

#U2-053 Martins Creek 800 MW  
**Generator Interconnection**

**This analysis was completed to assess the reliability impact for a new generator interconnecting to the PJM System as a Capacity Resource.**

### ***Network Impacts***

Queue U2-053 was studied as an 800 MW Capacity injection at Martins Creek 230 kV substation with 285 MW of grandfathered Capacity Interconnection Rights transferred from deactivated Martins Creek units #1 (140 MW) and #2 (140 MW) and Deisel generators #1 (2.5 MW) and #2 (2.5 MW). **Net Capacity injection at Martins Creek equals 515 MW.** U2-053 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

#### NETWORK IMPACTS

##### **Generator Deliverability**

*(Normal System, Single or N-1 contingencies for the Capacity portion only of the interconnection)*

1. **(PPL/JCP&L)** The Martins Creek – Morris Park 230 kV line (bus #3076-2556) loads from **92.98%** to **104.33%** of its emergency rating (1394 MVA) for the single line contingency outage of the Hosensack - Steel City 500kV line (Contingency PJM28A). This project contributes approximately **161.8 MW** to cause this thermal violation.
2. **(PPL/Met Ed)** The Martins Creek - Portland 230 kV line (bus #3076-1162) loads from **95.19%** to **106.70%** of its emergency rating (1386 MVA) for the single contingency outage of the following facilities: Morris Park - Gilbert 230 kV, Morris Park – Martins Creek 230 kV, and the Morris Park 34.5/230kV transformer (Contingency JC44). This project contributes approximately **157.5 MW** to cause this thermal violation.

##### **Multiple Facility Contingencies**

*(Double Circuit Tower Line contingencies only for the full energy output. Stuck Breaker and Bus Fault contingencies will be performed for the Impact Study)*

3. **(JCP&L)** The Kittatinny - Newton 230 kV line (bus #2535-2553) loads from **96.54%** to **100.18%** of its emergency rating (925 MVA) for the double circuit tower line outage of the following lines: Portland – Greystone 230 kV, Kittatinny – Pohatcong 230 kV, and the Pohatcong 230/34.5kV transformer (Contingency 5JC). This project contributes approximately **33.7 MW** to cause this thermal violation.

**Contribution to Previously Identified Overloads**

*(This project contributes greater than the PJM cost allocation threshold loading to the following contingency overloads, i.e. “Network Impacts”, identified for earlier generation or transmission interconnection projects in the PJM Queue)*

4. **(Penelec)** N. Meshoppen 230/115 kV transformer #3 loads from **177.56%** to **183.5%** of its emergency rating (157 MVA) for the single line contingency outage of the N. Meshoppen - E. Towanda 230 kV line, with the N. Meshoppen 230/115kV transformer #4 (Contingency PN47B). This project contributes approximately **9.3 MW** to the thermal violation.
  
5. **(Penelec)** N. Meshoppen 230/115 kV transformer #3 115 kV Reactor loads from **115.16%** to **119.8%** of its emergency rating (201 MVA) for the single line contingency outage of the N. Meshoppen - E. Towanda 230 kV line, with the N. Meshoppen 230/115kV transformer #4 (Contingency PN47B). This project contributes approximately **9.3 MW** to the thermal violation.
  
6. **(PPL/Penelec)** The Lackawaana - Oxbow 230 kV line loads from **112.45%** to **116.61%** of its emergency rating (617 MVA) for the single line contingency outage of the (planned PPL-PSEG Baseline Upgrade) Jefferson - Lackawanna 500 kV line (Contingency PJM JEFF-LACK 500). This project contributes approximately **25.6 MW** to the thermal violation.
  
7. **(Penelec)** Oxbow - N. Meshoppen 230 kV line loads from **107.84%** to **111.92%** of its emergency rating (617 MVA) for the single line contingency outage of the (planned PPL-PSEG Baseline Upgrade) Jefferson - Lackawanna 500 kV line (Contingency PJM JEFF-LACK 500). This project contributes approximately **25.2 MW** to the thermal violation.

**Short Circuit**

8. The following circuit breakers were found to exceed their interrupting rating as a result of the addition of Queue U2-025 generation.

Station	Volt (Kv)	CB	Short Cicuit Interrupting Requirement Before U2-053 (% of CB Rating)	Short Cicuit Interrupting Requirement After U2-053 (% of CB Rating)
Martins Creek	230	G2-Northwood	99.4%	112.5%
Martins Creek	230	Gen 2	99.0%	109.1%
Martins Creek	230	LMBE-Portland	97.9%	106.9%

**Stability Analysis**

Will be performed for the Queue U2-053 Impact Study.

## NETWORK UPGRADE REQUIREMENTS

*(Queue U2-053 cost allocation for these upgrades will be determined for the Impact Study)*

*(Upgrade Requirements 1 to 8 correspond to Network Impacts 1 to 8)*

### **New System Reinforcements**

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

1. **(PPL/JCP&L) Martins Creek – Morris Park 230 kV line 4.33% (emergency rating) overload.**

Total upgrade Cost = **\$200,000**. Total construction time = **18 Months**.

#### **PPL Portion:**

The **Martins Creek-Morris Park 230 kV line** overload requires that the existing 3000 Amp wave trap and associated terminal equipment on the Morris Park (Gilbert) terminal at Martins Creek be replaced with a 4000 Amp wave trap. This replacement will increase the rating of the Martins Creek-Morris Park 230 kV line to 1306/1586 MVA summer normal/summer emergency. This is the rating of 2-1590 ACSR conductors. This scope of work is based on the assumption that the line current flows will divide 80/20 between the two Morris Park circuit breakers in the breaker and a half bay at Martins Creek and therefore breaker ratings do not need to be as high. An Operating Guide would need to be developed to address abnormal operating conditions when the line current flows do not divide between the line breakers due to equipment outages. During abnormal conditions, the line would be limited by the circuit breaker ratings of 1245/1431 MVA summer normal/summer emergency.

The total estimated cost for PPL portion of this upgrade is **\$200,000**. The estimated time to complete is **18 months**.

#### **JCP&L Portion:**

No JCP&L facility upgrades are required.

2. **(PPL/Met Ed) Martins Creek - Portland 230 kV line 6.70% (emergency rating) overload.**

Total upgrade Cost = **\$2,234,100**. Total construction time = **24 Months**.

#### **PPL Portion:**

At PPL Eu’s Martins Creek 230 kV Substation – Replace the Portland line 3000 amp wavetrapped with a 4000 amp wave trap at an estimated cost of \$100,000 and time of 18 months.

**Met Ed Portion:**

Line: Reconductor / Rebuild 1.3 miles of line from 1590 Kcmil ACSR to 2493 Kcmil ACAR at \$1,196,500.

Terminal equipment: Replace the Portland 230 kV breaker, line trap and disconnect switches from 3000 Amp rating to 4000 Amp rating at \$937,600. This terminal equipment work is already planned for interconnection request Queue O66, therefore Queue U2-053 will have a cost allocation.

**3. (JCP&L) Kittatinny - Newton 230 kV line 0.18% (emergency rating) overload.**

Total upgrade Cost = **\$309,300**. Total construction time = **24 Months**.

Terminal equipment work.

**Contribution to Previously Identified System Reinforcements**

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

**4. (Penelec) N. Meshoppen 230/115 kV transformer #3 83.5% (emergency rating) overload.**

Total upgrade Cost = **\$2,396,200**. Total construction time = **24 Months**.

Expand N. Meshoppen substation so a new ring bus configuration with the addition of two (2) 230 kV circuit breakers and four (4) disconnect switches.

This upgrade also satisfies the N. Meshoppen transformer #3 Reactor overload in number 5 below.

**5. (Penelec) N. Meshoppen 230/115 kV transformer #3 115 kV Reactor 19.8% (emergency rating) overload.**

Total upgrade Cost = **See number 4**. Total construction time = **See number 4 above**.

**6. (PPL/Penelec) Lackawaana - Oxbow 230 kV line 16.61% (emergency rating) overload.**

Total upgrade Cost = **\$14,631,700**. Total construction time = **24-36 Months**.

**PPL PORTION:**

The overload of the PPL portion of the Lackawanna – Oxbow 230 kV line requires that the existing 1033.3 kcmil ACSR conductors be replaced with 1590 kcmil ACSR conductors for a rating of 653/793 MVA summer normal/summer emergency. Terminal equipment at Lackawanna 230 kV substation would also be replaced with higher ratings than the conductor. PPL EU owns approximately 0.2 miles of this transmission line from Lackawanna to Oxbow. Please note that the description of work and the cost estimates are preliminary without any field checks and extensive engineering review and therefore are subject to change. If for some reason Penelec decides to use a different conductor, PPL EU would have to reevaluate the cost estimate.

The total estimated cost for the PPL portion of the upgrade is **\$700,000**. The estimated time to complete is **24 months**.

**PENELEC PORTION:**

To alleviate the overload on the Penelec portion of the Lackawanna – Oxbow 230kV line, a rebuild of approximately 16.33 miles of transmission line would be required. This overload also requires the following terminal upgrades at Oxbow substation: replace substation conductor and replace a disconnect switch. The estimated cost of Penelec work is **\$13,931,700**.

**7. (Penelec) Oxbow - N. Meshoppen 230 kV line 11.92% (emergency rating) overload.**

Total upgrade Cost = **\$8,769,000**. Total construction time = **24-36 Months**.

This upgrade requires reconductor / rebuild of 10.16 miles of 230 kV line and replacement of terminal equipment at Oxbow and N. Meshoppen.

**Short Circuit Upgrades**

- 8. The following circuit breakers were found to exceed their interrupting rating as a result of Queue U2-053 interconnection. The upgrade requirements and cost estimates are shown below.

Station	Volt (Kv)	CB	Upgrade Type	Upgrade Cost
Martins Creek	230	G2-Northwood	Replacement	<b>\$566,700</b>
Martins Creek	230	Gen 2	Replacement	<b>\$566,700</b>
Martins Creek	230	LMBE-Portland	Replacement	<b>\$566,700</b>