Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC1-171

Powerton

March 2017

Network Impacts

The Queue Project AC1-171 was evaluated as a 79.4 MW (Capacity 10.3 MW) injection at the Powerton 138kV in the ComEd area. Project AC1-171 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-171 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Generator Deliverability

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

None

Multiple Facility Contingency

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

None

Contribution to Previously Identified Overloads

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

1. (CE - MISO AMIL) The KEWANEE ;12-4EDWARDS3 138 kV line (from bus 271837 to bus 349637 ckt 1) loads from 109.86% to 111.58% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of '155-38-L15508_'. This project contributes approximately 5.46 MW to the thermal violation.

```
CONTINGENCY '155-38-L15508_'
 TRIP BRANCH FROM BUS 271331 TO BUS 271333 CKT 1          / DIXON;8R 138 DIXON; R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 271331 CKT 1          / NELSO;RT 138 DIXON;8R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 272095 CKT 1          / NELSO;RT 138 NELSO; R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 293710 CKT 1          / NELSO;RT 138 O29 138
 MOVE 100 PERCENT LOAD FROM BUS 271331 TO BUS 271330      / DIXON;8R 138 DIXON;7B 138
 DISCONNECT BUS 272095                    / NELSO; R 138
 END
```

2. (CE - MISO AMIL) The KEWANEE ;13-4KEWANEE N 138 kV line (from bus 271838 to bus 348923 ckt 1) loads from 110.96% to 112.42% (**DC power flow**) of its emergency rating (449 MVA) for the line fault with failed breaker contingency outage of '155-38-L15508_'. This project contributes approximately 14.52 MW to the thermal violation.

```
CONTINGENCY '155-38-L15508_'
 TRIP BRANCH FROM BUS 271331 TO BUS 271333 CKT 1          / DIXON;8R 138 DIXON; R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 271331 CKT 1          / NELSO;RT 138 DIXON;8R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 272095 CKT 1          / NELSO;RT 138 NELSO; R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 293710 CKT 1          / NELSO;RT 138 O29 138
```

```
 MOVE 100 PERCENT LOAD FROM BUS 271331 TO BUS 271330          / DIXON;8R 138 DIXON;7B 138
 DISCONNECT BUS 272095                          / NELSO; R 138
 END
```

3. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the bus fault outage of '074_KE-138___2'. This project contributes approximately 33.81 MW to the thermal violation.

```
CONTINGENCY '074_KE-138___2'
 DISCONNECT BUS 271835                          / KEWANEE ;23 138
 DISCONNECT BUS 271839                          / KEWANEE ;22 138
 DISCONNECT BUS 271845                          / KEWANEE ;21 138
 END
```

4. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the line fault with failed breaker contingency outage of '074-38-L94301_'. This project contributes approximately 33.81 MW to the thermal violation.

```
CONTINGENCY '074-38-L94301_'
 TRIP BRANCH FROM BUS 271134 TO BUS 271845 CKT 1              / BSHIL; 138 KEWAN; 3 138
 TRIP BRANCH FROM BUS 271134 TO BUS 274452 CKT 1              / BSHIL; 138 BSHIL; 1 34.5
 TRIP BRANCH FROM BUS 271134 TO BUS 274453 CKT 1              / BSHIL; 138 BSHIL; 2 34.5
 TRIP BRANCH FROM BUS 274422 TO BUS 274877 CKT 1              / BSHIL; 1H 34.5 BSHIL; 1U 0.69
 TRIP BRANCH FROM BUS 274423 TO BUS 274878 CKT 1              / BSHIL; 2H 34.5 BSHIL; 2U 0.69
 TRIP BRANCH FROM BUS 274452 TO BUS 274422 CKT 1              / BSHIL; 1 34.5 BSHIL; 1H 34.5
 TRIP BRANCH FROM BUS 274453 TO BUS 274423 CKT 1              / BSHIL; 2 34.5 BSHIL; 2H 34.5
 REMOVE UNIT W1 FROM BUS 274877                     / BSHIL; 1U 0.69
 REMOVE UNIT W2 FROM BUS 274878                     / BSHIL; 2U 0.69
 DISCONNECT BUS 271835                          / KEWAN; 2 138
 DISCONNECT BUS 271839                          / KEWAN; 3 138
 DISCONNECT BUS 271845
 END
```

5. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the line fault with failed breaker contingency outage of '074-38-L91901_'. This project contributes approximately 33.81 MW to the thermal violation.

```
CONTINGENCY '074-38-L91901_'
 TRIP BRANCH FROM BUS 271835 TO BUS 271655 CKT 1              / KEWAUNEE T143
 DISCONNECT BUS 271835                          / KEWAN; 2 138
 DISCONNECT BUS 271839                          / KEWAN; 3 138
 END
```

6. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the line fault with failed breaker contingency outage of '074-38-L7421__'. This project contributes approximately 33.81 MW to the thermal violation.

```
CONTINGENCY '074-38-L7421__'
 TRIP BRANCH FROM BUS 271839 TO BUS 272607 CKT 1              / KEWANEE ;22 138 TOULON ; R 138
```

```
DISCONNECT BUS 271835                    / KEWANEE ;23 138
DISCONNECT BUS 271839                    / KEWANEE ;22 138
DISCONNECT BUS 271845                    / KEWANEE ;21 138
REMOVE UNIT W1 FROM BUS 274877
REMOVE UNIT W2 FROM BUS 274878
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 GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 99.84% to 100.01% (**DC power flow**) of its emergency rating (1802 MVA) for the single line contingency outage of '345-L11613AB-S'. This project contributes approximately 6.77 MW to the thermal violation.

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

2. (CE - CE) The KEWANEE ;23-HENNEPIN ; T 138 kV line (from bus 271835 to bus 271655 ckt 1) loads from 162.67% to 164.52% (**DC power flow**) of its emergency rating (195 MVA) for

the single line contingency outage of 'KEWANEE ;13-4KEWANEE N'. This project contributes approximately 7.98 MW to the thermal violation.

```
CONTINGENCY 'KEWANEE ;13-4KEWANEE N'
 DISCONNECT BRANCH FROM BUS 271838 TO BUS 348923 CKT 1
 END
```

3. (CE - MISO AMIL) The KEWANEE ;12-4EDWARDS3 138 kV line (from bus 271837 to bus 349637 ckt 1) loads from 99.38% to 101.07% (**DC power flow**) of its emergency rating (143 MVA) for the single line contingency outage of 'KEWANEE ;13-4KEWANEE N'. This project contributes approximately 5.35 MW to the thermal violation.

```
CONTINGENCY 'KEWANEE ;13-4KEWANEE N'
 DISCONNECT BRANCH FROM BUS 271838 TO BUS 348923 CKT 1
 END
```

4. (CE - MISO AMIL) The KEWANEE ;13-4KEWANEE N 138 kV line (from bus 271838 to bus 348923 ckt 1) loads from 143.3% to 145.18% (**DC power flow**) of its normal rating (244 MVA) for non-contingency condition. This project contributes approximately 10.19 MW to the thermal violation.

5. (CE - MISO AMIL) The KEWANEE ;13-4KEWANEE N 138 kV line (from bus 271838 to bus 348923 ckt 1) loads from 102.88% to 104.16% (**DC power flow**) of its emergency rating (449 MVA) for the single line contingency outage of '074-L6101___'. This project contributes approximately 12.74 MW to the thermal violation.

```
CONTINGENCY '074-L6101___'
 TRIP BRANCH FROM BUS 271835 TO BUS 271655 CKT 1              / KEWAN; 2 138 HENNE; T 138
 END
```

6. (CE - CE) The KEWANEE ;22-KEWANEE ;23 138 kV line (from bus 271839 to bus 271835 ckt 1) loads from 111.86% to 113.64% (**DC power flow**) of its emergency rating (449 MVA) for the single line contingency outage of 'KEWANEE ;13-4KEWANEE N'. This project contributes approximately 17.69 MW to the thermal violation.

```
CONTINGENCY 'KEWANEE ;13-4KEWANEE N'
 DISCONNECT BRANCH FROM BUS 271838 TO BUS 348923 CKT 1
 END
```

7. (CE - CE) The KEWANEE ;22-KEWANEE ;23 138 kV line (from bus 271839 to bus 271835 ckt 1) loads from 93.86% to 95.4% (**DC power flow**) of its normal rating (351 MVA) for non-contingency condition. This project contributes approximately 12.03 MW to the thermal violation.

8. (CE - CE) The NORMANDY ; R-O09 OP1 138 138 kV line (from bus 272111 to bus 293510 ckt 1) loads from 89.86% to 91.9% (**DC power flow**) of its emergency rating (214 MVA) for the single line contingency outage of 'KEWANEE ;13-4KEWANEE N'. This project contributes approximately 9.71 MW to the thermal violation.

```
CONTINGENCY 'KEWANEE ;13-4KEWANEE N'
 DISCONNECT BRANCH FROM BUS 271838 TO BUS 348923 CKT 1
 END
```

9. (CE - CE) The POWERTON ;-POWERTON ;RT 138 kV line (from bus 272269 to bus 272285 ckt 1) loads from 68.71% to 105.8% (**DC power flow**) of its emergency rating (214 MVA) for the single line contingency outage of '138-L7421___-S'. This project contributes approximately 79.39 MW to the thermal violation.

```
CONTINGENCY '138-L7421___-S'
 TRIP BRANCH FROM BUS 271839 TO BUS 272607 CKT 1              / KEWAN; 3 138 TOULN; R 138
 END
```

10. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 105.79% to 131.41% (**DC power flow**) of its emergency rating (132 MVA) for the single line contingency outage of '138-L7421___-S'. This project contributes approximately 33.81 MW to the thermal violation.

```
CONTINGENCY '138-L7421___-S'
 TRIP BRANCH FROM BUS 271839 TO BUS 272607 CKT 1              / KEWAN; 3 138 TOULN; R 138
 END
```

11. (CE - CE) The ROCK FALL; R-NELSON ; R 138 kV line (from bus 272367 to bus 272095 ckt 1) loads from 170.72% to 172.7% (**DC power flow**) of its emergency rating (223 MVA) for the single line contingency outage of '187-L15508__'. This project contributes approximately 9.79 MW to the thermal violation.

```
CONTINGENCY '187-L15508__'
 TRIP BRANCH FROM BUS 293710 TO BUS 272097 CKT 1              / O29 ; 138 NELSO;RT 138
 END
```

12. (CE - CE) The ROCK FALL; R-NELSON ; R 138 kV line (from bus 272367 to bus 272095 ckt 1) loads from 109.12% to 110.59% (**DC power flow**) of its normal rating (173 MVA) for non-contingency condition. This project contributes approximately 5.65 MW to the thermal violation.

13. (CE - CE) The O09 OP1 138-ROCK FALL; R 138 kV line (from bus 293510 to bus 272367 ckt 1) loads from 201.3% to 203.45% (**DC power flow**) of its emergency rating (214 MVA) for the single line contingency outage of '187-L15508__'. This project contributes approximately 10.23 MW to the thermal violation.

```
CONTINGENCY '187-L15508__'
 TRIP BRANCH FROM BUS 293710 TO BUS 272097 CKT 1              / O29 ; 138 NELSO;RT 138
 END
```

14. (CE - CE) The O09 OP1 138-ROCK FALL; R 138 kV line (from bus 293510 to bus 272367 ckt 1) loads from 135.82% to 137.38% (**DC power flow**) of its normal rating (173 MVA) for non-contingency condition. This project contributes approximately 6.01 MW to the thermal violation.

15. (CE - CE) The O29-NELSON ;RT 138 kV line (from bus 293710 to bus 272097 ckt 1) loads from 166.86% to 168.59% (**DC power flow**) of its emergency rating (264 MVA) for the single line contingency outage of '133-CB_23___'. This project contributes approximately 10.16 MW to the thermal violation.

```
CONTINGENCY '133-CB_23___'
 TRIP BRANCH FROM BUS 272367 TO BUS 293510 CKT 1              / R FAL; R 138 O9 138
 END
```

16. (CE - CE) The O29-NELSON ;RT 138 kV line (from bus 293710 to bus 272097 ckt 1) loads from 131.88% to 133.16% (**DC power flow**) of its normal rating (208 MVA) for non-contingency condition. This project contributes approximately 5.91 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 99.99% to 100.2% (**DC power flow**) of its normal rating (1334 MVA) for non-contingency condition. This project contributes approximately 5.96 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)

None

Contribution to Previously Identified System Reinforcements

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

1. (CE - MISO AMIL) The KEWANEE ;12-4EDWARDS3 138 kV line (from bus 271837 to bus 349637 ckt 1) loads from 109.86% to 111.58% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of '155-38-L15508_'. This project contributes approximately 5.46 MW to the thermal violation.

Comed: ComEd 138kV L7423 SLD rating is 256 MVA and the ALDR rating is 290 MVA. No upgrade is required.

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

2. (CE - MISO AMIL) The KEWANEE ;13-4KEWANEE N 138 kV line (from bus 271838 to bus 348923 ckt 1) loads from 110.96% to 112.42% (**DC power flow**) of its emergency rating (449 MVA) for the line fault with failed breaker contingency outage of '155-38-L15508_'. This project contributes approximately 14.52 MW to the thermal violation.

Comed: ComEd 138kV Bus at TSS 74 SLD & ALDR ratings are 498 MVA & 573 MVA. No upgrade required.

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

3. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the bus fault outage of '074_KE-138___2'. This project contributes approximately 33.81 MW to the thermal violation.

Comed: ComEd 138kV L1352 SLD & ALDR ratings are 280 MVA & 322 MVA. 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.

4. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the line fault with failed breaker contingency outage of '074-38-L94301_'. This project contributes approximately 33.81 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #3

5. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the line fault with failed breaker contingency outage of '074-38-L91901_'. This project contributes approximately 33.81 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #3

6. (CE - MISO AMIL) The POWERTON ;RT-4LILLY 138 kV line (from bus 272285 to bus 348875 ckt 1) loads from 106.25% to 131.86% (**DC power flow**) of its emergency rating (132 MVA) for the line fault with failed breaker contingency outage of '074-38-L7421__'. This project contributes approximately 33.81 MW to the thermal violation.

Same as Contribution to Previously Identified Overload #3

Network Impacts for Secondary POI

The Queue Project AC1-171 was evaluated as a 79.4 MW (Capacity 10.3 MW) injection tapping the Oglesby Tap-Mazon 138kV line in the ComEd area. Project AC1-171 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-171 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

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

None

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

1. (CE - MISO AMIL) The AC1-171 TAP-4EDWARDS3 138 kV line (from bus 926840 to bus 349637 ckt 1) loads from 88.04% to 117.92% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of '155-38-L15508_'. This project contributes approximately 42.73 MW to the thermal violation.

```
CONTINGENCY '155-38-L15508_'
 TRIP BRANCH FROM BUS 271331 TO BUS 271333 CKT 1          / DIXON;8R 138 DIXON; R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 271331 CKT 1          / NELSO;RT 138 DIXON;8R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 272095 CKT 1          / NELSO;RT 138 NELSO; R 138
 TRIP BRANCH FROM BUS 272097 TO BUS 293710 CKT 1          / NELSO;RT 138 O29 138
 MOVE 100 PERCENT LOAD FROM BUS 271331 TO BUS 271330        / DIXON;8R 138 DIXON;7B 138
 DISCONNECT BUS 272095                        / NELSO; R 138
 END
```

2. (CE - MISO AMIL) The AC1-171 TAP-4EDWARDS3 138 kV line (from bus 926840 to bus 349637 ckt 1) loads from 81.97% to 111.17% (**DC power flow**) of its emergency rating (143 MVA) for the tower line contingency outage of '138-L0108__B-S_+_138-L7713__R-S_B'. This project contributes approximately 41.75 MW to the thermal violation.

```
CONTINGENCY '138-L0108__B-S_+_138-L7713__R-S_B'
 TRIP BRANCH FROM BUS 271908 TO BUS 271986 CKT 1          / LASCO STA; B 138 MAZON ; B 138
 TRIP BRANCH FROM BUS 926820 TO BUS 271987 CKT 1          / AC1-168 TAP 138 MAZON; R 138
 TRIP BRANCH FROM BUS 272189 TO BUS 348935 CKT 1          / OGLES; T 138 4OGLESBY MN 138
 END
```

3. (CE - MISO AMIL) The AC1-171 TAP-4EDWARDS3 138 kV line (from bus 926840 to bus 349637 ckt 1) loads from 81.29% to 110.48% (**DC power flow**) of its emergency rating (143 MVA) for the line fault with failed breaker contingency outage of '077-38-BT_R___A'. This project contributes approximately 41.74 MW to the thermal violation.

```
CONTINGENCY '077-38-BT_R___A'
 TRIP BRANCH FROM BUS 272189 TO BUS 926820 CKT 1          / OGLES; T 138 AC1-168 TAP 138
 TRIP BRANCH FROM BUS 272189 TO BUS 348935 CKT 1          / OGLES; T 138 4OGLESBY MN 138
 TRIP BRANCH FROM BUS 271187 TO BUS 271987 CKT 1          / CHANNAHON; R 138 MAZON ; R 138
 TRIP BRANCH FROM BUS 271337 TO BUS 272125 CKT 1          / DRESDEN ; R 138 ESS J339 ; R 138
 TRIP BRANCH FROM BUS 271987 TO BUS 926820 CKT 1          / AC1-168 TAP 138 OGLESBY ; T 138
 TRIP BRANCH FROM BUS 272319 TO BUS 271187 CKT 1          / ESS J375 ; R 138 CHANNAHON; R 138
 TRIP BRANCH FROM BUS 272319 TO BUS 272125 CKT 1          / ESS J375 ; R 138 ESS J339 ; R 138
 MOVE 50 PERCENT LOAD FROM BUS 271187 TO BUS 271566       / CHANNAHON; R 138 GOOSE LK ; B 138
 MOVE 50 PERCENT LOAD FROM BUS 271187 TO BUS 271567       / CHANNAHON; R 138 GOOSE LK ; R 138
 MOVE 100 PERCENT LOAD FROM BUS 272125 TO BUS 272124      / ESS J339 ; R 138 ESS J339 ; B 138
 CLOSE LINE FROM BUS 271986 TO BUS 271987 CKT 1           / MAZON ; B 138 MAZON ; R 138
 DISCONNECT BUS 274836                                    / EQUISTAR ; R 13.8
 END
```

4. (CE - MISO AMIL) The AC1-171 TAP-4EDWARDS3 138 kV line (from bus 926840 to bus 349637 ckt 1) loads from 76.83% to 106.31% (**DC power flow**) of its emergency rating (143 MVA) for the tower line contingency outage of '138-L6101___-S_+_138-L7713__R-S'. This project contributes approximately 42.16 MW to the thermal violation.

```
CONTINGENCY '138-L6101___-S_+_138-L7713__R-S'
 TRIP BRANCH FROM BUS 271241 TO BUS 926820 CKT 1          / CRES; 138 AC1-168 OPT2; T 138
 TRIP BRANCH FROM BUS 271835 TO BUS 271655 CKT 1          / KEWANEE; 138 HENNEPIN 138
 TRIP BRANCH FROM BUS 271655 TO BUS 272521 CKT 1          / HENNEPIN; 138 STREAT; 138
 END
```

Contribution to Previously Identified Overloads

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

1. (CE - MISO AMIL) The KEWANEE ;13-4KEWANEE N 138 kV line (from bus 271838 to bus 348923 ckt 1) loads from 102.44% to 103.95% (**DC power flow**) of its emergency rating (449 MVA) for the tower line contingency outage of '138-L6101___-S_+_138-L7713__R-S'. This project contributes approximately 15.02 MW to the thermal violation.

```
CONTINGENCY '138-L6101___-S_+_138-L7713__R-S'
 TRIP BRANCH FROM BUS 271241 TO BUS 926820 CKT 1          / CRES; 138 AC1-168 OPT2; T 138
 TRIP BRANCH FROM BUS 271835 TO BUS 271655 CKT 1          / KEWANEE; 138 HENNEPIN 138
 TRIP BRANCH FROM BUS 271655 TO BUS 272521 CKT 1          / HENNEPIN; 138 STREAT; 138
 END
```

2. (CE - CE) The AC1-168 TAP-MAZON ; R 138 kV line (from bus 926820 to bus 271987 ckt 1) loads from 133.31% to 134.56% (**DC power flow**) of its emergency rating (230 MVA) for the bus fault outage of '001_LA-138B__1'. This project contributes approximately 6.37 MW to the thermal violation.

```
CONTINGENCY '001_LA-138B__1'
```

```
DISCONNECT BUS 271908                    / LASCO STA; B 138
END
```

3. (CE - CE) The AC1-168 TAP-MAZON ; R 138 kV line (from bus 926820 to bus 271987 ckt 1) loads from 133.31% to 134.56% (**DC power flow**) of its emergency rating (230 MVA) for the line fault with failed breaker contingency outage of '001-38-TR81___'. This project contributes approximately 6.37 MW to the thermal violation.

```
CONTINGENCY '001-38-TR81___'
 TRIP BRANCH FROM BUS 270802 TO BUS 270803 CKT 1          / LASCO STA; B 345 LASCO STA; R 345
 TRIP BRANCH FROM BUS 270802 TO BUS 271908 CKT 1          / LASCO STA; B 345 LASCO STA; B 138
 DISCONNECT BUS 271908                    / LASCO STA; B 138
 TRIP BRANCH FROM BUS 270802 TO BUS 270803 CKT 1          / LASCO STA; B 345 LASCO STA; R 345
 END
```

4. (CE - CE) The AC1-168 TAP-MAZON ; R 138 kV line (from bus 926820 to bus 271987 ckt 1) loads from 133.31% to 134.56% (**DC power flow**) of its emergency rating (230 MVA) for the line fault with failed breaker contingency outage of '001-38-L0108__'. This project contributes approximately 6.37 MW to the thermal violation.

```
CONTINGENCY '001-38-L0108__'
 TRIP BRANCH FROM BUS 271908 TO BUS 271986 CKT 1          / LASCO; B 138 MAZON; B 138
 DISCONNECT BUS 271908                    / LASCO; B 138
 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)

This project contributed to an existing over-duty breaker in the **Option 2** study.

Bus Number	Bus Name	BREAKER	Rating Type	Breaker Capacity (Amps)	Duty Percent With AC1-171_op2_v1_comed	Duty Percent Without AC1-171_op2_v1_comed	Duty Percent Difference	Duty Amps With AC1-171_op2_v1_comed	Duty Amps Without AC1-171_op2_v1_comed
0	Kewanee 1 138.kV	74 BT 1-2	T	14642.9	110.84%	107.20%	3.65%	16230.6	15696.5

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 GOODINGS ;4B-GOODINGS ;3B 345 kV line (from bus 270770 to bus 270766 ckt 1) loads from 99.98% to 100.19% (**DC power flow**) of its emergency rating (1802 MVA) for the single line contingency outage of '345-L11613AB-S'. This project contributes approximately 8.5 MW to the thermal violation.

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

2. (CE - CE) The CRESCENT ; R-AC1-168 TAP 138 kV line (from bus 271241 to bus 926820 ckt 1) loads from 158.79% to 160.61% (**DC power flow**) of its emergency rating (174 MVA) for the single line contingency outage of 'KEWANEE ;13-4KEWANEE N'. This project contributes approximately 7.03 MW to the thermal violation.

```
CONTINGENCY 'KEWANEE ;13-4KEWANEE N'
 DISCONNECT BRANCH FROM BUS 271838 TO BUS 348923 CKT 1
 END
```

3. (CE - CE) The KEWANEE ;23-HENNEPIN ; T 138 kV line (from bus 271835 to bus 271655 ckt 1) loads from 109.75% to 111.33% (**DC power flow**) of its emergency rating (195 MVA) for the single line contingency outage of 'KEWANEE ;13-4KEWANEE N'. This project contributes approximately 6.83 MW to the thermal violation.

```
CONTINGENCY 'KEWANEE ;13-4KEWANEE N'
 DISCONNECT BRANCH FROM BUS 271838 TO BUS 348923 CKT 1
 END
```

4. (CE - MISO AMIL) The KEWANEE ;13-4KEWANEE N 138 kV line (from bus 271838 to bus 348923 ckt 1) loads from 108.98% to 110.97% (**DC power flow**) of its normal rating (244

MVA) for non-contingency condition. This project contributes approximately 10.79 MW to the thermal violation.

5. (CE - CE) The ESS J339 ; R-DRESDEN ; R 138 kV line (from bus 272125 to bus 271337 ckt 1) loads from 106.84% to 107.78% (**DC power flow**) of its emergency rating (268 MVA) for the single line contingency outage of '138-L0112__B-S'. This project contributes approximately 5.57 MW to the thermal violation.

```
CONTINGENCY '138-L0112__B-S'
 TRIP BRANCH FROM BUS 271844 TO BUS 271908 CKT 1              / KICKA; B 138 LASCO; B 138
 END
```

6. (CE - CE) The ESS J339 ; R-DRESDEN ; R 138 kV line (from bus 272125 to bus 271337 ckt 1) loads from 96.18% to 97.19% (**DC power flow**) of its normal rating (210 MVA) for non-contingency condition. This project contributes approximately 4.7 MW to the thermal violation.

7. (CE - CE) The ROCK FALL; R-NELSON ; R 138 kV line (from bus 272367 to bus 272095 ckt 1) loads from 157.0% to 159.16% (**DC power flow**) of its emergency rating (223 MVA) for the single line contingency outage of '187-L15508__'. This project contributes approximately 10.7 MW to the thermal violation.

```
CONTINGENCY '187-L15508__'
 TRIP BRANCH FROM BUS 293710 TO BUS 272097 CKT 1              / O29 ; 138 NELSO;RT 138
 END
```

8. (CE - CE) The ROCK FALL; R-NELSON ; R 138 kV line (from bus 272367 to bus 272095 ckt 1) loads from 99.59% to 101.21% (**DC power flow**) of its normal rating (173 MVA) for non-contingency condition. This project contributes approximately 6.21 MW to the thermal violation.

9. (CE - CE) The O09 OP1 138-ROCK FALL; R 138 kV line (from bus 293510 to bus 272367 ckt 1) loads from 186.33% to 188.68% (**DC power flow**) of its emergency rating (214 MVA) for the single line contingency outage of '187-L15508__'. This project contributes approximately 11.19 MW to the thermal violation.

```
CONTINGENCY '187-L15508__'
 TRIP BRANCH FROM BUS 293710 TO BUS 272097 CKT 1              / O29 ; 138 NELSO;RT 138
 END
```

10. (CE - CE) The O09 OP1 138-ROCK FALL; R 138 kV line (from bus 293510 to bus 272367 ckt 1) loads from 125.64% to 127.36% (**DC power flow**) of its normal rating (173 MVA) for non-contingency condition. This project contributes approximately 6.61 MW to the thermal violation.

11. (CE - CE) The O29-NELSON ;RT 138 kV line (from bus 293710 to bus 272097 ckt 1) loads from 154.94% to 156.83% (**DC power flow**) of its emergency rating (264 MVA) for the single line contingency outage of '133-CB_23___'. This project contributes approximately 11.11 MW to the thermal violation.

```
CONTINGENCY '133-CB_23___'
 TRIP BRANCH FROM BUS 272367 TO BUS 293510 CKT 1              / R FAL; R 138 O9 138
 END
```

12. (CE - CE) The O29-NELSON ;RT 138 kV line (from bus 293710 to bus 272097 ckt 1) loads from 123.63% to 125.04% (**DC power flow**) of its normal rating (208 MVA) for non-contingency condition. This project contributes approximately 6.49 MW to the thermal violation.

13. (CE - CE) The AC1-168 TAP-MAZON ; R 138 kV line (from bus 926820 to bus 271987 ckt 1) loads from 135.74% to 137.03% (**DC power flow**) of its emergency rating (223 MVA) for the single line contingency outage of '138-L0112__B-S'. This project contributes approximately 6.4 MW to the thermal violation.

```
CONTINGENCY '138-L0112__B-S'
 TRIP BRANCH FROM BUS 271844 TO BUS 271908 CKT 1              / KICKA; B 138 LASCO; B 138
 END
```

14. (CE - CE) The AC1-168 TAP-MAZON ; R 138 kV line (from bus 926820 to bus 271987 ckt 1) loads from 113.97% to 115.36% (**DC power flow**) of its normal rating (173 MVA) for non-contingency condition. This project contributes approximately 5.32 MW to the thermal violation.

15. (CE - MISO AMIL) The AC1-171 TAP-4EDWARDS3 138 kV line (from bus 926840 to bus 349637 ckt 1) loads from 71.77% to 101.44% (**DC power flow**) of its emergency rating (143 MVA) for the single line contingency outage of 'KEWANEE ;13-4KEWANEE N'. This project contributes approximately 42.43 MW to the thermal violation.

```
CONTINGENCY 'KEWANEE ;13-4KEWANEE N'
 DISCONNECT BRANCH FROM BUS 271838 TO BUS 348923 CKT 1
 END
```

Light Load Analysis - 2020

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