*Generation Interconnection*
*Feasibility Study Report*

*For*

# *PJM Generation Interconnection Request Queue Position AC2-173*

# *Wempletown—Belvidere*

**July 2017**

## Network Impacts

The Queue Project AC2-173 was evaluated as a 100.0 MW (Capacity 67.6 MW) injection tapping the Wempletown – Belvidere 138 kV line in the ComEd area. Project AC2-173 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-173 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 - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 123.08% to 124.2% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.62 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

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

2. (CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 104.43% to 105.55% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_A'. This project contributes approximately 16.62 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_A'
 TRIP BRANCH FROM BUS 270678 TO BUS 923001 CKT 1              / BYRON ; B 345 AB1-089 TAP
 END
```

3. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 125.67% to 126.18% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.62 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1          / AB1-089 TAP WAYNE ; B 345
 END
```

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

4. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 109.3% to 109.8% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_A'. This project contributes approximately 16.62 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_A'
 TRIP BRANCH FROM BUS 270678 TO BUS 923001 CKT 1          / BYRON ; B 345 AB1-089 TAP
 END
```

5. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 105.2% to 105.68% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 12.81 MW to the thermal violation.

6. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.91% to 133.04% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 9.72 MW to the thermal violation.

```
CONTINGENCY '112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

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

7. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.9% to 133.03% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 9.72 MW to the thermal violation.

```
CONTINGENCY '112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
```

TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

**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 issued identified.

## Affected System Analysis & Mitigation

### MISO Impacts:

There are potential impacts in MISO's area; the impacts will be determined during later study phases.

**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 BYRON ; B-AB1-089 TAP 345 kV line (from bus 270678 to bus 923001 ckt 1) loads from 107.87% to 108.39% (**DC power flow**) of its emergency rating (2058 MVA) for the single line contingency outage of '345-L97116__-R'. This project contributes approximately 23.5 MW to the thermal violation.

CONTINGENCY '345-L97116__-R'
TRIP BRANCH FROM BUS 270759 TO BUS 270883 CKT 1 / U3-021 SILVE; R 345
END

2. (CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 146.59% to 147.34% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 24.58 MW to the thermal violation.

CONTINGENCY '345-L0626__B-R_B'

```
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

3. (CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 110.96% to 111.67% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 18.94 MW to the thermal violation.

4. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 151.1% to 151.85% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 24.58 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

5. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 126.87% to 127.58% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 18.94 MW to the thermal violation.

6. (CE - CE) The LEE CO EC;BP-NELSON ; B 345 kV line (from bus 274768 to bus 270828 ckt 1) loads from 132.18% to 133.89% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 25.33 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

7. (CE - CE) The AB1-089 TAP-WAYNE ; B 345 kV line (from bus 923001 to bus 270916 ckt 1) loads from 139.17% to 139.68% (**DC power flow**) of its emergency rating (2058 MVA) for the single line contingency outage of '345-L97116__-R'. This project contributes approximately 23.5 MW to the thermal violation.

```
CONTINGENCY '345-L97116__-R'
 TRIP BRANCH FROM BUS 270759 TO BUS 270883 CKT 1              / U3-021 SILVE; R 345
 END
```

8. (CE - CE) The AB1-089 TAP-WAYNE ; B 345 kV line (from bus 923001 to bus 270916 ckt 1) loads from 135.58% to 136.62% (**DC power flow**) of its normal rating (1679 MVA) for non-contingency condition. This project contributes approximately 17.6 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.

**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 - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 123.08% to 124.2% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.62 MW to the thermal violation.

> **ComEd 345 kV L15616 SSTE rating is 1568 MVA. The post contingency flow for this event exceeds the rating therefore an upgrade is required. The upgrades include a re-conductor of L15616 and L15616 station conductor upgrades at both station terminals.**
> **Upgrade relay package and current transformer BT 4-7 at Cherry Valley.**
> **Preliminary estimate is $45.2M with a construction time of 24-30 months.**
> **Upon completion of upgrade, the ratings will be 1448/1863/1975/2232 MVA, SN/SE/SSTE/SLD.**

2. (CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 104.43% to 105.55% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_A'. This project contributes approximately 16.62 MW to the thermal violation.

**ComEd 345kV L15616 SSTE rating is 1568 MVA. The post contingency flow for this event exceeds the rating therefore an upgrade is required. Upgrades include re-conductor of L15616 and L15616 station conductor upgrades at both station terminals. Preliminary estimate is $40M with a construction time of 24-30 months. Upon completion of upgrade, the ratings will be 1248/1441/1667/1982 MVA, SN/SE/SSTE/SLD.**

3. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 125.67% to 126.18% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.62 MW to the thermal violation.

**Same reinforcement as Contribution to Previously Identified #1**

4. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 109.3% to 109.8% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_A'. This project contributes approximately 16.62 MW to the thermal violation.

**Same reinforcement as Contribution to Previously Identified #2**

5. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 105.2% to 105.68% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 12.81 MW to the thermal violation.

**Same reinforcement as Contribution to Previously Identified #2**

6. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.91% to 133.04% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 9.72 MW to the thermal violation.

**ComEd:**

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

**AEP:**

**(1) A Sag Study will be required on the 40.71 mile section of line to mitigate the overload. Depending on the sag study results, cost for this upgrade is expected to be between $162,840 (no remediation required, just sag study) and $80.42 million (complete line re-conductor/rebuild required).**

**Estimated Time: Sag Study: 6 to 12 months. (2) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 36 to 48 months after signing an interconnection agreement.**

7. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.9% to 133.03% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 9.72 MW to the thermal violation.

**Same reinforcement as Contribution to Previously Identified #6**

# Appendices

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

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

# Appendix 1

(CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 123.08% to 124.2% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.62 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1            / AB1-089 TAP WAYNE ; B 345
 END
```

| *Bus Number* | *Bus Name* | *Full Contribution* |
|---|---|---|
| *931011* | *AC2-007 C* | *1.26* |
| *931881* | *AC2-115 1* | *5.1* |
| *931891* | *AC2-115 2* | *5.1* |
| *931921* | *AC2-116* | *1.78* |
| *932341* | *AC2-147 C* | *1.41* |
| *932351* | *AC2-148 C* | *0.99* |
| *932361* | *AC2-149 C* | *0.76* |
| *932371* | *AC2-150 C* | *0.99* |
| *932401* | *AC2-153 C* | *0.3* |
| *932511* | *AC2-166 C* | *1.49* |
| *932561* | *AC2-173 C OP* | *16.62* |
| *274656* | *BYRON ;1U* | *49.77* |
| *274657* | *BYRON ;2U* | *48.68* |
| *274856* | *ECOGROVE ;U1* | *0.74* |
| *998251* | *J485* | *2.38* |
| *998391* | *J504* | *2.55* |
| *998451* | *J523* | *2.54* |
| *998531* | *J531* | *10.55* |
| *961381* | *J606* | *16.28* |
| *961431* | *J614* | *3.49* |
| *961441* | *J615* | *3.57* |
| *274760* | *LEE CO EC;1U* | *2.36* |
| *274761* | *LEE CO EC;2U* | *2.35* |
| *274762* | *LEE CO EC;3U* | *2.35* |
| *274763* | *LEE CO EC;4U* | *2.34* |
| *274764* | *LEE CO EC;5U* | *2.36* |
| *274765* | *LEE CO EC;6U* | *2.37* |
| *274767* | *LEE CO EC;8U* | *2.32* |
| *290266* | *R-018* | *0.27* |
| *274822* | *ROCKFORD ;11* | *3.65* |
| *274824* | *ROCKFORD ;12* | *3.62* |
| *274823* | *ROCKFORD ;21* | *3.74* |
| *900371* | *V4-046* | *5.22* |
| *900381* | *V4-047* | *5.22* |
| *907361* | *X1-087* | *0.54* |

| | | |
|---|---|---|
| *701621* | *Y4-063* | *2.71* |
| *701641* | *Y4-065* | *125.37* |
| *702031* | *Y4-104* | *2.31* |
| *702041* | *Y4-105* | *2.07* |
| *LTF* | *Z1-112* | *7.12* |
| *LTF* | *AA1-071* | *4.74* |
| *921632* | *AA1-146* | *20.55* |
| *921682* | *AA2-030* | *20.55* |
| *923002* | *AB1-089 C* | *143.37* |
| *923012* | *AB1-090 C* | *143.37* |
| *930751* | *AB1-121* | *258.07* |
| *925161* | *AB2-173 C* | *3.67* |
| *925301* | *AB2-191 C* | *1.04* |
| *926421* | *AC1-113 1* | *2.55* |
| *926422* | *AC1-113 2* | *2.55* |
| *926431* | *AC1-114* | *5.1* |
| *926981* | *AC1-185 1* | *1.09* |
| *926982* | *AC1-185 2* | *1.09* |
| *926983* | *AC1-185 3* | *1.09* |
| *926984* | *AC1-185 4* | *1.09* |
| *926985* | *AC1-185 5* | *1.09* |
| *926986* | *AC1-185 6* | *1.09* |
| *926987* | *AC1-185 7* | *1.09* |
| *926988* | *AC1-185 8* | *1.09* |

# Appendix 2

(CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 125.67% to 126.18% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.62 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

| *Bus Number* | *Bus Name* | *Full Contribution* |
|---|---|---|
| *931011* | *AC2-007 C* | *1.26* |
| *931881* | *AC2-115  1* | *5.1* |
| *931891* | *AC2-115  2* | *5.1* |
| *931921* | *AC2-116* | *1.78* |
| *932341* | *AC2-147 C* | *1.41* |
| *932351* | *AC2-148 C* | *0.99* |
| *932361* | *AC2-149 C* | *0.76* |
| *932371* | *AC2-150 C* | *0.99* |
| *932401* | *AC2-153 C* | *0.3* |
| *932511* | *AC2-166 C* | *1.49* |
| *932561* | *AC2-173 C OP* | *16.62* |
| *998251* | *J485* | *2.38* |
| *998391* | *J504* | *2.55* |
| *998451* | *J523* | *2.54* |
| *998531* | *J531* | *10.55* |
| *961381* | *J606* | *16.28* |
| *961431* | *J614* | *3.49* |
| *961441* | *J615* | *3.57* |
| *274830* | *PWR VTREC;1U* | *25.2* |
| *274831* | *PWR VTREC;2U* | *25.2* |
| *900371* | *V4-046* | *5.22* |
| *900381* | *V4-047* | *5.22* |
| *701621* | *Y4-063* | *2.71* |
| *701641* | *Y4-065* | *125.37* |
| *702031* | *Y4-104* | *2.31* |
| *702041* | *Y4-105* | *2.07* |
| *LTF* | *Z1-112* | *7.12* |
| *LTF* | *AA1-071* | *4.74* |
| *921632* | *AA1-146* | *20.55* |
| *921682* | *AA2-030* | *20.55* |
| *923002* | *AB1-089 C* | *143.37* |
| *923012* | *AB1-090 C* | *143.37* |
| *930751* | *AB1-121* | *258.07* |
| *924471* | *AB2-096* | *174.97* |
| *925161* | *AB2-173 C* | *3.67* |

| | | |
|---|---|---|
| *925301* | *AB2-191 C* | *1.04* |
| *926421* | *AC1-113 1* | *2.55* |
| *926422* | *AC1-113 2* | *2.55* |
| *926431* | *AC1-114* | *5.1* |
| *926981* | *AC1-185 1* | *1.09* |
| *926982* | *AC1-185 2* | *1.09* |
| *926983* | *AC1-185 3* | *1.09* |
| *926984* | *AC1-185 4* | *1.09* |
| *926985* | *AC1-185 5* | *1.09* |
| *926986* | *AC1-185 6* | *1.09* |
| *926987* | *AC1-185 7* | *1.09* |
| *926988* | *AC1-185 8* | *1.09* |

# Appendix 3

(CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.91% to 133.04% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 9.72 MW to the thermal violation.

```
CONTINGENCY '112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

| *Bus Number* | *Bus Name* | *Full Contribution* |
|---|---|---|
| *931011* | *AC2-007 C* | *0.7* |
| *931012* | *AC2-007 E* | *1.29* |
| *931881* | *AC2-115  1* | *1.96* |
| *931891* | *AC2-115  2* | *1.96* |
| *931921* | *AC2-116* | *0.68* |
| *931931* | *AC2-117* | *10.58* |
| *932341* | *AC2-147 C* | *< 0.01* |
| *932342* | *AC2-147 E* | *< 0.01* |
| *932361* | *AC2-149 C* | *0.77* |
| *932362* | *AC2-149 E* | *1.25* |
| *932381* | *AC2-151 C* | *0.82* |
| *932382* | *AC2-151 E* | *1.34* |
| *932401* | *AC2-153 C* | *0.38* |
| *932402* | *AC2-153 E* | *0.63* |
| *932411* | *AC2-154 C* | *2.15* |
| *932412* | *AC2-154 E* | *3.5* |
| *932431* | *AC2-156 C OP* | *0.79* |
| *932432* | *AC2-156 E OP* | *1.29* |
| *932511* | *AC2-166 C* | *1.92* |
| *932512* | *AC2-166 E* | *3.14* |
| *932561* | *AC2-173 C OP* | *6.57* |
| *932562* | *AC2-173 E OP* | *3.15* |
| *290051* | *GSG-6; E* | *8.57* |
| *998401* | *J505* | *6.14* |
| *961281* | *J592* | *2.84* |
| *961381* | *J606* | *9.05* |
| *275149* | *KEMPTON  ;1E* | *15.82* |
| *290108* | *LEEDK;1U E* | *19.97* |
| *274850* | *MENDOTA H;RU* | *4.93* |
| *275148* | *MILKS GRV;1E* | *15.82* |
| *293061* | *N-015 E* | *13.2* |
| *293644* | *O22 E1* | *7.98* |
| *293645* | *O22 E2* | *15.5* |

| | | |
|---|---|---|
| *290021* | *O50 E* | *15.88* |
| *294392* | *P-010 E* | *16.76* |
| *294763* | *P-046 E* | *7.69* |
| *274830* | *PWR VTREC;1U* | *5.03* |
| *274831* | *PWR VTREC;2U* | *5.03* |
| *274722* | *S-055 E* | *9.32* |
| *884780* | *S-058 C* | *41.82* |
| *884781* | *S-058 E* | *125.45* |
| *295111* | *SUBLETTE E* | *2.23* |
| *291984* | *U4-033* | *1.35* |
| *274802* | *UNIV PARK;5U* | *1.26* |
| *274803* | *UNIV PARK;6U* | *1.26* |
| *274814* | *UNIV PK N;0U* | *0.99* |
| *274805* | *UNIV PK N;1U* | *0.99* |
| *274806* | *UNIV PK N;2U* | *0.99* |
| *274807* | *UNIV PK N;3U* | *0.99* |
| *274808* | *UNIV PK N;4U* | *0.99* |
| *274809* | *UNIV PK N;5U* | *0.99* |
| *274810* | *UNIV PK N;6U* | *0.99* |
| *274811* | *UNIV PK N;7U* | *0.99* |
| *274812* | *UNIV PK N;8U* | *0.99* |
| *274813* | *UNIV PK N;9U* | *0.99* |
| *274815* | *UNIV PK N;XU* | *0.99* |
| *274816* | *UNIV PK N;YU* | *0.99* |
| *900371* | *V4-046* | *1.94* |
| *900381* | *V4-047* | *1.94* |
| *295109* | *WESTBROOK E* | *4.59* |
| *274687* | *WILL CNTY;4U* | *54.02* |
| *910542* | *X3-005 E* | *0.53* |
| *920462* | *Y2-103* | *37.27* |
| *920472* | *Y3-013 1* | *3.11* |
| *920482* | *Y3-013 2* | *3.11* |
| *920492* | *Y3-013 3* | *3.11* |
| *701621* | *Y4-063* | *1.31* |
| *701641* | *Y4-065* | *44.55* |
| *701682* | *Y4-069 E* | *5.5* |
| *LTF* | *Z1-043* | *23.31* |
| *916502* | *Z1-106 E1* | *1.05* |
| *916504* | *Z1-106 E2* | *1.05* |
| *916512* | *Z1-107 E* | *2.26* |
| *916522* | *Z1-108 E* | *2.06* |
| *LTF* | *Z1-112* | *7.59* |
| *916651* | *Z1-127 1* | *1.43* |
| *916652* | *Z1-127 2* | *0.97* |
| *920782* | *Z2-081* | *1.35* |

| | | |
|---|---|---|
| *920932* | *AA1-018 C* | *2.18* |
| *920933* | *AA1-018 E* | *14.62* |
| *921012* | *AA1-040 1* | *1.07* |
| *921022* | *AA1-040 2* | *1.07* |
| *LTF* | *AA1-071* | *5.06* |
| *921222* | *AA1-078* | *4.6* |
| *918972* | *AA1-116 E* | *2.26* |
| *918982* | *AA1-117 E* | *2.26* |
| *921692* | *AA2-035* | *107.64* |
| *922053* | *AA2-107 E* | *2.02* |
| *922183* | *AA2-123 E* | *2.02* |
| *923002* | *AB1-089 C* | *55.32* |
| *923012* | *AB1-090 C* | *55.32* |
| *923022* | *AB1-091 C OP* | *61.17* |
| *930751* | *AB1-121* | *96.09* |
| *930752* | *AB1-121 E* | *91.14* |
| *930761* | *AB1-122 1* | *60.85* |
| *930762* | *AB1-122 2* | *58.84* |
| *923562* | *AB1-172* | *0.7* |
| *LTF* | *AB2-013* | *12.98* |
| *924471* | *AB2-096* | *34.92* |
| *925301* | *AB2-191 C* | *1.04* |
| *925302* | *AB2-191 E* | *0.92* |
| *925891* | *AC1-067 C2* | *23.13* |
| *925901* | *AC1-067 C3* | *30.9* |
| *925911* | *AC1-067 C4* | *23.13* |
| *925881* | *AC1-067 C1* | *30.9* |
| *926311* | *AC1-109* | *1.58* |
| *926321* | *AC1-109 2* | *1.58* |
| *926331* | *AC1-110* | *1.57* |
| *926341* | *AC1-110 2* | *1.57* |
| *926351* | *AC1-111* | *0.63* |
| *926361* | *AC1-111 2* | *0.63* |
| *926371* | *AC1-111 3* | *0.63* |
| *926381* | *AC1-111 4* | *0.63* |
| *926391* | *AC1-111 5* | *0.63* |
| *926401* | *AC1-111 6* | *0.63* |
| *926421* | *AC1-113 1* | *0.98* |
| *926422* | *AC1-113 2* | *0.98* |
| *926431* | *AC1-114* | *1.96* |
| *926601* | *AC1-142A* | *3.52* |
| *926602* | *AC1-142A 2* | *3.52* |
| *926701* | *AC1-153 C* | *63.96* |
| *926711* | *AC1-153 C2* | *66.14* |
| *926702* | *AC1-153 E* | *2.56* |

| | | |
|---|---|---|
| *926712* | *AC1-153 E2* | *2.65* |
| *926821* | *AC1-168 C OP* | *0.98* |
| *926822* | *AC1-168 E OP* | *6.6* |
| *927091* | *AC1-204* | *60.22* |
| *927092* | *AC1-204 2* | *60.26* |

**Network Impacts**

The Queue Project AC2-173 was evaluated as a 100.0 MW (Capacity 67.6 MW) injection at the Wempletown 138 kV substation in the ComEd area. Project AC2-173 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-173 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 - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 123.09% to 124.22% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.61 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

2. (CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 104.45% to 105.57% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_A'. This project contributes approximately 16.61 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_A'
 TRIP BRANCH FROM BUS 270678 TO BUS 923001 CKT 1              / BYRON ; B 345 AB1-089 TAP
 END
```

3. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 125.69% to 126.19% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 16.61 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

4. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 109.3% to 109.81% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_A'. This project contributes approximately 16.61 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_A'
 TRIP BRANCH FROM BUS 270678 TO BUS 923001 CKT 1              / BYRON ; B 345 AB1-089 TAP
 END
```

5. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 105.21% to 105.69% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 12.8 MW to the thermal violation.

6. (CE - CE) The LEE CO EC;BP-NELSON ; B 345 kV line (from bus 274768 to bus 270828 ckt 1) loads from 100.83% to 101.99% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 17.13 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

7. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.92% to 133.05% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 9.72 MW to the thermal violation.

```
CONTINGENCY '112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1              / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1              / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1              / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1              / WILTO;4M 345 WILTO;4C 33
 END
```

8. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 132.91% to 133.04% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 9.72 MW to the thermal violation.

```
CONTINGENCY '112-65-BT3-4__'
```

```
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1        / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1        / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1        / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1        / WILTO;3M 345 WILTO;3C 33
END
```

**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 BYRON ; B-AB1-089 TAP 345 kV line (from bus 270678 to bus 923001 ckt 1) loads from 107.88% to 108.4% (**DC power flow**) of its emergency rating (2058 MVA) for the single line contingency outage of '345-L97116__-R'. This project contributes approximately 23.51 MW to the thermal violation.

```
CONTINGENCY '345-L97116__-R'
 TRIP BRANCH FROM BUS 270759 TO BUS 270883 CKT 1        / U3-021 SILVE; R 345
 END
```

2. (CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 146.6% to 147.35% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 24.58 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
```

```
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

3. (CE - CE) The CHERRY VA; B-GARDEN PR; R 345 kV line (from bus 270694 to bus 270759 ckt 1) loads from 110.97% to 111.68% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 18.94 MW to the thermal violation.

4. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 151.11% to 151.86% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 24.58 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

5. (CE - CE) The GARDEN PR; R-SILVER LK; R 345 kV line (from bus 270759 to bus 270883 ckt 1) loads from 126.89% to 127.6% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 18.94 MW to the thermal violation.

6. (CE - CE) The LEE CO EC;BP-NELSON ; B 345 kV line (from bus 274768 to bus 270828 ckt 1) loads from 132.17% to 133.88% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of '345-L0626__B-R_B'. This project contributes approximately 25.33 MW to the thermal violation.

```
CONTINGENCY '345-L0626__B-R_B'
 TRIP BRANCH FROM BUS 923001 TO BUS 270916 CKT 1              / AB1-089 TAP WAYNE ; B 345
 END
```

7. (CE - CE) The AB1-089 TAP-WAYNE ; B 345 kV line (from bus 923001 to bus 270916 ckt 1) loads from 139.18% to 139.69% (**DC power flow**) of its emergency rating (2058 MVA) for the single line contingency outage of '345-L97116__-R'. This project contributes approximately 23.51 MW to the thermal violation.

```
CONTINGENCY '345-L97116__-R'
 TRIP BRANCH FROM BUS 270759 TO BUS 270883 CKT 1              / U3-021 SILVE; R 345
 END
```

8. (CE - CE) The AB1-089 TAP-WAYNE ; B 345 kV line (from bus 923001 to bus 270916 ckt 1) loads from 135.59% to 136.63% (**DC power flow**) of its normal rating (1679 MVA) for non-contingency condition. This project contributes approximately 17.61 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.

**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)*

None