Queue X4-030 Fremont 69kV
Generation Interconnection

This analysis was completed to assess the reliability impact for the new generation interconnecting to the PJM System as a capacity resource.

Interconnection Option #1

Network Impacts

The Queue Project #X4-030 was studied as a(n) 13.8MW(Capacity 5.2MW) injection as a tap into Fremont-Clyde 69kV station in the AEP area. Project #X4-030 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Generator Deliverability

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

No Problems Identified.

Multiple Facility Contingency

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

1. The West Fremont-Ottawa 138 kV line (from bus 239154 to bus 239030 ckt 1) loads from 99.03% to 100.52% (AC power flow) of its emergency rating (289 MVA) for the tower line contingency outage of CONTINGENCY DESCRIPTION ('C5-TWL-WR010'). This project contributes approximately 4.19 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-WR010'                          /* LEMO K-W.FREM/LEMOYNE-W.END 138
  DISCONNECT BUS 239176                             /* 02WOOD+ 138.00
  DISCONNECT BUS 239177                             /* 02WOODVI 138.00
  DISCONNECT BRANCH FROM BUS 238884 TO BUS 239154 CKT 1     /* 02LEMO K 138.00 02W.FREM 138.00
  END
```

Short Circuit

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

No Problems Identified.

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. The Kelsey Hayes-Ottawa 138 kV line (from bus 238871 to bus 239030 ckt 1) loads from 104.75% to 106.12% (AC power flow) of its emergency rating (289 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR145'). This project contributes approximately 3.92 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-WR145'                          /* OTTAWA B4 BREAKER
  DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1        /* 02OTTAWA 138.00 02W.FREM 138.00
  DISCONNECT BRANCH FROM BUS 239030 TO BUS 238658 CKT 1        /* 02OTTAWA 138.00 02DECANT 138.00
  END
```

2. The Kelsey Hayes-Ottawa 138 kV line (from bus 238871 to bus 239030 ckt 1) loads from 104.96% to 106.34% (AC power flow) of its emergency rating (289 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR142'). This project contributes approximately 3.95 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-WR142'                          /* OTTAWA B1 BREAKER
  DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1        /* 02OTTAWA 138.00 02W.FREM 138.00
  DISCONNECT BUS 239140                             /* 02TOUSNT 138.00
  END
```

3. The West Fremont-Kelsey Hayes 138 kV line (from bus 239154 to bus 238871 ckt 1) loads from 105.41% to 106.78% (AC power flow) of its emergency rating (289 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR145'). This project contributes approximately 3.92 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-WR145'                          /* OTTAWA B4 BREAKER
  DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1        /* 02OTTAWA 138.00 02W.FREM 138.00
  DISCONNECT BRANCH FROM BUS 239030 TO BUS 238658 CKT 1        /* 02OTTAWA 138.00 02DECANT 138.00
  END
```

4. The West Fremont-Kelsey Hayes 138 kV line (from bus 239154 to bus 238871 ckt 1) loads from 105.62% to 107% (AC power flow) of its emergency rating (289 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR142'). This project contributes approximately 3.95 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-WR142'                          /* OTTAWA B1 BREAKER
  DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1        /* 02OTTAWA 138.00 02W.FREM 138.00
  DISCONNECT BUS 239140                             /* 02TOUSNT 138.00
  END
```

5. The West Fremont-Ottawa 138 kV line (from bus 239154 to bus 239030 ckt 1) loads from 108.73% to 110.24% (AC power flow) of its emergency rating (289 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR147'). This project contributes approximately 4.28 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-WR147'                          /* OTTAWA B6 BREAKER
 DISCONNECT BRANCH FROM BUS 239030 TO BUS 240954 CKT 1      /* 02OTTAWA 138.00 02OTTAWA 69.00
 DISCONNECT BUS 238871                              /* 02KY-HS 138.00
 END
```

6. The West Fremont-Ottawa 138 kV line (from bus 239154 to bus 239030 ckt 1) loads from 111.09% to 112.48% (AC power flow) of its emergency rating (289 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR146'). This project contributes approximately 3.96 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-WR146'                          /* OTTAWA B5 BREAKER
 DISCONNECT BUS 238871                              /* 02KY-HS 138.00
 DISCONNECT BRANCH FROM BUS 239030 TO BUS 238658 CKT 1      /* 02OTTAWA 138.00 02DECANT 138.00
 END
```

7. The Kelsey Hayes-Ottawa 138 kV line (from bus 238871 to bus 239030 ckt 1) loads from 114.53% to 116.02% (AC power flow) of its emergency rating (289 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR136'). This project contributes approximately 4.26 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-WR136'                          /* WEST FREMONT B5 BREAKER
 DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1      /* 02OTTAWA 138.00 02W.FREM 138.00
 DISCONNECT BRANCH FROM BUS 239155 TO BUS 239154 CKT 2      /* 02W.FREM 69.00 02W.FREM 138.00
 DISCONNECT BUS 239155                              /* 02W.FREM 69.00
 DISCONNECT BUS 240865                              /* GRNSPR 69.00
 DISCONNECT BUS 240851                              /* CLYDE 69.00
 END
```

8. The Melmore Tap-V1-010 Tap 138 kV line (from bus 243039 to bus 892000 ckt 1) loads from 123.89% to 124.88% (AC power flow) of its emergency rating (167 MVA) for the tower line contingency outage of CONTINGENCY DESCRIPTION ('C5-TWL-WR022'). This project contributes approximately 1.67 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-WR022'                          /* WEST FREMONT-OTTAWA & W.FREMONT-KH-OTTAWA
 DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1      /* 02OTTAWA 138.00 02W.FREM 138.00
 DISCONNECT BUS 238871                              /* 02KY-HS 138.00
 END
```

9. The Tiffin-Greenlawn 138 kV line (from bus 243130 to bus 243015 ckt 1) loads from 159.66% to 162.21% (AC power flow) of its emergency rating (143 MVA) for the tower

line contingency outage of CONTINGENCY DESCRIPTION ('C5-TWL-WR022'). This project contributes approximately 3.59 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-WR022'                          /* WEST FREMONT-OTTAWA & W.FREMONT-KH-OTTAWA
 DISCONNECT BRANCH FROM BUS 239030 TO BUS 239154 CKT 1      /* 02OTTAWA 138.00 02W.FREM 138.00
 DISCONNECT BUS 238871                              /* 02KY-HS 138.00
 END
```

10. The Lakeview-Greenfield 138 kV line (from bus 238874 to bus 238768 ckt 1) loads from 216.1% to 217.26% (AC power flow) of its emergency rating (243 MVA) for the tower line contingency outage of CONTINGENCY DESCRIPTION ('C5-TWL-CR040'). This project contributes approximately 2.84 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-CR040'                          /* DAVIS BESSE-BEAVER + DAVIS BESSE-HAYES 345KV
 DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1      /* 02DAV-BE 345.00 02HAYES 345.00
 DISCONNECT BRANCH FROM BUS 238654 TO BUS 238569 CKT 1      /* 02DAV-BE 345.00 02BEAVER 345.00
 END
```

Steady-State Voltage Requirements

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

To be determined

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined.

Interconnection Option #2

Network Impacts

The Queue Project #X4-030 was studied as a(n) 13.8MW(Capacity 5.2MW) injection as a tap into Castalia 12.47kV station in the FirstEnergy territory. Project #X4-030 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Normal System (2015 Summer Conditions Capacity Level)

- No problems identified

Single Contingency (2015 Summer Conditions Capacity Level)

- No problems identified

Multiple Contingency (2015 Summer Conditions Capacity Level)

- No problems identified

Contribution to Previously Identified Overloads (2015 Summer Conditions Capacity Level)

- None

Normal System (2015 Summer Conditions Full Output)

- No problems identified

Single Contingency (2015 Summer Conditions Full Output)

- No problems identified

Multiple Contingency (2015 Summer Conditions Full Output)

- No problems identified

Contribution to Previously Identified Overloads (2015 Summer Conditions Full Output)

- None

Short Circuit Analysis

- No problems identified

Stability Analysis

- Not required

Additional Limitations of Concern

- None

Local/Network Upgrades

- None