

***Generation Interconnection Feasibility Study
Report***

***PJM Generation Interconnection Request
Queue Position #U2-016
Grover 230kV
85MW
(11 MW capacity)***

October 2008

Preface

The intent of the Generation Interconnection Feasibility Study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation interconnection project 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.

The proposed interconnection facilities must be designed in accordance with the FirstEnergy “Requirements for Transmission Connected Facilities” document. Procedures for gaining access to these standards can be found at the link below.

<http://www.pjm.com/planning/trans-standard.html>

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 possibility of sharing the reinforcement costs with other projects may be identified in the Generation Interconnection Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed.

The Generation Interconnection Feasibility 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 any and all permits unless prior agreement by interested parties allows for other arrangements. For properties currently owned by Transmission Owners, some permitting and real estate 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 developer will be charged for actual costs. Any under-runs or over-runs will be reconciled at the conclusion of the project.

General

The #U2-016 project was studied as a 85 MW (11 MW of capacity) injection into the Penelec system at the Grover-East Towanda 230 kV line. Project #U2-016 was evaluated for compliance with reliability criteria for summer peak conditions in 2012.

Metering

The Interconnection Customer will be required to install and 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. The PJM and Transmission Owner requirements for Metering Equipment will be discussed in more detail in subsequent studies.

Design Requirements

The generation owner is responsible for specifying appropriate equipment and facilities such that the parallel generation is compatible with the FirstEnergy Transmission System. The generation owner is also responsible for meeting any applicable federal, state, and local codes. It is also the developer's responsibility to obtain any needed right-of-way between the plant site and FirstEnergy's facilities.

FirstEnergy may complete detailed relay coordination studies to identify off-site relay setting changes required due to this generation interconnection during the Facilities Study phase of this project. This may result in additional individual relay replacements being required. These relay replacements will be done at the cost of the developer.

Reactive Power

Requirements to be provided during the System Impact Study or Facilities Study phase of the project studies.

Cost and Timing Estimates

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.

Direct Connection Facilities

Connection to the Grover to East Towanda 230kV line would be through a 230 kV substation with a 3 breaker ring bus (see Figure 1). This substation will be built for the sole benefit of the developer and may thus be subject to ongoing maintenance costs. The developer is responsible for constructing all of the facilities on its side of the Point of Interconnection.

The proposed Interconnection Facilities must be designed in accordance with the FirstEnergy “Requirements for Transmission Connected Facilities” document. Procedures for gaining access to these standards can be found at the link below.

<http://www.pjm.com/planning/trans-standard.html>

Below are conceptual estimates for the engineering/construction associated with Direct Connection requirements based upon similar projects that have been designed and/or constructed.

Option #1

Item	Description	Conceptual Cost Estimate
1	New 230 kV 3-breaker ring bus termination point at a new interconnection substation.	\$3,080,000
2	New 230 kV loop into interconnection substation	\$400,000
3	230 kV transmission line extending from the new interconnection substation structure to the generation plant substation.	Developer cost. Line built, owned and maintained by the developer.
4	Relay and control work on Moshannon-East Towanda 230 kV line (Moshannon, Chapman, Lobo, Laurel Hill, Grover, and East Towanda substations)	\$2,730,000

Conceptual Estimate:

\$6,210,000

Estimated Lead Time:

2.0 years from signed CSA

Notes:

- The above estimates do not include 1) tax gross-up, 2) property costs and site development up to rough grade which is to be provided by the developer, 3) interconnection metering and generation SCADA to be provided by the developer, and 4) engineering and field activities for design review and commissioning of the developer’s facilities

Network Impacts

Potential network impacts were as follows:

Generator Deliverability

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

No problems were 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)

No problems were 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)

1. The SHELOCTA-KEYSTONE 230kV line loads to 117.46% (DC power flow) of its emergency rating (841MVA) for the Tower contingency outage (Contingency 83). This project contributes approximately 8.6MW to the thermal congestion. To mitigate an overload would require the replacement of a disconnect switch at Shelocta Substation (estimated to cost \$100,000) and a disconnect switch (estimated to cost \$100,000) and a CT circuit (estimated to cost \$140,000) at Keystone Substation. Further upgrades would require the upgrade/reconductor of 2.26 miles of transmission line (estimated to cost \$1,356,000). Further upgrades would require the replacement of a CT circuit at Keystone Substation (estimated to cost \$140,000).
2. The OXBOW-LACKAWANA 230kV line loading increases an additional 6% (DC power flow) of its emergency rating (617MVA) for the Tower contingency outage (Contingency UGI-TOWER2). This project contributes approximately 36.2MW to the thermal congestion. To mitigate this overload would require the rebuild of approximately 16.33 miles of transmission line (estimated to cost approximately \$19,596,000). This overload also requires the following terminal upgrades at Oxbow substation: replace substation conductor (estimated cost approximately \$125,000) and replace a disconnect switch (estimated cost approximately \$85,000). Additionally, terminal upgrades and substation work would be required at the Lackawanna substation (estimated to cost approximately \$500,000).

Short Circuit

PJM studied the 230kV and above voltage systems and found no new breakers to be overdutied, and no addition to the fault current associated with any previously identified overdutied breakers. Additional short circuit study will be conducted during the System Impact Study phase of this project.

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined during the System Impact Study phase of the study of this project.

Stability and Reactive Power Requirement

(Results of the dynamic studies should be inserted here)

To be determined during the System Impact Study phase of the study of this project.

Delivery of Energy Portion of Interconnection Request

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 #U2-016) of potential congestion issues (operational restrictions) that may occur and affect the Queue Position #U2-016 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 #U2-016 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. The developer can proceed with Network Upgrades to eliminate the operational restriction at their discretion by submitting a 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.

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

1. The South Troy-Towanda 115kV line loads from 312.8% to 320.1% (DC power flow) of its emergency rating (130MVA) for the single line contingency outage (GROVER_TWANDA_B).
2. The T100-East Towanda 230kV line loads from 93.4% to 106.6% (DC power flow) of its normal rating (488MVA) for non-contingency condition.
3. The T100-East Towanda 230kV line loads from 100.6% to 112.6% (DC power flow) of its emergency rating (554MVA) for the single line contingency outage (PN27).
4. The 01Shingletown-Lewistown 230kV line loads from 106.0% to 112.3% (DC power flow) of its emergency rating (505MVA) for the single line contingency outage (GROVER_TWANDA_B).
5. The Homer City-Shelocta 230kV line loads from 153.7% to 154.9% (DC power flow) of its emergency rating (854MVA) for the single line contingency outage (PN33A).

6. The S44COP1-Juniata 230kV line loads from 118.1% to 121.9% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (GROVER_TWANDA_B).
7. The North Meshoppen-Oxbow 230kV line loads from 101.9% to 109.2% (DC power flow) of its normal rating (499MVA) for non-contingency condition.
8. The Oxbow-Lackawanna 230kV line loads from 101.9% to 109.3% (DC power flow) of its normal rating (499MVA) for non-contingency condition.
9. The Towanda-East Sayreville 115kV line loads to 128.7% (DC power flow) of its emergency rating (159MVA) for the single contingency outage APS-SB-656.
10. The Grover 230/34.5kV transformer loads to 118.8% (DC power flow) of its emergency rating (75.9MVA) for the single contingency PN35A_T100_B.
11. The Lewistown-S44COP1 230kV line loads to 105.3% (DC power flow) of its emergency rating (617MVA) for the single contingency Grover_Twanda_B.

