Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-053

Brokaw-Lanesville

February 2017

Network Impacts

The Queue Project AC1-053 was evaluated as a 200.0 MW (Capacity 26.0 MW) injection at the AB2-070 project which taps the Brokaw-W2-048 345kV line substation in the ComEd area. Project AC1-053 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-053 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

System Reinforcement responsible by Transmission Owner(s)

1. Existing Baseline project

(This project contributes to the following contingency overloads, and there are existing PJM baseline projects to fix the following overloads. If a customer desires to expedite the required date for the existing PJM baseline projects, the customer will be financially responsible)

1. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 108.33% to 110.67% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of '012-45-BT11-14'. This project contributes approximately 52.1 MW to the thermal violation.

```
CONTINGENCY '012-45-BT11-14'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1          / DRESDEN ; R 345 ELWOOD ; R 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 270717 TO BUS 930760 CKT 1          / DRESDEN ; R 345 AB1-122 ; 345
 END
```

2. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 108.33% to 110.67% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT13-14_A'. This project contributes approximately 52.1 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT13-14_A'
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 270717 TO BUS 930760 CKT 1          / *DRESDEN RED* AB1-122 TAP 345
 END
```

3. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 106.9% to 109.23% (**DC power flow**) of its emergency rating (2221 MVA) for the

line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT14-15'. This project contributes approximately 51.76 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT14-15'
 TRIP BRANCH FROM BUS 270697 TO BUS 270717 CKT 1          / COLLI; R 345 DRESD; R 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 END
```

PJM baseline project (b2728) will eliminate the identified overloads. The scheduled in service date b2728 is 06/01/2019.

Generator Deliverability

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

1. (MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 99.84% to 100.41% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L17802__-S'. This project contributes approximately 8.7 MW to the thermal violation.

```
CONTINGENCY '345-L17802__-S'                          / W4-005 BLUE MOUND
 TRIP BRANCH FROM BUS 270668 TO BUS 905080 CKT 1          / BLUEM; B 345 W4-005
 END
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Multiple Facility Contingency

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

1. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 98.8% to 101.14% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT14-15'. This project contributes approximately 51.82 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT14-15'
 TRIP BRANCH FROM BUS 270697 TO BUS 270717 CKT 1          / COLLI; R 345 DRESD; R 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 END
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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-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 108.33% to 110.67% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of '012-45-BT11-14'. This project contributes approximately 52.1 MW to the thermal violation.

```
CONTINGENCY '012-45-BT11-14'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1          / DRESDEN ; R 345 ELWOOD ; R 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 270717 TO BUS 930760 CKT 1          / DRESDEN ; R 345 AB1-122 ; 345
 END
```

2. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 108.33% to 110.67% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT13-14_A'. This project contributes approximately 52.1 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT13-14_A'
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 270717 TO BUS 930760 CKT 1          / *DRESDEN RED* AB1-122 TAP 345
 END
```

3. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 106.9% to 109.23% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT14-15'. This project contributes approximately 51.76 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT14-15'
 TRIP BRANCH FROM BUS 270697 TO BUS 270717 CKT 1          / COLLI; R 345 DRESD; R 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 END
```

4. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 118.76% to 123.96% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of '080-45-BT5-6__'. This project contributes approximately 41.4 MW to the thermal violation.

```
CONTINGENCY '080-45-BT5-6__'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1          / PONTIAC ; B 345 BLUEMOUND; B 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
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TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
END
```

5. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 111.63% to 122.78% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of 'LAN-45-BT1-3_A'. This project contributes approximately 88.83 MW to the thermal violation.

```
CONTINGENCY 'LAN-45-BT1-3_A'
 TRIP BRANCH FROM BUS 270673 TO BUS 348847 CKT 1          / BROKAW ; T 345 7BROKAW T1 345
 TRIP BRANCH FROM BUS 270673 TO BUS 924260 CKT 1          / BROKAW ; T 345 AB2-070 TAP 345
 TRIP BRANCH FROM BUS 349700 TO BUS 349701 CKT 1          / 7LANSVLAM 345 4LANVL AM 138
 END
```

6. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 114.34% to 120.09% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of '080-45-BT7-8__A'. This project contributes approximately 45.9 MW to the thermal violation.

```
CONTINGENCY '080-45-BT7-8__A'
 TRIP BRANCH FROM BUS 270853 TO BUS 920791 CKT 1          / PONTIAC ; R 345 Z2-087 TAP 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 END
```

7. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 112.22% to 117.31% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of '080-45-BT4-5__'. This project contributes approximately 40.57 MW to the thermal violation.

```
CONTINGENCY '080-45-BT4-5__'
 TRIP BRANCH FROM BUS 270852 TO BUS 270668 CKT 1          / PONTI; B 345 BLUEM; B 345
 TRIP BRANCH FROM BUS 270852 TO BUS 270704 CKT 1          / PONTI; B 345 LORET; B 345
 END
```

8. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 100.22% to 102.57% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of '012-45-BT11-14'. This project contributes approximately 52.16 MW to the thermal violation.

```
CONTINGENCY '012-45-BT11-14'
 TRIP BRANCH FROM BUS 270717 TO BUS 270737 CKT 1          / DRESDEN ; R 345 ELWOOD ; R 345
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
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CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
TRIP BRANCH FROM BUS 270717 TO BUS 930760 CKT 1          / DRESDEN ; R 345 AB1-122 ; 345
END
```

9. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 100.22% to 102.57% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT13-14_A'. This project contributes approximately 52.16 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_012-45-BT13-14_A'
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 270717 TO BUS 930760 CKT 1          / *DRESDEN RED* AB1-122 TAP 345
 END
```

10. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 173.87% to 173.91% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of '363_B2_TOR1682'. This project contributes approximately 1.33 MW to the thermal violation.

```
CONTINGENCY '363_B2_TOR1682'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1          / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

11. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 118.64% to 120.72% (**DC power flow**) of its emergency rating (1466 MVA) for the line fault with failed breaker contingency outage of '3128_C2_05EUGENE 345-A2'. This project contributes approximately 30.39 MW to the thermal violation.

```
CONTINGENCY '3128_C2_05EUGENE 345-A2'
 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
```

Steady-State Voltage Requirements

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

To be determined

Short Circuit

(Summary of impacted circuit breakers)

No issues identified

Affected System Analysis & Mitigation

MISO Impacts:

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

Delivery of Energy Portion of Interconnection Request

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

1. (AEP - AEP) The 05EUGENE-05DEQUIN 345 kV line (from bus 243221 to bus 243217 ckt 1) loads from 122.23% to 122.8% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of '345-L8001___-S_A'. This project contributes approximately 12.2 MW to the thermal violation.

```
CONTINGENCY '345-L8001___-S_A'
 TRIP BRANCH FROM BUS 270853 TO BUS 920791 CKT 1          / PONTI; R 345 Z2-087 TAP
 END
```

2. (CE - CE) The BLUEMOUND; B-PONTIAC ; B 345 kV line (from bus 270668 to bus 270852 ckt 1) loads from 104.07% to 106.22% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L8001___-S_A'. This project contributes approximately 32.81 MW to the thermal violation.

```
CONTINGENCY '345-L8001___-S_A'
 TRIP BRANCH FROM BUS 270853 TO BUS 920791 CKT 1          / PONTI; R 345 Z2-087 TAP
 END
```

3. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 155.18% to 158.57% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L8014_T_-S'. This project contributes approximately 51.71 MW to the thermal violation.

```
CONTINGENCY '345-L8014_T_-S'
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 END
```

4. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 113.85% to 116.34% (**DC power flow**) of its normal rating (1364 MVA) for non-

contingency condition. This project contributes approximately 34.03 MW to the thermal violation.

5. (CE - CE) The DRESDEN ; R-COLLINS ; R 345 kV line (from bus 270717 to bus 270697 ckt 1) loads from 83.61% to 84.06% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L1223_TR-S'. This project contributes approximately 15.94 MW to the thermal violation.

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

6. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 109.32% to 114.52% (**DC power flow**) of its emergency rating (797 MVA) for the single line contingency outage of '345-L8014_T_-S'. This project contributes approximately 41.43 MW to the thermal violation.

```
CONTINGENCY '345-L8014_T_-S'
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 END
```

7. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 143.42% to 146.81% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L8014_T_-S'. This project contributes approximately 51.77 MW to the thermal violation.

```
CONTINGENCY '345-L8014_T_-S'
 TRIP BRANCH FROM BUS 270853 TO BUS 270717 CKT 1          / PONTIAC ; R 345 DRESDEN ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 270853 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 345
 TRIP BRANCH FROM BUS 275210 TO BUS 272261 CKT 1          / PONTIAC ;2M 138 PONTIAC ; R 138
 TRIP BRANCH FROM BUS 275210 TO BUS 275310 CKT 1          / PONTIAC ;2M 138 PONTIAC ;2C 34.5
 CLOSE BRANCH FROM BUS 272260 TO BUS 272261 CKT 1          / PONTIAC ; B 138 PONTIAC ; R 138
 END
```

8. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 102.89% to 105.38% (**DC power flow**) of its normal rating (1364 MVA) for non-contingency condition. This project contributes approximately 34.09 MW to the thermal violation.

9. (CE - CE) The PONTIAC ; R-DRESDEN ; R 345 kV line (from bus 270853 to bus 270717 ckt 1) loads from 166.16% to 169.8% (**DC power flow**) of its emergency rating (1481 MVA) for

the single line contingency outage of '345-L11212_B-S'. This project contributes approximately 53.8 MW to the thermal violation.

```
CONTINGENCY '345-L11212_B-S'
 TRIP BRANCH FROM BUS 270926 TO BUS 270704 CKT 1              / WILTO; B 345 LORET; B 345
 END
```

10. (CE - CE) The PONTIAC ; R-DRESDEN ; R 345 kV line (from bus 270853 to bus 270717 ckt 1) loads from 117.78% to 120.45% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 35.63 MW to the thermal violation.

11. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 184.55% to 184.88% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of '363_B2_TOR1682'. This project contributes approximately 10.22 MW to the thermal violation.

```
CONTINGENCY '363_B2_TOR1682'
 OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1              / 243208 05JEFRSO 765 243209 05ROCKPT 765 1
 END
```

12. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 126.89% to 129.14% (**DC power flow**) of its normal rating (1334 MVA) for the single line contingency outage of '286_B2_TOR1687'. This project contributes approximately 30.06 MW to the thermal violation.

```
CONTINGENCY '286_B2_TOR1687'
 OPEN BRANCH FROM BUS 243221 TO BUS 348885 CKT 1              / 243221 05EUGENE 345 348885 7BUNSONVILLE 345 1
 END
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13. (MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 109.93% to 114.31% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L8002___-S'. This project contributes approximately 66.87 MW to the thermal violation.

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

14. (CE - CE) The W4-005 TAP-BLUEMOUND; B 345 kV line (from bus 905080 to bus 270668 ckt 1) loads from 100.86% to 103.32% (**DC power flow**) of its emergency rating (1334 MVA) for the single line contingency outage of '345-L8001___-S_A'. This project contributes approximately 32.89 MW to the thermal violation.

```
CONTINGENCY '345-L8001___-S_A'
 TRIP BRANCH FROM BUS 270853 TO BUS 920791 CKT 1              / PONTI; R 345 Z2-087 TAP
 END
```

15. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 920791 to bus 270853 ckt 1) loads from 128.63% to 133.01% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L8002___-S'. This project contributes approximately 66.87 MW to the thermal violation.

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

16. (CE - CE) The Z2-087 TAP-PONTIAC ; R 345 kV line (from bus 920791 to bus 270853 ckt 1) loads from 106.37% to 111.12% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 63.36 MW to the thermal violation.

17. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 920791 ckt 1) loads from 119.98% to 124.36% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L8002___-S'. This project contributes approximately 66.87 MW to the thermal violation.

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

18. (CE - CE) The AB2-047 TAP-Z2-087 TAP 345 kV line (from bus 924040 to bus 920791 ckt 1) loads from 95.25% to 99.99% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 63.36 MW to the thermal violation.

Light Load Analysis - 2020

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

System Reinforcements

Short Circuit

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

None required.

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

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

Generator Deliverability

1. (MISO AMIL - CE) The 7BROKAW-AB2-047 TAP 345 kV line (from bus 348847 to bus 924040 ckt 1) loads from 99.84% to 100.41% (**DC power flow**) of its emergency rating (1528 MVA) for the single line contingency outage of '345-L17802__-S'. This project contributes approximately 8.7 MW to the thermal violation.

AMIL (MISO) will have to evaluate this violation during the SIS phase.

Comed: ComEd 345kV L8001 SSTE rating is 1793 MVA. No upgrade required.

Multiple Facility Contingency

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

1. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 98.8% to 101.14% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT14-15'. This project contributes approximately 51.82 MW to the thermal violation.

Reinforcement: ComEd 345kV L8012 SLD rating is 1912 MVA & ALDR rating is 2199 MVA. The post contingency flow for this event exceeds the applicable ratings therefore an upgrade is required. The upgrade will be to replace the 345kV Circuit Breaker Bus Tie disconnect switches on Bus 4 & Bus 5 at Pontiac. The L8012 Motor Operated Disconnect switch at Pontiac will also need to be replaced. Upon completion of this work the new ratings will be 1364/1528/2221/2554 MVA, (SN/SE/SLD/ALDR) respectively.
Cost: $500k
Time: 24-30 months

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-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 108.33% to 110.67% (**DC power flow**) of its emergency rating (2221 MVA) for

the line fault with failed breaker contingency outage of '012-45-BT11-14'. This project contributes approximately 52.1 MW to the thermal violation.

This contingency is no longer valid once the topology in the model is updated to reflect the mitigation of the sag limitations on the Loretto - Wilton Center 345 kV line and replace the station conductor at Wilton Center and all contingencies are updated once **b2728** is in service. Upon completion of this work the new ratings will be 1364/1528/2221/2554 MVA, (SN/SE/SLD/ALDR) respectively. Upon completion of this work the post contingency flow will be below the ALDR rating.

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

2. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 108.33% to 110.67% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT13-14_A'. This project contributes approximately 52.1 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #1

3. (CE - CE) The LORETTO ; B-WILTON ; B 345 kV line (from bus 270704 to bus 270926 ckt 1) loads from 106.9% to 109.23% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT14-15'. This project contributes approximately 51.76 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #1

4. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 118.76% to 123.96% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of '080-45-BT5-6__'. This project contributes approximately 41.4 MW to the thermal violation.

Comed: ComEd 345kV L2106 SLD & ALDR ratings are 1494 MVA & 1494 MVA respectively (ALDR = SLD due to a relay thermal limit). No upgrade required.

AMIL (MISO) will have to evaluate this violation during the SIS phase.

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

5. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 111.63% to 122.78% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of 'LAN-45-BT1-3_A'. This project contributes approximately 88.83 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #5

6. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 114.34% to 120.09% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of '080-45-BT7-8__A'. This project contributes approximately 45.9 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #5

7. (CE - MISO AMIL) The KINCAID ; B-7AUSTIN 345 kV line (from bus 270796 to bus 347955 ckt 1) loads from 112.22% to 117.31% (**DC power flow**) of its emergency rating (797 MVA) for the line fault with failed breaker contingency outage of '080-45-BT4-5__'. This project contributes approximately 40.57 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #5

8. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 100.22% to 102.57% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of '012-45-BT11-14'. This project contributes approximately 52.16 MW to the thermal violation.

Reinforcement: ComEd 345kV L8012 SLD rating is 1912 MVA & ALDR rating is 2199 MVA. The post contingency flow for this event exceeds the applicable ratings therefore an upgrade is required. The upgrade will be to replace the 345kV Circuit Breaker Bus Tie disconnect switches on Bus 4 & Bus 5 at Pontiac. The L8012 Motor Operated Disconnect switch at Pontiac will also need to be replaced. Upon completion of this work the new ratings will be 1364/1528/2221/2554 MVA, (SN/SE/SLD/ALDR) respectively.
Cost: $500K
Time: 24 – 30 months.

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

9. (CE - CE) The PONTIAC ; B-LORETTO ; B 345 kV line (from bus 270852 to bus 270704 ckt 1) loads from 100.22% to 102.57% (**DC power flow**) of its emergency rating (2221 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_012-45-BT13-14_A'. This project contributes approximately 52.16 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #8

10. (LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 173.87% to 173.91% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of '363_B2_TOR1682'. This project contributes approximately 1.33 MW to the thermal violation.

LGEE will have to evaluate this violation during the SIS phase.

OVEC will have to evaluate this violation during the SIS phase.

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

11. (MISO AMIL - AEP) The 7CASEY-05SULLIVAN 345 kV line (from bus 346809 to bus 247712 ckt 1) loads from 118.64% to 120.72% (**DC power flow**) of its emergency rating (1466 MVA) for the line fault with failed breaker contingency outage of '3128_C2_05EUGENE 345-A2'. This project contributes approximately 30.39 MW to the thermal violation.

AMIL (MISO) will have to evaluate this violation during the SIS phase.

Reinforcement: AEP owns 0.6 mile section of line between Sullivan/Breed and West Casey 345 kV stations which will need to be rebuilt to increase AEP end ratings at an approximate cost of $2.0 million. S/N: 1754 S/E: 2369
Cost: $2M
Time: 24-36 months

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

Light Load Load Flow Analysis Reinforcements

New System Reinforcements

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

To be determined in System Impact Study phase.