

#X1-109– East Towanda – North Meshoppen 230kV Generation 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 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 X1-109 project was studied as a 905MW (765MW Capacity) injection into the PENELEC area at the tap between East Towanda and North Meshoppen 230kV line. Project X1-109 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)

Table 3 below provides a summary of the impacts caused by the X1-109 project on the Penelec transmission system for generator deliverability:

Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
3a	X1-109	339.87	X1-109 TAP - North Meshoppen 230kV line	77.70%	139.61%	Emergency	549	'B_PN230-XF-#133A_X1_018_A'
3b	X1-109	330.4	X1-109 TAP - North Meshoppen 230kV line	72.40%	140.10%	Normal	488	None
3c	X1-109	51.68	Shawville 2 - Shingletown 230kV line	94.64%	104.87%	Emergency	505	'APS_B_G297_U2-055A'
3d	X1-109	366.26	Oxbow - Lackawanna Bus 230kV line	77.59%	136.95%	Emergency	617	'B_PN230-XF-#133A_X1_018_A'
3e	X1-109	355.69	Oxbow - Lackawanna Bus 230kV line	77.98%	150.87%	Emergency	488	None
3f	X1-109	344.97	North Meshoppen - Oxbow 230kV line	81.23%	137.96%	Emergency	608	'PJM SUSQ-LACK 500'
3g	X1-109	351.69	North Meshoppen - Oxbow 230kV line	81.91%	155.48%	Normal	478	None
3h	X1-109	30.44	Otter Creek Switchyard - Conastone 230kV line	99.30%	100.22%	Emergency	531	'PJM17'
3i	X1-109	112.13	X1-018 TAP - Lewistown 2 230kV line	90.63%	112.83%	Emergency	505	'PL100328'
3j	X1-109	67.30	X1-018 TAP - Lewistown 2 230kV line	95.90%	111.70%	Normal	426	None
3k	X1-109	112.13	Shingletown - X1-018 TAP 230kV line	80.76%	102.97%	Emergency	505	'PL100328'
3l	X1-109	413.48	X1-109 TAP - East Towanda 230kV line	6.25%	126.01%	Emergency	549	'B_PN230-SX-#47'

Item 3a. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 77.70% to 139.61% (DC power flow) of its emergency rating (549 MVA) for the single contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 339.87 MW to the thermal violation.

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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
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Item 3b. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 72.40% to 140.1% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 330.40 MW to the thermal violation.

Item 3c. (PENELEC/AP) The Shawville 2-Shingletown 230 kV line (from bus 200726 to bus 235248 ckt 1) loads from 94.64% to 104.87% (DC power flow) of its emergency rating (505 MVA) for the single contingency 'APS_B_G297_U2-055A'. This project contributes approximately 51.68 MW to the thermal violation.

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CONTINGENCY 'APS_B_G297_U2-055A' / 235219 01MILESB 230 235853 01KARTHS 230 1
OPEN BRANCH FROM BUS 235219 TO BUS 889060 CKT 1
END
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Item 3d. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 77.59% to 136.95% (DC power flow) of its emergency rating (617 MVA) for the single contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 366.26 MW to the thermal violation.

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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
```

Item 3e. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 77.98% to 150.87% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 355.69 MW to the thermal violation.

Item 3f. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 81.23% to 137.96% (DC power flow) of its emergency rating (608 MVA) for the single contingency 'PJM SUSQ-LACK 500'. This project contributes approximately 344.97 MW to the thermal violation.

CONTINGENCY 'PJM SUSQ-LACK 500'
OPEN BRANCH FROM BUS 200022 TO BUS 200074 CKT 1 /* 22 SUSQ 500 74 LACKAW 500 1
END

Item 3g. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 81.91% to 155.48% (DC power flow) of its normal rating (478 MVA) for non contingency condition. This project contributes approximately 351.69 MW to the thermal violation.

Item 3h. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 99.30% to 100.22% (DC power flow) of its emergency rating (531 MVA) for the single contingency 'PJM17'. This project contributes approximately 30.44 MW to the thermal violation.

CONTINGENCY 'PJM17'
DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 3i. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 90.63% to 112.83% (DC power flow) of its emergency rating (505 MVA) for the single contingency 'PL100328'. This project contributes approximately 112.13 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

Item 3j. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 95.90% to 111.7% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 67.30 MW to the thermal violation.

Item 3k. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 80.76% to 102.97% (DC power flow) of its emergency rating (505 MVA) for the single contingency 'PL100328'. This project contributes approximately 112.13 MW to the thermal violation.

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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
```

Item 3l. (PENELEC) The X1-109 TAP-East Towanda 230 kV line (from bus 907910 to bus 200675 ckt 1) loads from 6.25% to 126.01% (DC power flow) of its emergency rating (549 MVA) for the single contingency 'B_PN230-SX-#47'. This project contributes approximately 726.12 MW to the thermal violation.

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CONTINGENCY 'B_PN230-SX-#47' /* LACKAWANNA-OXBOW-NORTH MESHOPPEN 230 KV
DISCONNECT BRANCH FROM BUS 200706 TO BUS 200708 CKT 1
DISCONNECT BRANCH FROM BUS 200708 TO BUS 208009 CKT 1
DISCONNECT BRANCH FROM BUS 200706 TO BUS 200825 CKT 3
DISCONNECT BRANCH FROM BUS 200825 TO BUS 200677 CKT 3
DISCONNECT BRANCH FROM BUS 200708 TO BUS 200709 CKT 1
DISCONNECT BUS 200708
DISCONNECT BUS 200825
END
```

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 X1-109 queue project E. Towanda 230 kV. One option was considered during this study: the option was a tap of the E.TWANDA and N.MESHPPN 230 kV line. There were no new breakers found to be over-duty in the PENELEC transmission area.

Contribution to Previously Identified Overloads

(X1-109 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 4 below provides a summary of the impacts on the Penelec transmission system for contributions to previously identified overloads with additional contribution by the X1-109 project:

Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
4a	X1-109	104.92	Peach Bottom to Conastone 500kV line	134.53%	135.11%	Emergency	2815	'PJM67'
4b	X1-109	94.33	Peach Bottom to Conastone 500kV line	135.04%	135.63%	Normal	2490	None
4c	X1-109	25.53	Lewistown - Reeds Gap Tap 115kV line	106.25%	108.16%	Emergency	216	'PL100639'
4d	X1-109	25.53	Shade Gap - Roxbury 115kV line	145.68%	148.45%	Emergency	149	'PL100639'
4e	X1-109	21.53	Shade Gap - Roxbury 115kV line	108.27%	110.61%	Emergency	149	'B_PN230-XF-#133C'
4f	X1-109	98.59	Conastone - EMORY GR 500kV line	109.44%	110.12%	Emergency	2338	None
4g	X1-109	25.53	W1-015 Tap - Shade Gap 115kV line	112.85%	114.76%	Emergency	216	'PL100639'

Item 4a. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 134.53% to 135.11% (DC power flow) of its emergency rating (2815 MVA) for the single contingency 'PJM67'. This project contributes approximately 104.92 MW to the thermal violation.

CONTINGENCY 'PJM67'

DISCONNECT BRANCH FROM BUS 200026 TO BUS 200004 CKT 1 /* HUNTERTN CNASTONE 500
500
END

Item 4b. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 135.04% to 135.63% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 94.33 MW to the thermal violation.

Item 4c. (PENELEC) The Lewistown-Reeds Gap Tap 115 kV line (from bus 200512 to bus 200519 ckt 1) loads from 106.25% to 108.16% (DC power flow) of its emergency rating (216 MVA) for the tower contingency 'PL100639'. This project contributes approximately 25.53 MW to the thermal violation.

CONTINGENCY 'PL100639' /*JUN-LEWISTOWN & JUN-DAUPHIN 230& DAUPHIN
T2(D/C.92MILES)

DISCONNECT BRANCH FROM BUS 207955 TO BUS 209866 CKT 2 /*DAUP 230 69 TR2
DISCONNECT BRANCH FROM BUS 208005 TO BUS 207955 CKT 1 /*JUNI-DAUP 230
DISCONNECT BRANCH FROM BUS 208005 TO BUS 200513 CKT 1 /*JUNI-LEWISTN 230
END

Item 4d. (PENELEC) The Shade Gap-Roxbury 115 kV line (from bus 200522 to bus 200520 ckt 1) loads from 145.68% to 148.45% (DC power flow) of its emergency rating (149 MVA) for the tower contingency 'PL100639'. This project contributes approximately 25.53 MW to the thermal violation.

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CONTINGENCY 'PL100639' /*JUN-LEWISTOWN & JUN-DAUPHIN 230& DAUPHIN
T2(D/C.92MILES)
DISCONNECT BRANCH FROM BUS 207955 TO BUS 209866 CKT 2 /*DAUP 230 69 TR2
DISCONNECT BRANCH FROM BUS 208005 TO BUS 207955 CKT 1 /*JUNI-DAUP 230
DISCONNECT BRANCH FROM BUS 208005 TO BUS 200513 CKT 1 /*JUNI-LEWISTN 230
END
```

Item 4e. (PENELEC) The Shade Gap-Roxbury 115 kV line (from bus 200522 to bus 200520 ckt 1) loads from 108.27% to 110.61% (DC power flow) of its emergency rating (149 MVA) for the single contingency 'B_PN230-XF-#133C'. This project contributes approximately 21.53 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133C' /* LEWISTOWN 230/115KV BANK #1 FAULT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 208005 CKT 1
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 1
REDUCE BUS 200513 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 1
END
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Item 4f. (PJM) The Conastone-EMORY GR500 500 kV line (from bus 200004 to bus 200101 ckt 1) loads from 109.44% to 110.12% (DC power flow) of its normal rating (2338 MVA) for non contingency condition. This project contributes approximately 98.59 MW to the thermal violation.

Item 4g. (PENELEC) The W1-015 TAP-Shade Gap 115 kV line (from bus 901070 to bus 200522 ckt 1) loads from 112.85% to 114.76% (DC power flow) of its emergency rating (216 MVA) for the tower contingency 'PL100639'. This project contributes approximately 25.53 MW to the thermal violation.

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CONTINGENCY 'PL100639' /*JUN-LEWISTOWN & JUN-DAUPHIN 230& DAUPHIN
T2(D/C.92MILES)
DISCONNECT BRANCH FROM BUS 207955 TO BUS 209866 CKT 2 /*DAUP 230 69 TR2
DISCONNECT BRANCH FROM BUS 208005 TO BUS 207955 CKT 1 /*JUNI-DAUP 230
DISCONNECT BRANCH FROM BUS 208005 TO BUS 200513 CKT 1 /*JUNI-LEWISTN 230
END
```

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, I.e. “Network Impacts”, initially caused by the addition of this project’s generation.)

For Items 3a and 3b, the overload of X1-109 TAP - North Meshoppen 230kV line can be relieved by the following: upgrading East Towanda (future X1-109) line terminal to get a LTE

summer rating of 766MVA at North Meshoppen substation and replacing 230kV disconnect switches to get a minimum summer LTE rating of 766MVA at Canyon substation. Also approximately 21 miles of the X1-109 TAP – North Meshoppen 230kV line will have to be rebuilt and reconductored with 1033kcmil ACSS, which includes replacing existing H-frame structures. The total estimated cost to perform this work is **\$22,732,400**. Please see the breakdown of costs in **Table 3a** below:

Table 3a. Reinforcements for X1-109 – North Meshoppen 230kV Line Overloads	
Reinforcement Description	Upgrade Cost
Upgrade East Towanda line terminal for minimum summer emergency rating of 766MVA at North Meshoppen substation	\$16,900
Replace 230kV disconnect switches for minimum summer rating of 766MVA at Canyon substation	\$179,000
Rebuild and reconductor approximately 21 miles of X1-109 – North Meshoppen 230kV line with 1033kcmil ACSS, which includes replacing existing H-frame structures	\$22,536,500
Total estimated cost:	\$22,732,400

Note: Tax gross-ups are not included in the upgrade costs in this table. However, if applicable, apply 30.54% tax gross-up.

For Item 3c, the overload of Shawville 2 - Shingletown 230kV line can be relieved by upgrading the relaying at Shingletown substation. The estimated cost to perform this work is **\$219,700**. If applicable, add a tax gross-up of 30.54%.

For Items 3d and 3e, the overload of the Oxbow - Lackawanna Bus 230kV line can be relieved by the following: upgrading terminal equipment at the Oxbow substation to get a minimum summer LTE rating of 839MVA and rebuilding and reconductoring approximately 16.33 miles of the Lackawanna – Oxbow 230kV line with 1590kcmil ACSS, which includes replacing existing H-frame structures. The total estimated cost to perform this work is **\$18,055,700**. Please see the breakdown of costs in **Table 3b** below:

Table 3b. Reinforcements for Oxbow – Lackawanna Bus 230kV Line Overloads	
Reinforcement Description	Upgrade Cost
Upgrade terminal equipment at Oxbow substation for minimum summer LTE rating of 839MVA	\$128,800
Rebuild and reconductor approximately 16 miles of North Meshoppen – Oxbow - Lackawanna 230kV line with 1590kcmil ACSS, which includes replacing existing H-frame structures	\$17,926,900
Total estimated cost:	\$18,055,700

Note: Tax gross-ups are not included in the upgrade costs in this table. However, if applicable, apply 30.54% tax gross-up.

For Items 3f and 3g, the overload of the North Meshoppen – Oxbow 230kV line can be relieved by the following: upgrading terminal equipment at North Meshoppen and Oxbow substations to get a summer LTE rating of 839MVA and reconductoring 10.16 miles of the North Meshoppen – Oxbow 230kV line to support bundled conductor. The total estimated cost to perform this work is **\$11,566,615** and will take approximately **4-5 years** to complete after a signed ISA. Please see the breakdown of costs in **Table 1c** below:

Reinforcement Description	Upgrade Cost
Upgrade terminal equipment at North Meshoppen and Oxbow substations for summer LTE rating of 839MVA	\$233,500
Reconductor approximately 10.16 miles of North Meshoppen – Oxbow 230kV line to support bundled conductor	\$11,333,115
Total estimated cost:	\$11,566,615

Note: Tax gross-ups are not included in the upgrade costs in this table. However, if applicable, apply 30.54% tax gross-up.

For Item 3h, the overload of Otter Creek Switchyard - Conastone 230kV line can be relieved by the following upgrades in BG&E and PPL:

- The BG&E portion of the Conastone to Otter Creek line can be upgraded by Reconducting from Gorsuch Mills to the Pennsylvania State Line (change of ownership to PPL). The existing circuit 2302 conductor is 1,590 kcmil 45/7 ACSR from Conastone to Gorsuch Mills and 795 kcm 30/19 ACSR from Gorsuch Mills to the PA State Line.
 - Assumptions:
 - Reconductor with 1,590 kcm ACSR from Gorsuch Mills to PA line to match capability of remainder of line.
 - Length of this line section is 1.7 miles.
 - Towers can be reinforced instead of replaced.
 - Based on previous estimate by R.W.M. for PJM (B48) study on circuit 22008

The estimated cost of this upgrade is **\$700,000**. Estimated construction time is **36 months**.
- PPL has recently submitted plans to PJM to rebuild the Otter Creek - Conastone 230kV line as part of a modernization project (submitted to PJM as supplemental project S0233). This project is tentatively scheduled to be complete by May 2013 (prior to the IPP's 2014 requested in-service date).

The S0233 upgrade will consist of rebuilding approximately 12 miles of 795 kcmil 30/19 ACSR (current ratings 425/531MVA Summer Normal/Summer Emergency based on conductor temp @ 125 Deg C) with new 1590 kcmil 45/7 ACSR or equivalent (new ratings 653/793MVA Summer Normal/Summer Emergency based on conductor temp @ 125 Deg C). The new circuit will be designed for double circuit but built single circuit initially. Existing structures will need to be removed and rebuilt as part of this upgrade.

This does not include rebuilding of the remaining ~5 miles of the BG&E portion of the line or the upgrade of any substation terminal equipment required at Conastone 230 kV substation. BG&E will need to provide comments on the proposed upgrade and the associated cost estimate.

For Items 3i, 3j, and 3k, the overloads of X1-018 TAP - Lewistown 2 230kV line and Shingletown - X1-018 TAP 230kV line can be relieved by upgrading the Shingletown (future X1-018) line terminal and replacing a wave trap and circuit breaker at Lewistown substation. The estimated cost to perform this work is **\$794,800**. If applicable, apply a 30.54% tax gross-up.

For Item 3l, the overload of X1-109 TAP - East Towanda 230kV line can be relieved by the following: upgrading the North Meshoppen/CNYU&G line terminal, and replacing a wave trap, adding slipover CT's and adjusting relay settings at the East Towanda substation. Also approximately 2 miles of the X1-109 TAP – East Towanda 230kV line will have to be rebuilt and reconducted with 1033kcmil ACSS, which includes replacing existing H-frame structures. The estimated cost to perform this work is **\$2,397,900**. Please see the breakdown of costs in **Table 3d** below:

Table 3d. Reinforcements for X1-109 – East Towanda 230kV Line Overload	
Reinforcement Description	Upgrade Cost
Upgrade North Meshoppen/CNYO&G line terminal, and replacing a wave trap, adding slipover CT's and adjusting relay settings at the East Towanda substation.	\$283,300
Rebuild and reconductor approximately 2 miles of X1-109 – East Towanda 230kV line with 1033kcmil ACSS, which includes replacing existing H-frame structures	\$2,114,600
Total estimated cost:	\$2,397,900

Note: Tax gross-ups are not included in the upgrade costs in this table. However, if applicable, apply 30.54% tax gross-up.

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.)

For Item 4a and 4b, the overload of Peach Bottom - Conastone 500kV line can be relieved by adding a second Peach Bottom – Conastone 500kV line. The estimated cost to perform this work is **\$56,000,000**, and will require **7 years** to complete.

For Item 4c, the overload of Lewistown - Reeds Gap Tap 115kV line can be relieved by the following: upgrading both Shade Gap 115kV line terminals to get a minimum summer LTE rating of 234 MVA at the Lewistown substation, upgrading the Lewistown and Shade Gap line terminals to get a minimum summer LTE rating of 234 MVA at the Reeds Gap substation. Also approximately 0.4 miles of the Lewistown – Shades Gap 115kV line at Reeds Gap will have to

be rebuilt and reconducted with 795kcmil ACSR, which includes replacing existing H-frame structures. The estimated cost to perform this work is **\$341,800**. Please see the breakdown of costs in **Table 4a** below:

Table 4a. Reinforcements for Lewistown – Reeds Gap Tap 115kV Line Overload	
Reinforcement Description	Upgrade Cost
Upgrade both Shade Gap 115kV line terminals for minimum summer emergency rating of 234MVA at Lewistown substation	\$30,400
Upgrade Oxbow line terminal for minimum summer emergency rating of 839MVA at North Meshoppen substation	\$14,200
Rebuild and reconductor approximately 0.4 miles of Lewistown – Shades Gap 115kV line at Reeds Gap with 795kcmil ACSR, which includes replacing existing H-frame structures	\$297,200
Total estimated cost:	\$341,800

Note: Tax gross-ups are not included in the upgrade costs in this table. However, if applicable, apply 30.54% tax gross-up.

For Item 4d and 4e, the overload of Shade Gap - Roxbury 115kV line can be relieved by the following: upgrading the Roxbury 115kV line terminal to get a summer LTE rating of 221MVA at the Shade Gap substation and upgrading the Shade Gap 115kV line terminal to get a minimum summer LTE rating of 221MVA at the Roxbury substation. Also approximately 13.6 miles of the Shade Gap – Roxbury 115kV line will have to be rebuilt and reconducted with 795kcmil ACSR, which includes replacing existing H-frame structures. The estimated cost to perform this work is **\$10,336,800**. Please see the breakdown of costs in **Table 4b** below:

Table 4b. Reinforcements for Shade Gap – Roxbury 115kV Line Overloads	
Reinforcement Description	Upgrade Cost
Upgrade Roxbury 115kV line terminal for summer LTE rating of 221MVA at Shade Gap substation	\$163,900
Upgrade Shade Gap 115kV line terminal for minimum summer LTE rating of 221MVA at Roxbury substation	\$166,900
Rebuild and reconductor approximately 13.6 miles of Shade Gap – Roxbury 115kV line with 795kcmil ACSR, which includes replacing existing H-frame structures	\$10,006,000
Total estimated cost:	\$10,336,800

Note: Tax gross-ups are not included in the upgrade costs in this table. However, if applicable, apply 30.54% tax gross-up.

For Item 4f, the overload of Conastone - EMORY GR 500kV line can be relieved by constructing a new double circuit from Conastone to NW using 1590MCM conductor. The estimated cost to perform this work is **\$54,700,000**, and will require **6-7 years** to complete. This estimate is based on a cursory review of BGE land for transmission lines. A detailed study will be conducted when the facilities study has been completed.

For Item 4g, the overload of W1-015 Tap - Shade Gap 115kV line can be relieved by the following: upgrading the Lewistown 115kV (future W1-015) line terminal to get a minimum

summer LTE rating of 248 MVA at Shade Gap substation. Also approximately 0.2 miles of the Lewistown - Shade Gap 115kV line at Shade Gap will have to be rebuilt and reconducted with 1033kcmil ACSR, which includes replacing existing H-frame structures. The estimated cost to perform this work is **\$225,700**. Please see the breakdown of costs in **Table 4c** below:

Table 4c. Reinforcements for W1-015 TAP – Shade Gap 115kV Line Overloads	
Reinforcement Description	Upgrade Cost
Upgrade Lewistown 115kV line terminal for minimum summer LTE rating of 248MVA at the Shade Gap substation.	\$40,800
Rebuild and reconductor approximately 0.2 miles of Lewistown – Shade Gap 115kV line with 1033kcmil ACSR, which includes replacing existing H-frame structures	\$184,900
Total estimated cost:	\$225,700

Note: Tax gross-ups are not included in the upgrade costs in this table. However, if applicable, apply 30.57% tax gross-up.

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.

Table 5 below provides a summary of the impacts caused by the X1-109 project on the Penelec transmission system for delivery of energy portion:

Table 5: Delivery of Energy Portion of Interconnection Request

Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
5a	X1-109	402.07	X1-109 - North Meshoppen 230kV line	110.94%	184.17%	Emergency	549	'B_PN230-XF-#133A_X1_018_A'
5b	X1-109	390.87	X1-109 - North Meshoppen 230kV line	99.89%	179.99%	Normal	488	None
5c	X1-109	61.14	Shawville 2 - Shingletown 230kV line	112.46%	114.41%	Emergency	505	'APS_B_G297_U2-055A'
5d	X1-109	12.06	Garrett Tap - Garrett 115kV line	106.13%	107.63%	Emergency	129	'01HATFLD_01BLACKO_058'
5e	X1-109	11.89	Garrett Tap - Garrett 115kV line	106.43%	108.23%	Normal	107	None
5f	X1-109	6.92	R-092 TAP - Rockton Mountain 115kV	134.85%	135.79%	Emergency	119	'B_PN230-XF-#89A'
5g	X1-109	126.95	Shelocta - Keystone 230kV line	104.09%	106.37%	Emergency	841	'CONEM-GH_CONEMGH230'
5h	X1-109	25.48	Lewistown - Reeds Gap Tap 115kV line	105.69%	107.60%	Emergency	216	'B_PN230-XF-#133C'
5i	X1-109	6.92	Rockton Mountain - Shawville 1 115kV line	134.66%	135.60%	Emergency	119	'B_PN230-XF-#89A'
5j	X1-109	25.48	Shade Gap - Roxbury 115kV line	144.88%	147.64%	Emergency	149	'B_PN230-XF-#133C'
5k	X1-109	15.67	Shade Gap - Roxbury 115kV line	111.54%	113.82%	Normal	111	None
5l	X1-109	433.29	Oxbow - Lackawanna Bus 230kV line	127.00%	197.20%	Emergency	617	'B_PN230-XF-#133A_X1_018_A'
5m	X1-109	420.79	Oxbow - Lackawanna Bus 230kV line	128.63%	214.86%	Emergency	488	None
5n	X1-109	428.38	North Meshoppen - Oxbow 230kV line	126.52%	196.94%	Emergency	608	'B_PN230-XF-#133A_X1_018_A'
5o	X1-109	416.06	North Meshoppen - Oxbow 230kV line	132.47%	219.51%	Normal	478	None
5p	X1-109	25.48	W1-015 Tap - Shade Gap 115kV line	112.30%	114.20%	Emergency	216	'B_PN230-XF-#133C'
5q	X1-109	63.91	Milesburg - Dale Summit 230kV line	100.91%	102.92%	Emergency	505	'B_PN230-SX-#61'
5r	X1-109	132.66	X1-018 TAP - Lewistown 2 230kV line	128.92%	133.16%	Emergency	505	'PL100328'
5s	X1-109	79.62	X1-018 TAP - Lewistown 2 230kV line	133.22%	136.24%	Normal	427	None
5t	X1-109	24.79	Shawville 2 - Phillipsburg 115kV line	124.00%	127.37%	Emergency	119	'B_PN230-LS-#51_X1_018_A'
5u	X1-109	87.24	Shingletown - X1-018 TAP 230kV line	121.61%	124.41%	Emergency	505	'B_PN230-SX-#28'
5v	X1-109	79.62	Shingletown - X1-018 TAP 230kV line	121.68%	124.70%	Emergency	426	None
5w	X1-109	68.84	U2-055 TAP - Milesburg 230kV line	104.69%	106.57%	Emergency	593	'B_PN230-SX-#61'
5x	X1-109	859.01	X1-109 - East Towanda 230kV line	2.23%	158.70%	Emergency	549	'PL100328'
5y	X1-109	54.11	Lewistown 2- Juniata Fake Bus 2 230kV line	130.14%	131.55%	Emergency	617	'KEYSTONE_JACKMTN1_1'
5z	X1-109	56.28	Lewistown 2- Juniata Fake Bus 2 230kV line	139.37%	141.23%	Normal	488	None
5aa	X1-109	25.54	Blairsville East - Blairsville 115/138kV transformer	129.48%	132.17%	Emergency	153	'CONEM-GH_CONEMGH230'
5bb	X1-109	18.91	Blairsville East - Blairsville 115/138kV transformer	109.16%	111.51%	Emergency	130	None
5cc	X1-109	125.47	Homer City - Shelocta 230kV line	111.65%	113.78%	Emergency	841	'CONEM-GH_CONEMGH230'
5dd	X1-109	117.94	Towanda East - East Sayre 115kV line	52.91%	142.94%	Emergency	131	'PL100328'

Item 5a. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 110.94% to 184.17% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 402.07 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
```

Item 5b. (PENELEC) The X1-109 TAP-North Meshoppen 230 kV line (from bus 907910 to bus 200706 ckt 1) loads from 99.89% to 179.99% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 390.87 MW to the thermal violation.

Item 5c. (PENELEC/AP) The Shawville 2-Shingletown 230 kV line (from bus 200726 to bus 235248 ckt 1) loads from 112.46% to 114.41% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'APS_B_G297_U2-055A'. This project contributes approximately 61.14 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
```

Item 5d. (PENELEC/AP) The Garrett Tap-Garrett 115 kV line (from bus 200762 to bus 235470 ckt 1) loads from 106.13% to 107.63% (DC power flow) of its emergency rating (129 MVA) for the operational contingency '01HATFLD_01BLACKO_058'. This project contributes approximately 12.06 MW to the thermal violation.

```
CONTINGENCY '01HATFLD_01BLACKO_058'
DISCONNECT BRANCH FROM BUS 235108 TO BUS 235103 CKT 1 /* 500/500KV, AREA 201/201.
END
```

Item 5e. (PENELEC/AP) The Garrett Tap-Garrett 115 kV line (from bus 200762 to bus 235470 ckt 1) loads from 106.43% to 108.23% (DC power flow) of its normal rating (107 MVA) for non contingency condition. This project contributes approximately 11.89 MW to the thermal violation.

Item 5f. (PENELEC) The R-092 TAP-Rockton Mountain 115 kV line (from bus 883550 to bus 200713 ckt 1) loads from 134.85% to 135.79% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-XF-#89A'. This project contributes approximately 6.92 MW to the thermal violation.

CONTINGENCY 'B_PN230-XF-#89A' /* FOREST 230/115 KV BANK 1 FAULT
DISCONNECT BRANCH FROM BUS 200581 TO BUS 200647 CKT 1
DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1
DISCONNECT BRANCH FROM BUS 200581 TO BUS 235175 CKT 1
END

Item 5g. (PENELEC) The Shelocta-Keystone 230 kV line (from bus 200795 to bus 200810 ckt 1) loads from 104.09% to 106.37% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 126.95 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

Item 5h. (PENELEC) The Lewistown-Reeds Gap Tap 115 kV line (from bus 200512 to bus 200519 ckt 1) loads from 105.69% to 107.6% (DC power flow) of its emergency rating (216 MVA) for the operational contingency 'B_PN230-XF-#133C'. This project contributes approximately 25.48 MW to the thermal violation.

CONTINGENCY 'B_PN230-XF-#133C' /* LEWISTOWN 230/115KV BANK #1 FAULT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 208005 CKT 1
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 1
REDUCE BUS 200513 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 1
END

Item 5i. (PENELEC) The Rockton Mountain-Shawville 1 115 kV line (from bus 200713 to bus 200714 ckt 1) loads from 134.66% to 135.6% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-XF-#89A'. This project contributes approximately 6.92 MW to the thermal violation.

CONTINGENCY 'B_PN230-XF-#89A' /* FOREST 230/115 KV BANK 1 FAULT
DISCONNECT BRANCH FROM BUS 200581 TO BUS 200647 CKT 1
DISCONNECT BRANCH FROM BUS 200581 TO BUS 200593 CKT 1
DISCONNECT BRANCH FROM BUS 200581 TO BUS 235175 CKT 1
END

Item 5j. (PENELEC) The Shade Gap-Roxbury 115 kV line (from bus 200522 to bus 200520 ckt 1) loads from 144.88% to 147.64% (DC power flow) of its emergency rating (149 MVA) for the operational contingency 'B_PN230-XF-#133C'. This project contributes approximately 25.48 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133C' /* LEWISTOWN 230/115KV BANK #1 FAULT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 208005 CKT 1
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 1
REDUCE BUS 200513 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 1
END
```

Item 5k. (PENELEC) The Shade Gap-Roxbury 115 kV line (from bus 200522 to bus 200520 ckt 1) loads from 111.54% to 113.82% (DC power flow) of its normal rating (111 MVA) for non contingency condition. This project contributes approximately 15.67 MW to the thermal violation.

Item 5l. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 127.00% to 197.2% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 433.29 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
```

Item 5m. (PENELEC/PL) The Oxbow-Lackawanna Bus 230 kV line (from bus 200708 to bus 208009 ckt 1) loads from 128.63% to 214.86% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 420.79 MW to the thermal violation.

Item 5n. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 126.52% to 196.94% (DC power flow) of its emergency rating (608 MVA) for the operational contingency 'B_PN230-XF-#133A_X1_018_A'. This project contributes approximately 428.38 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
```

Item 5o. (PENELEC) The North Meshoppen-Oxbow 230 kV line (from bus 200706 to bus 200708 ckt 1) loads from 132.47% to 219.51% (DC power flow) of its normal rating (478 MVA) for non contingency condition. This project contributes approximately 416.06 MW to the thermal violation.

Item 5p. (PENELEC) The W1-015 TAP-Shade Gap 115 kV line (from bus 901070 to bus 200522 ckt 1) loads from 112.30% to 114.2% (DC power flow) of its emergency rating (216 MVA) for the operational contingency 'B_PN230-XF-#133C'. This project contributes approximately 25.48 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-XF-#133C' /* LEWISTOWN 230/115KV BANK #1 FAULT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 208005 CKT 1
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200531 CKT 1
REDUCE BUS 200513 SHUNT BY 100 PERCENT
DISCONNECT BRANCH FROM BUS 200513 TO BUS 200512 TO BUS 200548 CKT 1
END
```

Item 5q. (AP) The Milesburg-Dale Summit 230 kV line (from bus 235219 to bus 235970 ckt 1) loads from 100.91% to 102.96% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 63.91 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
```

Item 5r. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 128.92% to 133.16% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'PL100328'. This project contributes approximately 132.66 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
```

Item 5s. (AP/PENELEC) The X1-018 TAP-Lewistown 2 230 kV line (from bus 907140 to bus 200513 ckt 1) loads from 133.22% to 136.24% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 79.62 MW to the thermal violation.

Item 5t. (PENELEC) The Shawville 2-Philipsburg 115 kV line (from bus 200727 to bus 200716 ckt 1) loads from 124.00% to 127.37% (DC power flow) of its emergency rating (119 MVA) for the operational contingency 'B_PN230-LS-#51_X1_018A'. This project contributes approximately 24.79 MW to the thermal violation.

CONTINGENCY 'B_PN230-LS-#51_X1_018A' /* LEWISTOWN - SHINGLETOWN (SL) 230 KV - (PJM-PN27)
DISCONNECT BRANCH FROM BUS 200513 TO BUS 907140 CKT 1
END

Item 5u. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 121.62% to 124.41% (DC power flow) of its emergency rating (505 MVA) for the operational contingency 'B_PN230-SX-#28'. This project contributes approximately 87.24 MW to the thermal violation.

CONTINGENCY 'B_PN230-SX-#28' /* GLADE - WARREN 230 KV & WARREN 230/115 BK 4 - (PJM-PN28)
DISCONNECT BRANCH FROM BUS 200811 TO BUS 200593 CKT 1
DISCONNECT BRANCH FROM BUS 200818 TO BUS 200811 CKT 4
END

Item 5v. (AP) The Shingletown-X1-018 TAP 230 kV line (from bus 235248 to bus 907140 ckt 1) loads from 121.68% to 124.7% (DC power flow) of its normal rating (426 MVA) for non contingency condition. This project contributes approximately 79.62 MW to the thermal violation.

Item 5w. (AP) The U2-055 TAP-Milesburg 230 kV line (from bus 889060 to bus 235219 ckt 1) loads from 104.69% to 106.57% (DC power flow) of its emergency rating (593 MVA) for the operational contingency 'B_PN230-SX-#61'. This project contributes approximately 68.84 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

Item 5x. (PENELEC) The X1-109 TAP-East Towanda 230 kV line (from bus 907910 to bus 200675 ckt 1) loads from 2.23% to 158.7% (DC power flow) of its emergency rating (549 MVA) for the operational contingency 'PL100328'. This project contributes approximately 859.01 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

Item 5y. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 130.14% to 131.55% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'KEYSTONE_JACKMTN1_1'. This project contributes approximately 54.11 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

Item 5z. (PENELEC/PL) The Lewistown 2-Juniata Fake Bus 2 230 kV line (from bus 200513 to bus 208005 ckt 1) loads from 139.37% to 141.23% (DC power flow) of its normal rating (488 MVA) for non contingency condition. This project contributes approximately 56.28 MW to the thermal violation.

Item 5aa. (PENELEC) The Blairsville East-Blairsville 115/138 kV transformer (from bus 200740 to bus 200763 ckt 1) loads from 129.48% to 132.17% (DC power flow) of its emergency rating (153 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 25.54 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

Item 5bb. (PENELEC) The Blairsville East-Blairsville 115/138 kV transformer (from bus 200740 to bus 200763 ckt 1) loads from 109.16% to 111.51% (DC power flow) of its normal rating (130 MVA) for non contingency condition. This project contributes approximately 18.91 MW to the thermal violation.

Item 5cc. (PENELEC) The Homer City-Shelocta 230 kV line (from bus 200767 to bus 200795 ckt 1) loads from 111.65% to 113.78% (DC power flow) of its emergency rating (841 MVA) for the operational contingency 'CONEM-GH_CONEMGH230'. This project contributes approximately 125.47 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

Item 5dd. (PENELEC) The Towanda East-East Sayre 115 kV line (from bus 200674 to bus 200676 ckt 1) loads from 52.91% to 142.94% (DC power flow) of its emergency rating (131 MVA) for the operational contingency 'PL100328'. This project contributes approximately 117.94 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