# *Combined Feasibility/System Impact Study Report*

# *PJM Generation Interconnection Request Queue Position #Q63 Seneca 230kV*

**September 2008**

## Preface

The intent of the Generation Interconnection Feasibility Study and the System Impact Study is to determine a plan, with cost and construction time estimates, to connect the subject Generation Interconnection Request to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a Generation Interconnection Request must be designed to meet the technical specifications (located on the PJM web site: http://www.pjm.com/planning/trans-standard.html) for the appropriate Transmission Owner. It must be noted that this project is currently interconnected to the FirstEnergy system and the requirements for connection to the FirstEnergy system have been met, therefore no changes have been identified as being required for this project during this study.

In some instances an Interconnection Customer may not be responsible for 100% of the identified Network Upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement.

The study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities unless noted in the report. The project developer is responsible for acquiring any necessary right of way and real estate, as well as applying for and obtaining construction permits unless prior agreement by interested parties allows for other arrangements. For properties currently owned by Transmission Owners, some costs may be included in the study.

## Cost and Timing Estimates

The estimates in this report do not include tax gross-up.

While the information in this transmittal is reasonable for the scope of work defined, it should, however, be noted that the cost figures and time estimates are conceptual in nature at this stage, as an engineering team has not been assigned to the project. Any change to the scope of work will require that the estimates be revisited. The costs are a best estimate, but the Interconnection Customer will be charged for actual costs. Any under-runs or over-runs will be reconciled at the conclusion of the project.

**General**

First Energy Solutions has proposed the upgrade of one of the existing pumped hydro generators at Seneca Generating Station by 16 MW. A rewind was recently completed of Generating Unit #1 in May of 2006. This rewind increases the generating capability of Unit #1 from 210 MW to 226 MW, but does not result in increased load when it is operating as a pump. The project is capable of being in-service at this time. The Queue Position #Q63 project was studied as an injection of 16 MW of capacity at the Seneca 230 kV Generating Station. Queue Position #Q63 was evaluated for compliance with reliability criteria for summer peak conditions in 2011.

This increased generation capacity is proposed for interconnection with Pennsylvania Electric Company (Penelec), a FirstEnergy Company, at a location at the existing Seneca 230 kV Generating Station.

It is estimated that no costs will be associated with this interconnection.

The proposed upgrade must be designed in accordance with the FirstEnergy "Requirements for Transmission Connected Facilities" document.

Located at: http://www.pjm.com/planning/trans-standard.html

**Metering**

The Interconnection Customer will be required to maintain metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM and the Transmission Owner. The PJM requirements for this equipment are listed in Appendix 2, section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D.

Potential network impacts were as follows:

**Direct Connection Facilities**

None identified

**Generator Deliverability**

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

None identified

**Multiple Facility Contingency**

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

None identified

**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)*

None identified

**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 System Impact Study)*

None identified

**Potential Congestion Issues**
There are several wind generation projects proposed in the general area of the Queue Position #Q63 project, each with only 20% of their peak output level considered as a Capacity Resource, and the remaining 80% as Energy only resource. If all of the wind generation projects are at their maximum output level simultaneously, a significant number of the 115 kV and 230 kV facilities, and many underlying system facilities are likely to be overloaded, restricting operation to a lower output level.

PJM and FirstEnergy studied the delivery of the energy portion of this interconnection request. The following analysis has been performed to inform the Interconnection Customer (Queue Position #Q63) of potential congestion issues (operational restrictions) that may occur and affect the Queue Position #Q63 project's ability to operate at full output for certain system conditions. **The upgrades listed below are not required reliability upgrades for the Queue Position #Q63 interconnection.** Please note that the number of facilities identified below as requiring upgrades may be quite extensive – with a number of these facilities requiring reconductoring/rebuilding of transmission lines. Some of the reconductoring/rebuilding projects can be done in a "short" time frame while others are quite extensive and will require a "long" time to complete. In general, the time necessary to design and rebuild an extensive facility upgrade will take approximately 2-3 years to complete. If the Queue Position #Q63 Interconnection Customer desires to pursue construction of any of these upgrades, a separate "Transmission Interconnection" request must be submitted and the upgrades must be performed as Merchant Network Upgrades. 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.

**Transmission System Impacts (Facilities monitored and operated by PJM)**
Load flow model used for analysis: Generator Deliverability dispatch with all generators (in-service or active Queue generators preceding Queue Position #Q63) at 100% energy output and Peak summer loading (80/20 load forecast).

Queue Position #Q63 Operational considerations: The facilities below (potentially overloaded) are monitored and operated by PJM. PJM rules and methods for readjusting pre-contingency (N-1)

dispatch will be followed if this system condition occurs. This may or may not cause curtailment of Queue Position #Q63 generation to below its 100% energy output.

1. The Homer City-Shelocta 230 kV line to loads to 104% (722MVA) of its normal rating (694 MVA) under **normal operating conditions.** The Queue Position #Q63 contributes approximately 3 MW to the normal facility loading, which was previously identified as a potential congestion issue for the energy portion of #Q62. The Homer City -Shelocta 230 kV line also loads to 120% (1027 MVA) of its emergency rating (854MVA) for the outage of the Handsome Lake-Wayne 345 kV circuit. The Queue Position #Q63 project contributes approximately 3 MW to the contingency facility loading, which was previously identified as a potential congestion issue for the energy portion of Queue Position #P22 project. To mitigate this overload would require replacement/upgrade of a disconnect switch at Shelocta (estimated to cost approximately $85,000) and the replacement/upgrade of approximately 10.73 miles of 230 kV transmission line (estimated to cost approximately $5,365,000) between Homer City and Shelocta substations.

2. The Shelocta-Keystone 230 kV line to loads to 104% (720MVA) of its normal rating (694 MVA) under **normal operating conditions.** The Queue Position #Q63 contributes approximately 3 MW to the normal facility loading. The Shelocta – Keystone230 kV line also loads to 119% (1017 MVA) of its emergency rating (854 MVA) for the outage of t the Handsome Lake-Wayne 345 kV circuit. The Queue Position #Q63 project contributes approximately 3 MW to the contingency facility loading, which was previously identified as a potential congestion issue for the energy portion of #P60 project. To mitigate this overload would require replacement/upgrade of a disconnect switch at Shelocta Substation (estimated to cost approximately $85,000) and the replacement/upgrade of approximately 2.26 miles of 230 kV transmission line (estimated to cost approximately $1,130,000) between Keystone and Shelocta substations.

3. The Keystone 500/230kV transformer #3 loads to 116% (621 MVA) of its emergency rating (534 MVA) for the outage of the Keystone 500/230kV transformer #4. The Queue Position #Q63 contributes approximately 3 MW to the contingency facility loading, which was previously identified as a potential congestion issue for the energy portion of Queue Position #Q34. The upgrade is a replacement of existing 500-230 kV transformer with a new transformer. It is estimated that this upgrade will cost $5,500,000 and take approximately 2 years to complete.

4. The Keystone 500/230kV transformer #4 loads to 117% (618 MVA) of its emergency rating (530 MVA) for the outage of the Keystone 500/230kV transformer #3. The Queue Position #Q63 project contributes approximately 3 MW to the contingency facility loading, which was previously identified as a potential congestion issue for the energy portion of Queue Position #Q34. The upgrade is a replacement of existing 500-230 kV transformer with a new transformer. It is estimated that this upgrade will cost $5,500,000 and take approximately 2 years to complete.

**Underlying Transmission System Impacts (Facilities monitored and operated by Penelec)**

Load flow model used for analysis: Generator Deliverability dispatch with all generators (in-service or active Queue generators preceding Queue Position #Q63) at 100% energy output and Peak summer loading (80/20 load forecast).

Queue Position #Q63 Operational considerations: The facilities below (potentially overloaded) are not monitored and operated by PJM. Penelec monitors these facilities in real time and will readjust the system according to Penelec's rules and methods if this system condition occurs. This may or may not cause curtailment of Queue Position #Q63 generation to below its 100% energy output.

**The following potential congestion issues (items 5 through 9) occur for an outage of the Glade-Warren 230 kV line. There is already an operating procedure in place that prohibits Seneca Generation Facility from generating or pumping during this outage.**

5. The Sabinsville-N36 115 kV line loads to 161% (256 MVA) of its emergency rating (159 MVA) for the outage of Glade-Warren 230 kV line. Queue Position #Q63 contributes approximately 6 MW to this condition, which was previously identified as a potential congestion issue.
   It requires replacement/upgrade of the following:
   Sabinsville substation:
   - Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)

   N36 substation:
   - It is assumed that the new equipment to be installed will not be a limiting component.

   Reconductor/upgrade of approximately 10.55 miles of the 12.3 miles of 115 kV transmission line between Gold and Sabinsville (estimated to cost approximately $2,901,250)

6. The Sabinsville-Niles Valley 115 kV line loads to 152% (242 MVA) of its emergency rating (159 MVA) for the outage of Glade-Warren 230 kV line. Queue Position #Q63 contributes approximately 6 MW to this condition, which was previously identified as a potential congestion issue.
   It requires replacement/upgrade of the following:
   Sabinsville substation:
   - Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)

   Niles Valley substation:
   - Replacement/upgrade of a CT circuits (estimated to cost approximately $125,000)
   - Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)
   - Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)

   Reconductor/upgrade of approximately 13.22 miles of transmission line between Sabinsville and Niles Valley (estimated to cost approximately $3,635,500)

7. The Niles Valley-Mansfield 115 kV line loads to 172% (205 MVA) of its emergency rating (119 MVA) for the outage of Glade-Warren 230 kV line. Queue Position #Q63 contributes approximately 6 MW to this condition, which was previously identified as a potential congestion issue.
   It requires replacement/upgrade of the following:
   Mansfield substation:
   - Replacement/upgrade of 2 CT circuits (estimated to cost approximately $250,000)
   - Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)
   - Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)
   - Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)

   Niles Valley substation:
   - Replacement/upgrade of a CT circuit (estimated to cost approximately $125,000)
   - Replacement/upgrade of a line/wave trap (estimated to cost approximately $115,000)

8. The Mansfield-P47 115 kV line loads to 135% (160 MVA) of its emergency rating (119 MVA) for the outage of Glade-Warren 230 kV line. Queue Position #Q63 contributes approximately 5 MW to this condition, which was previously identified as a potential congestion issue.
   It requires replacement/upgrade of the following:
   Mansfield substation:
   - Replacement/upgrade of a CT circuit (estimated to cost approximately $125,000)
   - Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)

9. The P47-South Troy 115 kV line loads to 213% (253 MVA) of its emergency rating (119 MVA) for the outage of Glade-Warren 230 kV line. Queue Position #Q63 contributes approximately 4 MW to this condition, which was previously identified as a potential congestion issue.
   It requires replacement/upgrade of the following:
   South Troy substation:
   - Replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000)
   - Replacement/upgrade of substation conductor (estimated to cost approximately $125,000)

   Reconductor/upgrade of approximately 1 mile of the 17.46 miles of transmission line between Mansfield and South Troy (estimated to cost approximately $275,000)

**Short Circuit**

Not required

Figure #1
Penelec Area Transmission Facilities - Existing Configuration (No change for proposed configuration)