Generation Interconnection Feasibility Study Report

PJM Generation Interconnection Request Queue Position #T100 Grover-East Towanda 230kV

200 MW

(40MW capacity)

September 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 Queue Position# T100 project was studied as a 200MW (40MW of capacity) injection on the Grover – East Towanda 230kV line. Project T100 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. A simplified one line diagram of the proposed project is shown in Figure #1.

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 will 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
Reactive Power requirements will be specified during the System Impact Study and / or the Facilities Study phase of the project. Final reactive power requirements will be listed in the Interconnection Service Agreement.

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 developer 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 – 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.

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

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.	N/A 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:
Detailed Engineering & Construction Estimates TBD via Facility Study
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, 4) engineering and field activities for design review and commissioning of the developer's facilities, and 5) Real estate costs that may be required for right-of-way easements to extend the 230 kV line.

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 TOWANDA-E.SAYREVILLE 115kV line loads from 106.87% to 113.19% (180MVA) (DC power flow) of its emergency rating (159MVA) for the tower line outage (5JC). This project contributes approximately 10.1MW to the thermal violation.

2. The S44COP1-JUNIATA 230kV line loads from 105.38% to 107.59% (664 MVA) (DC power flow) of its emergency rating (617MVA) for the tower line outage (PE506). This project contributes approximately 13.3MW to the thermal violation.

3. The E.SAYRE-N.WAVERLY 115kV line loads from 115.05% to 123.50% (DC power flow) of its emergency rating (119MVA) for the tower line outage (5JC). This project contributes approximately 10.1MW to the thermal violation.

4. The HOMER CITY-SHELOCTA 230kV line loads from 111.28% to 113.65% (970MVA) (DC power flow) of its emergency rating (854MVA) for the tower line outage (83). This project contributes approximately 19.2MW to the thermal violation.

5. The SHELOCTA-KEYSTONE 230kV line loads from 107.66% to 110.20% (942MVA) (DC power flow) of its emergency rating (854MVA) for the tower line outage (83). This project contributes approximately 20.6MW to the thermal violation.

6. The East Sayre – North Waverly 115 kV circuit is overloaded at 165% of the emergency rating (119 MVA) for the outage of East Towanda – Hillside 230 kV.

New System Reinforcements

None required

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)

1. The TOWANDA-E.SAYREVILLE 115kV line loads from 106.87% to 113.19% (180MVA) (DC power flow) of its emergency rating (159MVA) for the tower line outage (5JC). This project contributes approximately 10.1MW to the thermal violation. To mitigate this overload would require the rewiring of three CT circuits, two at E. Sayreville (estimated cost - $280,000) and one at E. Towanda (estimated cost - $140,000).

2. The S44COP1-JUNIATA 230kV line loads from 105.38% to 107.59% (664 MVA) (DC power flow) of its emergency rating (617MVA) for the tower line outage (PE506). This project contributes approximately 13.3MW to the thermal violation. The overloaded equipment and costs to mitigate these problems are: rebuilding 25.74 miles of line (estimated cost - $15,444,000) and replacement of a disconnect switch at Juniata Substation (estimated cost - $100,000).

3. The E.SAYRE-N.WAVERLY 115kV line loads from 115.05% to 123.50% (DC power flow) of its emergency rating (119MVA) for the tower line outage (5JC). This project contributes approximately 10.1MW to the thermal violation. This overload can be mitigated by opening the line per established PJM operating procedures.

4. The HOMER CITY-SHELOCTA 230kV line loads from 111.28% to 113.65% (970MVA) (DC power flow) of its emergency rating (854MVA) for the tower line outage (83). This project contributes approximately 19.2MW to the thermal violation. Mitigation requires the following upgrades at Homer City (current transformer - $140,000, circuit breaker - $425,000, line trap - $125,000), reconductoring 10.73 miles of line ($6,438,000), and the replacement of a disconnect switch at Shelocta ($100,000).

5. The SHELOCTA-KEYSTONE 230kV line loads from 107.66% to 110.20% (942MVA) (DC power flow) of its emergency rating (854MVA) for the tower line outage (83). This project contributes approximately 20.6MW to the thermal violation. The overloaded equipment and costs are: Shelocta (disconnect switch - $100,000), reconductoring 2.26 miles of line ($1,356,000), Keystone (disconnect switch - $100,000, rewiring CT 2 circuits - $280,000).

6. The East Sayre – North Waverly 115 kV circuit is overloaded at 165% of the emergency rating (119 MVA) for the outage of East Towanda – Hillside 230 kV. This overload can be mitigated by opening the line per established PJM operating procedures.

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this Interconnection Request. Any problems identified below are likely to result in operational restrictions to the project under study. 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.

Due to the large number of violations, the delivery-of-energy mitigations are roughly estimated to cost in excess of $200,000,000.

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 296% to 311% (DC power flow) of its emergency rating (130MVA) for the single line contingency outage (Grover_Twanda_B)). This project contributes approximately 151.3MW to the thermal congestion.

2. The LAUREL L-GOUDY115 115kV line loads from 175.7% to 183.3% (DC power flow) of its emergency rating (129MVA) for the single line contingency outage (PN20). This project contributes approximately 9.8MW to the thermal congestion.

3. The TOWANDA-E. SAYREVILLE 115kV line loads from 124.1% to 130.9% (DC power flow) of its emergency rating (159MVA) for the single line contingency outage (PN1B). This project contributes approximately 10.8MW to the thermal congestion.

4. The TOWANDA-NORTH MESHOPPEN 115kV line loads from 91.1% to 108.4% (DC power flow) of its emergency rating (159MVA) for the single line contingency outage (PN47B). This project contributes approximately 27.5MW to the thermal congestion.

5. The 01SHINGLETON-LEWISTWN 230kV line loads from 85.2% to 100.0% (DC power flow) of its emergency rating (505MVA) for the single line contingency outage (GROVER_TWANDA_B). This project contributes approximately 74.7MW to the thermal congestion.

6. The TIFFANY-LAUREL L 115kV line loads from 145.3% to 151.7% (DC power flow) of its emergency rating (151MVA) for the single line contingency outage (PN20). This project contributes approximately 9.8MW to the thermal congestion.

7. The E. SAYREVILLE-N. WAVERLY 115kV line loads from 155.7% to 166.8% (DC power flow) of its normal rating (90MVA) for non-contingency condition. This project contributes approximately 10.0MW to the thermal congestion.

8. The E. SAYREVILLE-N.WAVERLY 115kV line loads from 139.3% to 148.4% (DC power flow) of its emergency rating (119MVA) for the single line contingency outage (PN1B). This project contributes approximately 10.8MW to the thermal congestion.

9. The TOWANDA-E. SAYREVILLE 115kV line loads from 107.4% to 114.0% (DC power flow) of its normal rating (153MVA) for non-contingency condition. This project contributes approximately 10.0MW to the thermal congestion.

10. The S44COP1-JUNIATA 230kV line loads from 114.4% to 123.1% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (GROVER_TWANDA_B). This project contributes approximately 53.8MW to the thermal congestion.

11. The S44COP1-JUNIATA 230kV line loads from 123.3% to 126.1% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 13.3MW to the thermal congestion.

12. The HOMER CITY-SHELOCTA 230kV line loads from 145.2% to 147.7% (DC power flow) of its emergency rating (854MVA) for the single line contingency outage (PN33A). This project contributes approximately 20.4MW to the thermal congestion.

13. The SHELOCTA-KEYSTONE 230kV line loads from 133.8% to 136.3% (DC power flow) of its emergency rating (854MVA) for the single line contingency outage (PN33A). This project contributes approximately 21.1MW to the thermal congestion.

14. The LEWISTWN-S44COP1 230kV line loads from 102.3% to 111.0% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (GROVER_TWANDA_B). This project contributes approximately 53.8MW to the thermal congestion.

15. The HOMER CITY-SHELOCTA 230kV line loads from 134.5% to 137.4% (DC power flow) of its normal rating (694MVA) for non-contingency condition. This project contributes approximately 18.9MW to the thermal congestion.

16. The OXBOW-LACKAWNA 230kV line loads from 91.7% to 105.9% (DC power flow) of its emergency rating (617MVA) for the single line contingency outage (PL57). This project contributes approximately 86.6MW to the thermal congestion.

17. The LEWISTWN-S44COP1 230kV line loads from 108.5% to 111.3% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 13.3MW to the thermal congestion.

18. The SHELOCTA-KEYSTONE 230kV line loads from 124.0% to 127.0% (DC power flow) of its normal rating (694MVA) for non-contingency condition. This project contributes approximately 19.7MW to the thermal congestion. It must be noted that the same thermal violation (DC power flow: 124.0%) already exists in the 2012 base case.

19. The LENOX-TIFFANY 115kV line loads from 113.2% to 119.4% (DC power flow) of its emergency rating (151MVA) for the single line contingency outage (PN20). This project contributes approximately 9.4MW to the thermal congestion.

20. The NORTH MESHPPEN-OXBOW 230kV line loads from 93.9% to 111.6% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 86.6MW to the thermal congestion.

21. The OXBOW-LACKAWNA 230kV line loads from 93.7% to 111.4% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 86.6MW to the thermal congestion.

22. The NORTH MESHOPPEN-LENOX 115kV line loads from 105.3% to 110.7% (DC power flow) of its emergency rating (179MVA) for the single line contingency outage (PN20). This project contributes approximately 9.8MW to the thermal congestion.

Short Circuit

PJM studied the 230kV and above system which identified no breakers to be overdutied as a result of this project. Additional short circuit study shall occur during the System Impact Study.

Figure #1