#X2-021 – Erie East – South Ripley 230kV
Generation Interconnection

Option 1:

The X2-021 project was studied as a 153.75MW (19.98MW Capacity) tap of the Erie East – South Ripley 230kV line.

Revenue Metering and SCADA Requirements

For PJM: The Interconnection Customer will install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for Interconnection Customer's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 24.1 to 24.2.

For Penelec: The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:
www.firstenergycorp.com/feconnect
www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Network Impacts

The X2-021 project was studied as a 153.75MW (19.98MW Capacity) injection into the Penelec area tapping the Erie East S RIPLEY 230kV line. Project X2-021 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 violations were identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

No violations were identified.

Short Circuit
(Summary of impacted circuit breakers)

PJM has completed the short circuit analysis of the X2-021 queue project Erie East 230 kV. Two options were considered during this study: the first option was a tap between Erie East and South Ripley 230 kV line. Our analysis found no new breakers to be over-duty in the PENELEC transmission area.

Contribution to Previously Identified Overloads
(X2-021 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

No violations were identified.

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

Not required.

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contributions to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study.)

Not required.

Potential Issues

NYISO is a potentially affected RTO. PJM did not find any overloads that required upgrades for mitigation. However, it will be reevaluated during the System Impact Study.

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

1. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 179.86% to 180.38% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 17.38 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'     /* LEWISTOWN 230/115KV BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

2. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 176.79% to 177.3% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 15.60 MW to the thermal violation.

3. (PENELEC) The Erie East-W3-099 TAP 230 kV line (from bus 200654 to bus 903980 ckt 1) loads from 78.88% to 101.71% (DC power flow) of its emergency rating (554 MVA) for the operational contingency 'PL100328'. This project contributes approximately 126.45 MW to the thermal violation.

```
CONTINGENCY 'PL100328'     /* LACKAWANNA 230KV EAST BUS & LACK T2
  DISCONNECT BRANCH FROM BUS 211681 TO BUS 208009 CKT 2
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
  DISCONNECT BUS 200708
END
```

4. (AP) The Karthus-U2-055 TAP 230 kV line (from bus 235853 to bus 889060 ckt 1) loads from 99.94% to 100.2% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 9.69 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#61'     /* SHAWVILLE - SHINGLETOWN (SHS) 230 KV - (PJM-PN26)
  DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1
END
```

5. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 128.25% to 128.55% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'KEYSTONE_JACKMTN1_1'. This project contributes approximately 11.78 MW to the thermal violation.

```
CONTINGENCY 'KEYSTONE_JACKMTN1_1'     /* 500/500KV, AREA 225/225.
  DISCONNECT BRANCH FROM BUS 200011 TO BUS 200071 CKT 1
END
```

6. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 138.30% to 138.67% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 11.37 MW to the thermal violation.

7. (PENELEC) The Homer City-Shelocta 230 kV line (from bus 200767 to bus 200795 ckt 1) loads from 116.85% to 117.36% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 28.94 MW to the thermal violation.

```
CONTINGENCY 'CONEM-GH_CONEMGH230'
  DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 1        /* 500/230KV, AREA/AREA
225/226.
END
```

8. (PENELEC/AP) The Shawville 2-Shingletown 230 kV line (from bus 200726 to bus 235248 ckt 1) loads from 114.70% to 115.0% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'APS_B_G297_U2-055A'. This project contributes approximately 9.43 MW to the thermal violation.

```
CONTINGENCY 'APS_B_G297_U2-055A'     / 235219 01MILESB 230 235853 01KARTHS 230 1
  OPEN BRANCH FROM BUS 235219 TO BUS 889060 CKT 1
END
```

9. (FE) The Ashtabula No. 8 Tr 345/-Ashtabula Bus 3 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 108.45% to 118.12% (DC power flow) of its emergency rating (370 MVA) for the operational contingency 'DQE_161'. This project contributes approximately 35.78 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'     /* "LINE 02AT TO 02PERRY 345 CK 1"
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

10. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 195.97% to 196.56% (DC power flow) of its emergency rating (608 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 22.23 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'    /* LEWISTOWN 230/115KV BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

11. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 214.08% to 218.32% (DC power flow) of its normal rating (478 MVA) for non contingency condition. This project contributes approximately 20.26 MW to the thermal violation.

12. (PENELEC) The Homer City-Homer City 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 94.32% to 98.9% (DC power flow) of its emergency rating (824 MVA) for the operational contingency 'B_PN345-XF-#113'. This project contributes approximately 37.78 MW to the thermal violation.

```
CONTINGENCY 'B_PN345-XF-#113'       /* HOMER CITY 345/230 KV NORTH AUTO-TRANSFORMER - (PJM-PN30)
  DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
END
```

13. (PENELEC) The X2-021 TAP-Erie East 230 kV line (from bus 909170 to bus 200654 ckt 1) loads from 78.08% to 103.86% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 125.82 MW to the thermal violation.

14. (PENELEC) The R-092 TAP-Rockton Mountain 115 kV line (from bus 883550 to bus 200713 ckt 1) loads from 154.46% to 155.5% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 7.66 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#15'    /* ELKO - FOREST (FE) 230 KV - (PJM-PN09)
  DISCONNECT BRANCH FROM BUS 200581 TO BUS 235175 CKT 1
END
```

15. (AP) The Milesburg-Dale Summit 230 kV line (from bus 235219 to bus 235970 ckt 1) loads from 103.12% to 103.4% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 8.99 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#61'    /* SHAWVILLE - SHINGLETOWN (SHS) 230 KV - (PJM-PN26)
  DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1
END
```

16. (PENELEC/PJM) The CONEMGH230-Conemaugh 230/500 kV transformer (from bus 200912 to bus 200005 ckt 1) loads from 99.22% to 99.66% (DC power flow) of its emergency rating (960 MVA) for the operational contingency 'B_PN230-SX-#40'. This project contributes approximately 27.11 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#40'      /* HOMER CITY-SHELOCTA-KEYSTONE & SHELOCTA 2 XF -
(PJM-PN41)
  DISCONNECT BRANCH FROM BUS 200767 TO BUS 200795 CKT 1
  DISCONNECT BRANCH FROM BUS 200795 TO BUS 200810 CKT 1
  DISCONNECT BRANCH FROM BUS 200795 TO BUS 200739 CKT 1
  DISCONNECT BUS 200795
END
```

17. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 193.79% to 194.38% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 22.62 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'    /* LEWISTOWN 230/115KV BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

18. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 209.36% to 213.58% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 20.62 MW to the thermal violation.

19. (AP) The U2-055 TAP-Milesburg 230 kV line (from bus 889060 to bus 235219 ckt 1) loads from 106.85% to 107.11% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 9.69 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#61'    /* SHAWVILLE - SHINGLETOWN (SHS) 230 KV - (PJM-PN26)
  DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1
END
```

20. (NYISO/PENELEC) The FALCONER-Warren 115 kV line (from bus 135277 to bus 200579 ckt 1) loads from 113.57% to 138.37% (DC power flow) of its emergency rating (118 MVA) for the operational contingency 'B_PN230-SX-#17_W3-099A'. This project contributes approximately 29.26 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#17_W3-099A'    /* ERIE EAST - ERIE SOUTH (ESEE) 230 KV
  DISCONNECT BRANCH FROM BUS 200819 TO BUS 903980 CKT 1
END
```

21. (PENELEC) The Homer City-Homer City 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 96.96% to 101.66% (DC power flow) of its emergency rating (807 MVA) for the operational contingency 'B_PN345-XF-#114'. This project contributes approximately 37.97 MW to the thermal violation.

```
CONTINGENCY 'B_PN345-XF-#114'       /* HOMER CITY 345/230 KV SOUTH AUTO-TRANSFORMER -
(PJM-PN31)
  DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 2
END
```

22. (PENELEC) The Rockton Mountain-Shawville 1 115 kV line (from bus 200713 to bus 200714 ckt 1) loads from 154.27% to 155.31% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 7.66 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#15'    /* ELKO - FOREST (FE) 230 KV - (PJM-PN09)
  DISCONNECT BRANCH FROM BUS 200581 TO BUS 235175 CKT 1
END
```

23. (PENELEC) The Lewis Run-Farmers Valley 115 kV line (from bus 200667 to bus 200668 ckt 1) loads from 108.20% to 109.09% (DC power flow) of its emergency rating (149 MVA) for the operational contingency 'B_PN230-SX-#25'. This project contributes approximately 8.25 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#25'    /* FOREST - GLADE 230 KV
  DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1
END
```

24. (PENELEC) The Shelocta-Keystone 230 kV line (from bus 200795 to bus 200810 ckt 1) loads from 108.99% to 109.53% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 29.59 MW to the thermal violation.

```
CONTINGENCY 'CONEM-GH_CONEMGH230'
  DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 1       /* 500/230KV, AREA/AREA
225/226.
END
```

25. (NYISO/PENELEC) The N.WAV115-East Sayre 115 kV line (from bus 130836 to bus 200676 ckt 1) loads from 124.97% to 125.98% (DC power flow) of its emergency rating (128 MVA) for the operational contingency 'B_PN230-SX-#8'. This project contributes approximately 8.00 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#8'     /* EAST TOWANDA - HILLSIDE (ETH) 230 KV
  DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1
END
```

26. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 133.52% to 133.97% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 14.27 MW to the thermal violation.

```
CONTINGENCY 'PL100328'     /* LACKAWANNA 230KV EAST BUS & LACK T2
  DISCONNECT BRANCH FROM BUS 211681 TO BUS 208009 CKT 2
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
  DISCONNECT BUS 200708
END
```

27. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 136.94% to 137.38% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 11.70 MW to the thermal violation.

28. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 123.68% to 124.14% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 14.27 MW to the thermal violation.

```
CONTINGENCY 'PL100328'     /* LACKAWANNA 230KV EAST BUS & LACK T2
  DISCONNECT BRANCH FROM BUS 211681 TO BUS 208009 CKT 2
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
  DISCONNECT BUS 200708
END
```

29. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 125.41% to 125.85% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 11.70 MW to the thermal violation.

30. (PENELEC) The W3-099 TAP-Erie South East Bus 230 kV line (from bus 903980 to bus 200819 ckt 1) loads from 121.50% to 143.63% (DC power flow) of its emergency rating (554 MVA) for the operational contingency 'B_PN345-SX-#6'. This project contributes approximately 122.61 MW to the thermal violation.

```
CONTINGENCY 'B_PN345-SX-#6'     /* HANDSOME LAKE - WAYNE (WHL) 345 KV - (PJM-PN33A)
  DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END
```

31. (PENELEC) The W3-099 TAP-Erie South East Bus 230 kV line (from bus 903980 to bus 200819 ckt 1) loads from 121.57% to 147.35% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 125.82 MW to the thermal violation.

32. (PENELEC) The Erie South East Bus-Erie South East Bus 230/115 kV transformer (from bus 200819 to bus 200820 ckt 1) loads from 108.96% to 117.6% (DC power flow) of its emergency rating (305 MVA) for the operational contingency 'B_PN230-SX-#22'. This project contributes approximately 26.35 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#22'     /* ERIE SOUTH 230/115 KV BANK 6 FAULT
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200811 CKT 1
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200819 CKT 1
  REDUCE BUS 200568 SHUNT BY 100 PERCENT
  DISCONNECT BUS 200568
END
```

33. (PENELEC) The East Towanda-X1-109 TAP 230 kV line (from bus 200675 to bus 907910 ckt 1) loads from 106.91% to 107.42% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 17.38 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'     /* LEWISTOWN 230/115KV BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

34. (PENELEC) The East Towanda-X1-109 TAP 230 kV line (from bus 200675 to bus 907910 ckt 1) loads from 97.00% to 97.51% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 15.60 MW to the thermal violation.

Option 2:

The X2-021 project was studied as a 153.75MW (19.98MW Capacity) injection at the ERIE E 230kV substation.

Revenue Metering and SCADA Requirements

For PJM: The Interconnection Customer will install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for Interconnection Customer's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 24.1 to 24.2.

For Penelec: The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "FirstEnergy Requirements for Transmission Connected Facilities" document located at the following links:
www.firstenergycorp.com/feconnect
www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Network Impacts

The X2-021 project was studied as a 153.75MW (19.98MW Capacity) injection into the Penelec area at the W3-099 TAP 230kV substation. Project X2-021 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 violations were identified.

Multiple Facility Contingency
(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

No violations were identified.

Short Circuit
(Summary of impacted circuit breakers)

PJM has completed the short circuit analysis of the X2-021 queue project Erie East 230 kV. One option was considered during this study: the second option was a direct connection to Erie East 230 kV substation. No new breakers were found to be over-duty in the PENELEC transmission area.

Contribution to Previously Identified Overloads
(X2-021 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

No violations were identified.

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

Not required.

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contributions to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study.)

Not required.

Potential Issues

NYISO is a potentially affected RTO. PJM did not find any overloads that required upgrades for mitigation. However, it will be reevaluated during the System Impact Study.

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

1. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 179.91% to 180.35% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 15.08 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'     /* LEWISTOWN 230/115KV BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

2. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 176.84% to 177.29% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 13.51 MW to the thermal violation.

3. (PENELEC) The Erie East-W3-099 TAP 230 kV line (from bus 200654 to bus 903980 ckt 1) loads from 105.60% to 125.6% (DC power flow) of its emergency rating (554 MVA) for the operational contingency 'B_PN345-SX-#6'. This project contributes approximately 110.76 MW to the thermal violation.

```
CONTINGENCY 'B_PN345-SX-#6'     /* HANDSOME LAKE - WAYNE (WHL) 345 KV - (PJM-PN33A)
  DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END
```

4. (PENELEC) The Erie East-W3-099 TAP 230 kV line (from bus 200654 to bus 903980 ckt 1) loads from 102.99% to 126.29% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 113.69 MW to the thermal violation.

5. (AP) The Karthus-U2-055 TAP 230 kV line (from bus 235853 to bus 889060 ckt 1) loads from 99.94% to 100.17% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 8.55 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#61'     /* SHAWVILLE - SHINGLETOWN (SHS) 230 KV - (PJM-PN26)
  DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1
END
```

6. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 128.25% to 128.53% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'KEYSTONE_JACKMTN1_1'. This project contributes approximately 10.41 MW to the thermal violation.

```
CONTINGENCY 'KEYSTONE_JACKMTN1_1'     /* 500/500KV, AREA 225/225.
  DISCONNECT BRANCH FROM BUS 200011 TO BUS 200071 CKT 1
END
```

7. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 138.30% to 138.63% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 10.04 MW to the thermal violation.

8. (PENELEC) The Homer City-Shelocta 230 kV line (from bus 200767 to bus 200795 ckt 1) loads from 116.86% to 117.31% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 25.32 MW to the thermal violation.

```
CONTINGENCY 'CONEM-GH_CONEMGH230'
 DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 1       /* 500/230KV, AREA/AREA 225/226.
END
```

9. (PENELEC/AP) The Shawville 2-Shingletown 230 kV line (from bus 200726 to bus 235248 ckt 1) loads from 114.70% to 114.96% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'APS_B_G297_U2-055A'. This project contributes approximately 8.33 MW to the thermal violation.

```
CONTINGENCY 'APS_B_G297_U2-055A'    / 235219 01MILESB 230 235853 01KARTHS 230 1
 OPEN BRANCH FROM BUS 235219 TO BUS 889060 CKT 1
END
```

10. (FE) The Ashtabula No. 8 Tr 345/-Ashtabula Bus 3 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 109.00% to 117.66% (DC power flow) of its emergency rating (370 MVA) for the operational contingency 'DQE_161'. This project contributes approximately 32.03 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'    /* "LINE 02AT TO 02PERRY 345 CK 1"
 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

11. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 196.02% to 196.54% (DC power flow) of its emergency rating (608 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 19.25 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'    /* LEWISTOWN 230/115KV BANK #3 FAULT
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
 DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

12. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 214.15% to 214.74% (DC power flow) of its normal rating (478 MVA) for non contingency condition. This project contributes approximately 17.52 MW to the thermal violation.

13. (PENELEC) The Homer City-Homer City 345/230 kV transformer (from bus 200769 to bus 200767 ckt 2) loads from 94.56% to 98.56% (DC power flow) of its emergency rating (824 MVA) for the operational contingency 'B_PN345-XF-#113'. This project contributes approximately 33.02 MW to the thermal violation.

```
CONTINGENCY 'B_PN345-XF-#113'       /* HOMER CITY 345/230 KV NORTH AUTO-TRANSFORMER - (PJM-PN30)
  DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 1
END
```

14. (PENELEC) The R-092 TAP-Rockton Mountain 115 kV line (from bus 883550 to bus 200713 ckt 1) loads from 154.41% to 155.34% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 6.82 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#15'    /* ELKO - FOREST (FE) 230 KV - (PJM-PN09)
  DISCONNECT BRANCH FROM BUS 200581 TO BUS 235175 CKT 1
END
```

15. (AP) The Milesburg-Dale Summit 230 kV line (from bus 235219 to bus 235970 ckt 1) loads from 103.12% to 103.37% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 7.94 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#61'    /* SHAWVILLE - SHINGLETOWN (SHS) 230 KV - (PJM-PN26)
  DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1
END
```

16. (PENELEC/PJM) The CONEMGH230-Conemaugh 230/500 kV transformer (from bus 200912 to bus 200005 ckt 1) loads from 99.23% to 99.61% (DC power flow) of its emergency rating (960 MVA) for the operational contingency 'B_PN230-SX-#40'. This project contributes approximately 23.77 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#40'       /* HOMER CITY-SHELOCTA-KEYSTONE & SHELOCTA 2 XF - (PJM-PN41)
  DISCONNECT BRANCH FROM BUS 200767 TO BUS 200795 CKT 1
  DISCONNECT BRANCH FROM BUS 200795 TO BUS 200810 CKT 1
  DISCONNECT BRANCH FROM BUS 200795 TO BUS 200739 CKT 1
  DISCONNECT BUS 200795
END
```

17. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 193.84% to 194.35% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 19.59 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'    /* LEWISTOWN 230/115KV BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

18. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 209.43% to 210.02% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 17.83 MW to the thermal violation.

19. (NYISO/PENELEC) The N.WAV115-East Sayre 115 kV line (from bus 130836 to bus 200676 ckt 1) loads from 125.14% to 126.0% (DC power flow) of its emergency rating (128 MVA) for the operational contingency 'B_PN230-SX-#8'. This project contributes approximately 6.81 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#8'    /* EAST TOWANDA - HILLSIDE (ETH) 230 KV
  DISCONNECT BRANCH FROM BUS 200675 TO BUS 130763 CKT 1
END
```

20. (AP) The U2-055 TAP-Milesburg 230 kV line (from bus 889060 to bus 235219 ckt 1) loads from 106.85% to 107.08% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 8.55 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#61'    /* SHAWVILLE - SHINGLETOWN (SHS) 230 KV - (PJM-PN26)
  DISCONNECT BRANCH FROM BUS 200726 TO BUS 235248 CKT 1
END
```

21. (NYISO/PENELEC) The FALCONER-Warren 115 kV line (from bus 135277 to bus 200579 ckt 1) loads from 114.32% to 136.12% (DC power flow) of its emergency rating (118 MVA) for the operational contingency 'B_PN230-SX-#17_W3-099A'. This project contributes approximately 25.73 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#17_W3-099A'    /* ERIE EAST - ERIE SOUTH (ESEE) 230 KV
  DISCONNECT BRANCH FROM BUS 200819 TO BUS 903980 CKT 1
END
```

22. (PENELEC) The Homer City-Homer City 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 97.21% to 101.32% (DC power flow) of its emergency rating (807 MVA) for the operational contingency 'B_PN345-XF-#114'. This project contributes approximately 33.19 MW to the thermal violation.

```
CONTINGENCY 'B_PN345-XF-#114'       /* HOMER CITY 345/230 KV SOUTH AUTO-TRANSFORMER - (PJM-PN31)
  DISCONNECT BRANCH FROM BUS 200769 TO BUS 200767 CKT 2
END
```

23. (PENELEC) The Rockton Mountain-Shawville 1 115 kV line (from bus 200713 to bus 200714 ckt 1) loads from 154.23% to 155.16% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 6.82 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#15'     /* ELKO - FOREST (FE) 230 KV - (PJM-PN09)
  DISCONNECT BRANCH FROM BUS 200581 TO BUS 235175 CKT 1
END
```

24. (PENELEC) The Shelocta-Keystone 230 kV line (from bus 200795 to bus 200810 ckt 1) loads from 109.01% to 109.48% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 25.92 MW to the thermal violation.

```
CONTINGENCY 'CONEM-GH_CONEMGH230'
  DISCONNECT BRANCH FROM BUS 200005 TO BUS 200912 CKT 1       /* 500/230KV, AREA/AREA 225/226.
END
```

25. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 133.53% to 133.93% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 12.56 MW to the thermal violation.

```
CONTINGENCY 'PL100328'     /* LACKAWANNA 230KV EAST BUS & LACK T2
  DISCONNECT BRANCH FROM BUS 211681 TO BUS 208009 CKT 2
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
  DISCONNECT BUS 200708
END
```

26. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 136.93% to 137.32% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 10.33 MW to the thermal violation.

27. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 123.69% to 124.09% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 12.56 MW to the thermal violation.

```
CONTINGENCY 'PL100328'     /* LACKAWANNA 230KV EAST BUS & LACK T2
  DISCONNECT BRANCH FROM BUS 211681 TO BUS 208009 CKT 2
  DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
  DISCONNECT BUS 200708
END
```

28. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 125.39% to 125.78% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 10.33 MW to the thermal violation.

29. (PENELEC) The W3-099 TAP-Erie South East Bus 230 kV line (from bus 903980 to bus 200819 ckt 1) loads from 119.45% to 139.44% (DC power flow) of its emergency rating (554 MVA) for the operational contingency 'B_PN345-SX-#6'. This project contributes approximately 110.76 MW to the thermal violation.

```
CONTINGENCY 'B_PN345-SX-#6'     /* HANDSOME LAKE - WAYNE (WHL) 345 KV - (PJM-PN33A)
  DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1
END
```

30. (PENELEC) The W3-099 TAP-Erie South East Bus 230 kV line (from bus 903980 to bus 200819 ckt 1) loads from 119.14% to 142.44% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 113.69 MW to the thermal violation.

31. (PENELEC) The Erie South East Bus-Erie South East Bus 230/115 kV transformer (from bus 200819 to bus 200820 ckt 1) loads from 107.95% to 115.8% (DC power flow) of its emergency rating (305 MVA) for the operational contingency 'B_PN230-SX-#22'. This project contributes approximately 23.92 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#22'     /* ERIE SOUTH 230/115 KV BANK 6 FAULT
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200567 CKT 6
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200600 CKT 5
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200624 CKT 3
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200641 CKT 7
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200811 CKT 1
  DISCONNECT BRANCH FROM BUS 200568 TO BUS 200819 CKT 1
  REDUCE BUS 200568 SHUNT BY 100 PERCENT
  DISCONNECT BUS 200568
END
```

32. (PENELEC) The East Towanda-X1-109 TAP 230 kV line (from bus 200675 to bus 907910 ckt 1) loads from 106.96% to 107.4% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 15.08 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133A_X1_018_A'     /* LEWISTOWN 230/115KV BANK #3 FAULT
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 CKT 3
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200517 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 2
  DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 2
END
```

33. (PENELEC) The East Towanda-X1-109 TAP 230 kV line (from bus 200675 to bus 907910 ckt 1) loads from 97.05% to 97.5% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 13.51 MW to the thermal violation.