

#X2-020– Erie South – Erie East 230kV Generation Interconnection

Option 1:

The X2-020 project was studied as a 200MW (26MW Capacity) injection at the W3-099 TAP 230kV substation.

Facilities to Accommodate the Interconnection

Scope of Direct Connection Work

The X2-020 project will interconnect to the Erie South – Erie East 230kV line at the three breaker ring bus substation being built by project W3-099. To accommodate this interconnection, a new 4th 230kV breaker will be required for project X2-020 to connect to the ring bus. If project W3-099 withdraws from the PJM Interconnection queue, project X2-020 will be responsible for building the three breaker ring bus substation. It is estimated to take 2 years after the receipt of an executed Interconnection Service Agreement and Construction Service Agreement to complete this work.

The Interconnection Customer is responsible for meeting all criteria as specified in the applicable sections of the “FirstEnergy Requirements for Transmission Connected Facilities” document.

The Interconnection Customer is responsible for constructing all of the facilities on the Interconnection Customer’s side of the Point of Interconnection.

Direct Connection Cost Estimate

The total preliminary cost estimate for Direct Connection work performed by Penelec is **\$1,137,000**. This estimate consists of:

Description	Total Cost	Tax Gross Up %
New 230kV breaker at W3-099 ring bus substation	\$1,066,300	30.54
Engineering oversight and commissioning	\$126,300	30.53
Total Cost:	\$1,137,000	

Note: Tax gross-ups are not included in the upgrade costs. However, if applicable, apply the tax gross-up percentage shown in the chart per upgrade item.

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 FirstEnergy 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 X2-020 project was studied as a 200MW (26MW Capacity) injection into the Penelec area at the W3-099 TAP 230kV substation. Project X2-020 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 X2-020 queue project Erie East 230 kV. One option was considered during this study: the first option was a tap between Erie east and Erie SouthEast 230 kV line. Our analysis found 1 new breaker, to be over-duty in the PENNELEC transmission area. The new over-duty breakers are listed below:

- Buffalo Road 115kV breaker at Erie South substation
The reinforcement to correct this overload is to replace the Buffalo Road 115kV breaker. The cost estimate to perform this work is **\$346,600**. If tax gross-up is applicable, add 30.55%.

Contribution to Previously Identified Overloads

(X2-020 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.

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 179.32% to 179.85% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 18.06 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 176.25% to 176.78% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 16.03 MW to the thermal violation.

3. (AP) The Karthus-U2-055 TAP 230 kV line (from bus 235853 to bus 889060 ckt 1) loads from 99.63% to 99.93% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 11.02 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

4. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 127.90% to 128.25% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'KEYSTONE_JACKMTN1_1'. This project contributes approximately 13.47 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

5. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 137.87% to 138.29% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 12.95 MW to the thermal violation.

6. (PENELEC) The Homer City-Shelocta 230 kV line (from bus 200767 to bus 200795 ckt 1) loads from 116.28% to 116.83% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 31.48 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

7. (PENELEC/AP) The Shawville 2-Shingletown 230 kV line (from bus 200726 to bus 235248 ckt 1) loads from 114.35% to 114.7% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'APS_B_G297_U2-055A'. This project contributes approximately 10.77 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

8. (FE) The Ashtabula No. 8 Tr 345/-Ashtabula Bus 3 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 96.71% to 108.49% (DC power flow) of its emergency rating (370 MVA) for the operational contingency 'DQE_161'. This project contributes approximately 43.55 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

9. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 195.35% to 195.96% (DC power flow) of its emergency rating (608 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 22.92 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

10. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 213.37% to 214.06% (DC power flow) of its normal rating (478 MVA) for non contingency condition. This project contributes approximately 20.68 MW to the thermal violation.

11. (PENELEC) The R-092 TAP-Rockton Mountain 115 kV line (from bus 883550 to bus 200713 ckt 1) loads from 153.21% to 154.44% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 9.09 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

12. (AP) The Milesburg-Dale Summit 230 kV line (from bus 235219 to bus 235970 ckt 1) loads from 102.78% to 103.11% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 10.23 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

13. (PENELEC/PJM) The CONEMGH230-Conemaugh 230/500 kV transformer (from bus 200912 to bus 200005 ckt 1) loads from 98.73% to 99.21% (DC power flow) of its emergency rating (960 MVA) for the operational contingency 'B_PN230-SX-#40'. This project contributes approximately 29.77 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

14. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 193.17% to 193.78% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 23.32 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

15. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 208.65% to 209.35% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 21.04 MW to the thermal violation.

16. (AP) The U2-055 TAP-Milesburg 230 kV line (from bus 889060 to bus 235219 ckt 1) loads from 106.55% to 106.85% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 11.02 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

17. (NYISO/PENELEC) The FALCONER-Warren 115 kV line (from bus 135277 to bus 200579 ckt 1) loads from 85.93% to 113.57% (DC power flow) of its emergency rating (118 MVA) for the operational contingency 'B_PN230-SX-#17_W3-099A'. This project contributes approximately 32.61 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

18. (PENELEC) The Homer City-Homer City 345/230 kV transformer (from bus 200769 to bus 200767 ckt 1) loads from 91.86% to 96.94% (DC power flow) of its emergency rating (807 MVA) for the operational contingency 'B_PN345-XF-#114'. This project contributes approximately 41.06 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

19. (PENELEC) The Rockton Mountain-Shawville 1 115 kV line (from bus 200713 to bus 200714 ckt 1) loads from 153.02% to 154.26% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 9.09 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

20. (PENELEC) The Lewis Run-Farmers Valley 115 kV line (from bus 200667 to bus 200668 ckt 1) loads from 107.10% to 108.19% (DC power flow) of its emergency rating (149 MVA) for the operational contingency 'B_PN230-SX-#25'. This project contributes approximately 10.02 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

21. (PENELEC) The Shelocta-Keystone 230 kV line (from bus 200795 to bus 200810 ckt 1) loads from 108.39% to 108.98% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 32.37 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

22. (NYISO/PENELEC) The N.WAV115-East Sayre 115 kV line (from bus 130836 to bus 200676 ckt 1) loads from 124.01% to 124.96% (DC power flow) of its emergency rating (128 MVA) for the operational contingency 'B_PN230-SX-#8'. This project contributes approximately 7.50 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

23. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 132.98% to 133.49% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 15.96 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

24. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 136.42% to 136.92% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 13.33 MW to the thermal violation.

25. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 123.16% to 123.67% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 15.96 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) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 124.88% to 125.38% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 13.33 MW to the thermal violation.

27. (PENELEC) The W3-099 TAP-Erie South East Bus 230 kV line (from bus 903980 to bus 200819 ckt 1) loads from 93.43% to 121.5% (DC power flow) of its emergency rating (554 MVA) for the operational contingency 'B_PN345-SX-#6'. This project contributes approximately 155.50 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

28. (PENELEC) The W3-099 TAP-Erie South East Bus 230 kV line (from bus 903980 to bus 200819 ckt 1) loads from 88.83% to 121.58% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 159.78 MW to the thermal violation.

29. (PENELEC) The Erie South East Bus-Erie South East Bus 230/115 kV transformer (from bus 200819 to bus 200820 ckt 1) loads from 97.75% to 108.95% (DC power flow) of its emergency rating (305 MVA) for the operational contingency 'B_PN230-SX-#22'. This project contributes approximately 34.17 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

30. (PENELEC) The East Towanda-X1-109 TAP 230 kV line (from bus 200675 to bus 907910 ckt 1) loads from 106.38% to 106.91% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 18.06 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

31. (PENELEC) The East Towanda-X1-109 TAP 230 kV line (from bus 200675 to bus 907910 ckt 1) loads from 96.46% to 96.99% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 16.03 MW to the thermal violation.

Option 2:

The X2-020 project was studied as a 200MW (26MW Capacity) injection at the ERIE E 230kV substation.

Facilities to Accommodate the Interconnection

Scope of Direct Connection Work

The X2-020 project will interconnect via a new terminal at the Erie South substation. If this option is chosen, costs will be provided in the System Impact Study report.

The Interconnection Customer is responsible for meeting all criteria as specified in the applicable sections of the “FirstEnergy Requirements for Transmission Connected Facilities” document.

The Interconnection Customer is responsible for constructing all of the facilities on the Interconnection Customer’s side of the Point of Interconnection.

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 FirstEnergy 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 X2-020 project was studied as a 200MW (26MW Capacity) injection into the Penelec area at the ERIE E 230kV substation. Project X2-020 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 X2-020 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 PENNELEC transmission area.

Contribution to Previously Identified Overloads

(X2-020 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.

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 179.33% to 179.91% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 19.61 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 176.26% to 176.84% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 17.57 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 79.60% to 105.6% (DC power flow) of its emergency rating (554 MVA) for the operational contingency 'B_PN345-SX-#6'. This project contributes approximately 144.08 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 72.69% to 102.99% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 147.88 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 99.63% to 99.94% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 11.12 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 127.90% to 128.25% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'KEYSTONE_JACKMTN1_1'. This project contributes approximately 13.54 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 137.87% to 138.3% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 13.06 MW to the thermal violation.

8. (PENELEC) The Homer City-Shelocta 230 kV line (from bus 200767 to bus 200795 ckt 1) loads from 116.28% to 116.86% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 32.94 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

9. (PENELEC/AP) The Shawville 2-Shingletown 230 kV line (from bus 200726 to bus 235248 ckt 1) loads from 114.35% to 114.7% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'APS_B_G297_U2-055A'. This project contributes approximately 10.84 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 97.74% to 109.0% (DC power flow) of its emergency rating (370 MVA) for the operational contingency 'DQE_161'. This project contributes approximately 41.67 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 195.36% to 196.02% (DC power flow) of its emergency rating (608 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 25.05 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 213.38% to 214.15% (DC power flow) of its normal rating (478 MVA) for non contingency condition. This project contributes approximately 22.78 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 89.36% to 94.56% (DC power flow) of its emergency rating (824 MVA) for the operational contingency 'B_PN345-XF-#113'. This project contributes approximately 42.96 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 153.21% to 154.41% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 8.87 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 102.79% to 103.12% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 10.33 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 98.73% to 99.23% (DC power flow) of its emergency rating (960 MVA) for the operational contingency 'B_PN230-SX-#40'. This project contributes approximately 30.92 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 193.18% to 193.84% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 25.48 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 208.66% to 209.43% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 23.19 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 124.03% to 125.14% (DC power flow) of its emergency rating (128 MVA) for the operational contingency 'B_PN230-SX-#8'. This project contributes approximately 8.86 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 106.55% to 106.85% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 11.12 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 85.95% to 114.32% (DC power flow) of its emergency rating (118 MVA) for the operational contingency 'B_PN230-SX-#17_W3-099A'. This project contributes approximately 33.47 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 91.87% to 97.21% (DC power flow) of its emergency rating (807 MVA) for the operational contingency 'B_PN345-XF-#114'. This project contributes approximately 43.17 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 153.03% to 154.23% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-SX-#15'. This project contributes approximately 8.87 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 Lewis Run-Farmers Valley 115 kV line (from bus 200667 to bus 200668 ckt 1) loads from 107.10% to 108.14% (DC power flow) of its emergency rating (149 MVA) for the operational contingency 'B_PN230-SX-#25'. This project contributes approximately 9.61 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

25. (PENELEC) The Shelocta-Keystone 230 kV line (from bus 200795 to bus 200810 ckt 1) loads from 108.39% to 109.01% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 33.72 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

26. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 133.00% to 133.53% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 16.34 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 136.42% to 136.93% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 13.44 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 123.16% to 123.69% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 16.34 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 124.88% to 125.39% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 13.44 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 93.44% to 119.45% (DC power flow) of its emergency rating (554 MVA) for the operational contingency 'B_PN345-SX-#6'. This project contributes approximately 144.08 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 88.84% to 119.14% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 147.88 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 97.75% to 107.95% (DC power flow) of its emergency rating (305 MVA) for the operational contingency 'B_PN230-SX-#22'. This project contributes approximately 31.12 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 106.38% to 106.96% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 19.61 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 96.47% to 97.05% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 17.57 MW to the thermal violation.