

[#T117 Hunlock Creek 90 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

– Option #1 (Hunlock Creek 69 kV bus)

The T117 project was studied as a 90 MW Capacity injection into the Hunlock Creek 69 kV bus. Project T117 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

NETWORK IMPACTS

Local Transmission System Impacts

(Normal system conditions with all facilities in service, and contingency analysis per documented Reliability Criteria, generally FERC Form 715, for Transmission Owner's underlying system)

1. Hunlock – Mountain #1 66 kV line is loaded to **232%** of its emergency rating (56 MVA) for the outage of the Hunlock – Lincoln St. and Hunlock – Mountain #2 66 kV lines. This project contributes 68 MVA to the overload.
2. Hunlock – Mountain #2 66 kV line is loaded to **236%** of its emergency rating (56 MVA) for the outage of the Hunlock – Lincoln St. and Hunlock – Mountain #1 66 kV lines. This project contributes 68 MVA to the overload.
3. The Hunlock – Lincoln St. 66 kV line (5.4 miles) is overloaded to **185 %** of its emergency rating (68 MVA) for the Tower outage of Hunlock – Mountain #1 and Hunlock – Mountain #2 66 kV lines. This project contributes 56 MVA to the overload.
4. The Lincoln – Mountain 66 kV line (~ 7.2 miles) is overloaded to **133%** of its emergency rating (75 MVA) for the Tower outage of Hunlock – Mountain #1 and Hunlock – Mountain #2 66 kV lines. This project contributes 25 MVA to the overload.

Note: Initial load flow studies indicate that the T117 project may cause thermal overloads on the normally closed Hunlock – Berwick tie and the normally open Swoyersville – Stanton and Plymouth – Jenkins ties along with supporting lines under certain outage scenarios and load conditions. These overloads may be alleviated on a post contingency basis by running back T117 generation or thru operational measures. This issue will be investigated further in the System Impact Study.

Generator Deliverability

(Normal System with all facilities in-service and Single, or N-1, contingencies for the Capacity portion only of the interconnection)

No problems identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Short Circuit Analysis

5. Queue T117 generation addition caused the short circuit current to increase from **92% to 132%** of Hunlock OCBs 18 and 28 interrupting rating.

Steady-State Voltage Requirements

(Evaluation of steady-state voltage and reactive requirements)

Local 66 kV Impacts per UGI Analysis Results:

Significant voltage violations were identified in the preliminary load flow analysis for Option #1. To eliminate these voltage issues the studies indicate that the T117 facility will need to operate at unity power factor, as measured at the high side of the GSU transformer. Not doing so would require the installation of LTC transformers and/or voltage regulators at several substations to maintain distribution voltages within the required limits. These additional facility upgrades would significantly increase the cost for Option #1. If operation of the T117 facility at unity power factor is an issue then the addition of these voltage regulating devices will need to be further examined during the System Impact Study.

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Will be performed for the Impact Study.

Contribution to Previously Identified Overloads

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

6. The Oxbow – North Meshoppen 230 kV line loads from **125.90% to 127.84%** of its emergency rating (617MVA) for the single line contingency outage

(Contingency: PJM JEFF-LACK 500) of the Jefferson – Lackawanna 500kV line. This project contributes approximately **11.9 MW** to the thermal violation.

7. The Lackawanna - Oxbow 230 kV line loads from **176.20% to 178.33%** of its normal rating (499MVA) for non-contingency condition. This project contributes approximately **10.6 MW** to the thermal violation.
8. The Oxbow – North Meshoppen 230 kV line loads from **176.03% to 178.16%** of its normal rating (499MVA) for non-contingency condition. This project contributes approximately **10.6 MW** to the thermal violation. It must be noted that the same thermal violation (DC power flow: 151.0%) already exists in the 2012 base case.
9. The Susquehanna - Jenkins 230 kV line loads from **101.72% to 102.93%** of its emergency rating (617MVA) for the tower line outage (Contingency: UGI-TOWER2) of the following lines and transformers: Lackawanna – Mountain 230 kV, Mountain #T2 (230/69 kV), Mountain – Stanton 230kV and Stanton #T1 (230/69 kV). This project contributes approximately 7.5MW to the thermal violation.

NETWORK UPGRADE REQUIREMENTS

New System Reinforcements

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

1. Reconductor the Hunlock – Mountain #1 & #2 lines (7.5 miles) to 954 kcmil ACSR. Estimated cost is **\$2,747,455**, and construction time of **24** months.

Note: Assumes that the existing towers utilized for the double circuit (d/c) Hunlock - Mountain #1 and #2 lines are capable of supporting larger conductors. The replacement of these structures may increase the cost of the transmission upgrades by as much as **\$2,000,000**. If the Interconnection Customer (IC) decides to proceed with Option #1 then the structural capacity of the towers will be determined during the System Impact Study.

2. See #1 Reinforcement above.
3. Reconductor the Hunlock – Lincoln St. line (~ 5.4 miles) to 954 kcmil ACSR. Estimated cost is **\$976,287**, and construction time of **24** months.
4. Reconductor the Lincoln St. – Mountain line (3.3 miles) to the Loomis Tap to 954 kcmil ACSR. Estimated cost is **\$589,235**, and construction time of **24** months

5. Replace overdutied line OCBs 18 and 28 with two SF6 circuit breakers. Estimated cost is **\$92,000 each**, and construction time of **24 months**.

Contribution to Previously Identified System Reinforcements *(This project contributes to the Network Impact causing the need for these Network Upgrades. This project will be allocated a cost to be determined during the Impact Study)*

6. Oxbow to North Meshoppen 230 kV Line Upgrade.

Penelec Work

The estimated magnitude cost for this upgrade is **\$12,807,000**. Estimated construction time is **36 months**.

Description of Work:

Rebuild approximately 10.16 miles of transmission line, replacement of a disconnect switch and substation conductor at Oxbow substation, and replacement of substation conductor and upgrade / replacement of two CT circuits at North Meshoppen substation.

PPL Work

Associated Lackawanna – Oxbow 230kV line upgrade.

The estimated magnitude cost for this upgrade including substation terminal equipment cost is **\$550,000** in addition to the First Energy upgrade costs.

Description of Work:

In order to provide additional capacity on the North Meshoppen – Lackawanna 230 kV line, PPL EU is proposing to re-conductor 0.18 miles of existing 1033 kcmil line. The new line will be 1590 Kcmil equivalent ACCC (composite core) conductor. The 230 kV lines will be rated for summer normal/emergency of 653/793 MVA respectively or higher. This rebuild will also require substation terminal modifications at PPL EU's Lackawanna substation. The rebuild will be 0.18 miles long and will travel the existing right of way.

7. Lackawanna to Oxbow 230 kV Line Upgrade.

See Network Upgrade item number 6 above.

8. Oxbow to North Meshoppen 230 kV Line Upgrade.

See Network Upgrade item number 6 above.

9. Susquehanna to Jenkins 230 kV Line Upgrade.

The estimated magnitude cost for this upgrade including substation terminal equipment cost is **\$70,000,000**.

Description of Work:

In order to provide additional capacity on the Susquehanna – Jenkins 230kV line, PPL EU is proposing to rebuild the existing single circuit 230kV line to a future double-circuit (single circuit initial) design 230kV line between the two substations. The new line will be 26 miles long and will follow the existing right of way. The 230kV line will be constructed with 1590 kcmil ACSR conductor for a 653/793 MVA summer normal/emergency rating. The circuit capacity is based on the conductor size and may vary when the line is actually built.

POTENTIAL ISSUES

Delivery of the Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below may result in operational restrictions to the project under study or other PJM generation. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request. **These are not required reliability upgrades.**

As a result of the aggregate energy resources in the area, the following violations were identified:

None identified.

– Option #2 (Mountain 69 kV bus)

The T117 project was studied as a 90 MW Capacity injection into the Mountain 69 kV bus. Project T117 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Potential network impacts were as follows:

NETWORK IMPACTS

Local Transmission System Impacts

(Normal system conditions with all facilities in service, and contingency analysis per documented Reliability Criteria, generally FERC Form 715, for Transmission Owner's underlying system)

Initial load flow studies indicate that the T117 project may cause thermal overloads on the normally open Swoyersville – Stanton and Plymouth – Jenkins ties along with supporting lines under certain outage scenarios and load conditions. These overloads may be alleviated on a pre or post contingency basis depending on the severity of the overload, by running back T117 generation or thru operational measures if available. This issue will be investigated further in the System Impact Study.

Generator Deliverability

(Normal System with all facilities in-service and Single, or N-1, contingencies for the Capacity portion only of the interconnection)

None identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

None identified.

Short Circuit Analysis

1. Queue T117 generation addition caused the short circuit current to increase from 69% to 100% of Mountain OCBs 66225, 66235, 66250, 66265, and 66295 interrupting capability.

Steady-State Voltage Requirements

(Evaluation of steady-state voltage and reactive requirements)

UGI - no problems identified

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

Will be performed for the Impact Study.

Contribution to Previously Identified Overloads

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

2. The Lackawanna - Oxbow 230 kV line loads from **176.20% to 178.41%** of its normal rating (499MVA) for non-contingency, normal system, conditions. This project contributes approximately **11 MW** to the thermal violation.
3. The Oxbow – North Meshoppen 230 kV line loads from **176.03% to 178.25%** of its normal rating (499MVA) for non-contingency condition. This project contributes approximately **11 MW** to the thermal violation.
4. The Susquehanna - Jenkins 230 kV line loads from **101.76% to 103%** of its emergency rating (617MVA) for the tower line outage (Contingency: UGI-TOWER2) of the following lines and transformers: Lackawanna – Mountain 230 kV, Mountain #T2 (230/69 kV), Mountain – Stanton 230kV and Stanton #T1 (230/69 kV). This project contributes approximately 7.5MW to the thermal violation.

NETWORK UPGRADE REQUIREMENTS

New System Reinforcements

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

1. Mountain OCBs 66225, 66235, 66250, 66265, and 66295 do not require replacement or upgrade at 100% or less of rating. Any small decrease in generator or GSU impedance may cause these breakers to be overdutied. This may not be known until “as built” impedances are confirmed.

Contribution to Previously Identified System Reinforcements *(This project contributes to the Network Impact causing the need for these Network Upgrades. This project will be allocated a cost to be determined during the Impact Study)*

2. Lackawanna to Oxbow 230 kV Line Upgrade.

Same as PPL work for number 3 below.

3. Oxbow to North Meshoppen 230 kV Line Upgrade.

Penelec Work

The estimated magnitude cost for this upgrade is **\$12,807,000**. Estimated construction time is **36 months**.

Description of Work:

Rebuild approximately 10.16 miles of transmission line, replacement of a disconnect switch and substation conductor at Oxbow substation, and replacement of substation conductor and upgrade / replacement of two CT circuits at North Meshoppen substation.

PPL Work

Associated Lackawanna – Oxbow 230kV line upgrade.

The estimated magnitude cost for this upgrade including substation terminal equipment cost is **\$550,000** in addition to the First Energy upgrade costs.

Description of Work:

In order to provide additional capacity on the North Meshoppen – Lackawanna 230 kV line, PPL EU is proposing to re-conductor 0.18 miles of existing 1033 kcmil line. The new line will be 1590 Kcmil equivalent ACCC (composite core) conductor. The 230 kV lines will be rated for summer normal/emergency of 653/793 MVA respectively or higher. This rebuild will also require substation terminal modifications at PPL EU's Lackawanna substation. The rebuild will be 0.18 miles long and will travel the existing right of way.

See Network Upgrade item number 6 above.

4. Susquehanna to Jenkins 230 kV Line Upgrade.

The estimated magnitude cost for this upgrade including substation terminal equipment cost is **\$70,000,000**.

Description of Work:

In order to provide additional capacity on the Susquehanna – Jenkins 230kV line, PPL EU is proposing to rebuild the existing single circuit 230kV line to a future double-circuit (single circuit initial) design 230kV line between the two substations. The new line will be 26 miles long and will follow the existing right of way. The 230kV line will be constructed with 1590 kcmil ACSR conductor for a 653/793 MVA summer normal/emergency rating. The circuit capacity is based on the conductor size and may be vary when the line is actually built.

POTENTIAL ISSUES

Delivery of the Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below may result in operational restrictions to the project under study or other PJM generation. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request. **These are not required reliability upgrades.**

As a result of the aggregate energy resources in the area, the following violations were identified:

None identified.