

790MW Sayreville Project **Final - Feasibility Study Results**

Network Impacts

(Original Results)

The system, as planned, was evaluated for compliance with reliability criteria. The #G32 Sayreville HVDC project was modeled as described in the direct connection section of this report. The project was studied as a 685 MW firm withdrawal with an additional 105 MW non-firm withdrawal. In order to expedite this feasibility study, PJM did not request First Energy to review their local system for network impacts. This local system analysis will be performed as part of the system impact study. First Energy has particular concern about voltage violations on their Jersey Central 34.5 kV system. The bulk system results are summarized below.

Single Contingency (MAAC Criteria IIA)

1. Voltage magnitude and drop violations occurred for numerous contingencies. The worst contingency was the loss of the Salem – Windsor 500 kV circuit.

Multiple Facility Contingency (MAAC Criteria IIC)

2. The Glen Gardner - Chester 230 kV circuit is overloaded at 108% of the circuit's emergency rating (554 MVA) for the Kittatinny – Pohatcong and Portland - Greystone 230kV double circuit tower line (DCTL) outage. The project contributes approximately 40 MW to the loading on the facility.
3. The Kittatinny - Newton 230 kV circuit is overloaded at 101% of the emergency rating (739 MVA) due to an outage of the Portland – Greystone and Kittatinny - Pohatcong 230 kV DCTL outage. The project contributes approximately 48 MW to the loading on the facility.
4. The Portland – Kittatinny 230 kV circuit is overloaded at 107% of the emergency rating (793 MVA) due to an outage of the Portland – Greystone and Gilbert to Morristown 230 kV DCTL. This overload was identified for a previous project and project #G32 Sayreville HVDC contributes 52 MW to the loading on the facility.

Generator Deliverability

5. The Portland – Greystone 230 kV circuit is overloaded at 102% of the circuit's emergency rating (739 MVA) for the loss of the Martins Creek – Morris Park – Gilbert 230 kV circuit. The project contributes approximately 48 MW to the loading on the facility.

CETO/CETL (MAAC Criteria III / VIIB)

6. The Branchburg – Flagtown 230 kV circuit is overloaded at 104% of the circuit’s emergency rating (752 MVA) for the loss of the Branchburg – Readington and the Readington 230/34.5 kV transformer. The project contributes approximately 152 MW to the loading on this facility.

Short Circuit Analysis

Short circuit analysis is being performed as part of the system impact study.

Network Upgrades

1. The voltage magnitude and drop violations caused by this project can be eliminated by installing approximately 400 MVARs of switchable capacitors at the Sayreville 230 kV substation. The location and amount of reactive support will be better defined in the system impact study. The cost is estimated at \$4 million (assuming \$10/kVAR).
2. The Glen Gardner-Chester 230 kV line loading exceeds a metering CT rating. The estimated cost to replace the limiting metering CT is \$75,000.
3. The Kittatinny – Newton 230 kV line loading exceeds a wave trap rating. The estimated cost to replace the limiting wave trap is \$50,000.
4. Based upon estimates originally contained in the A43 Impact Study report, the Portland-Kittatinny 230 kV overload can be eliminated by reconductoring the 8 mile circuit. The cost is estimated at \$13 million and is estimated to take 2 years to complete.
5. The Portland - Greystone 230 kV line loading exceeds a wave trap rating. The estimated cost to replace the limiting wave trap is \$50,000.
6. The Branchburg-Flagtown 230 kV line loading exceeds the conductor rating. The estimated cost to reductor the 4 mile circuit is \$4.3 million which includes the circuit reconductoring, replacing two line disconnects and replacing one wave trap.
7. The #G32 Sayreville HVDC request will have cost allocation to the SVC at Juniata 500 kV, which is sized at 500 MVAR at this requests queue position. The 500 MVAR SVC is currently estimated at \$26.2 million and with a 24 months lead time.

Network Impacts

Reflects change in queue position from G32 to G07

The system, as planned, was evaluated for compliance with reliability criteria. The #G07 Sayreville HVDC project was modeled as described in the direct connection section of this report. The project was studied as a 685 MW firm withdrawal with an additional 105 MW non-firm withdrawal all at unity power factor. In order to expedite this feasibility study, PJM did not request First Energy to review their local system for network impacts. This local system analysis will be performed as part of the system impact study. First

Energy has particular concern about voltage violations on their Jersey Central 34.5 kV system. The bulk system results are summarized below.

Single Contingency (MAAC Criteria IIA)

No problems identified.

Multiple Facility Contingency (MAAC Criteria IIC)

No problems identified.

Generator Deliverability

No problems identified.

CETO/CETL (MAAC Criteria III / VIIB)

1. As a 685 MW withdrawal, the Brunswick 230 kV substation had voltage magnitude deficiencies for the loss of the connection from Brunswick – Deans 230 kV.
2. The Branchburg – Flagtown 230 kV circuit is overloaded at 104% of the circuit's emergency rating (752 MVA) for the loss of the Branchburg – Readington and the Readington 230/34.5 kV transformer. The project contributes approximately 152 MW to the loading on this facility.

Short Circuit Analysis

Short circuit analysis is being performed as part of the system impact study.

Network Upgrades

1. The voltage magnitude and drop violations caused by this project can be eliminated by installing approximately 50 MVARs of switchable capacitors at the Brunswick 230 kV substation. The location and amount of reactive support will be better defined in the system impact study. PJM estimates this cost is estimated at \$0.5 million assuming a per unit equipment cost of \$10/kVAR.
2. The Branchburg-Flagtown 230 kV line loading exceeds the conductor rating. The estimated cost to re-conductor the 4 mile circuit is \$4.3 million which includes the circuit re-conductoring, replacing two line disconnects and replacing one wave trap.
3. The #G07 Sayreville HVDC request will have cost allocation to a previously identified SVC at Juniata 500 kV, which is sized at 200 MVAR at this request's queue position. The 200 MVAR SVC is currently estimated at \$24.7 million and with a 24 months lead time.

