W2*	*99.02*
LTF	*CIN*	*10.75*
LTF	*CPLE*	*1.15*
LTF	*DEARBORN*	*0.89*
LTF	*G-007A*	*1.85*
LTF	*IPL*	*6.2*
983101	*J339*	*12.74*
951151	*J474 C*	*6.67*
981031	*J734*	*10.7*
939811	*J750 C*	*4.65*
981361	*J756 C*	*6.14*
938791	*J815*	*37.31*
938841	*J826*	*20.36*
938941	*J845 C*	*3.97*
938971	*J848 C*	*7.36*
939171	*J872 C*	*5.66*
939261	*J884*	*26.68*
939481	*J912*	*14.14*
274650	*KINCAID ;1U*	*21.16*
274651	*KINCAID ;2U*	*21.07*

LTF	*LGEE*	*1.21*
LTF	*MEC*	*9.14*
LTF	*NYISO*	*2.03*
296308	*R-030 C1*	*16.73*
296271	*R-030 C2*	*16.73*
296125	*R-030 C3*	*16.93*
290261	*S-027 C*	*3.03*
290265	*S-028 C*	*3.03*
LTF	*VFT*	*4.97*
905081	*W4-005 C*	*2.9*
900404	*X3-028 C*	*85.19*
917501	*Z2-087 C*	*13.07*
930461	*AB1-087*	*31.23*
930471	*AB1-088*	*31.23*
924041	*AB2-047 C O1*	*16.04*
924261	*AB2-070 C O1*	*7.66*
925771	*AC1-053 C*	*7.51*
926841	*AC1-171 C*	*0.92*