Generation Interconnection Feasibility Study Report

PJM Generation Interconnection Request Queue Position #U1-050 Punxsutawney 115 kV

200 MW

(26 MW capacity)

April 2009

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/design-engineering/to-tech-standards.aspx

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 Interconnection Customer 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 Interconnection Customer 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 U1-050 project was studied as a 200MW (Capacity=26MW) injection at/near Punxsutawney 115 kV substation in the PenElec area. Project U1-050 was evaluated for compliance with reliability criteria in accordance with the procedures set forth in PJM Manual 14A and the FirstEnergy planning 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.

PENELEC Revenue Metering Requirements for Generation Interconnection Customer

Interconnection Customer shall install, own, operate, test and maintain the necessary revenue quality Metering Equipment. This includes current transformers, voltage transformers, mounting structures, wiring, meters, communication circuits, and associated devices. The Metering Equipment must meet the specifications listed in the FirstEnergy connection documents. The FirstEnergy "Requirements for Transmission Connected Facilities" can be retrieved from:

http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

The Metering Equipment shall be located at the generation facility on the high voltage side of the generator step-up transformers or facility main step-up transformer and/or station service power transformers. Power flows to and from the facility shall be compensated to the Point of Interconnection.

Penelec will provide revenue quality Metering Equipment for a station service power supply at a generation facility if the supply is from the local Penelec distribution system.

The revenue quality Metering Equipment shall be capable of collecting and storing bidirectional billing data. The billing data shall be stored in intervals specified by Penelec, typically fifteen minutes or thirty minutes. The Interconnection Customer must provide Penelec with remote access to the billing data in the Metering Equipment via a dedicated voice-grade analog telephone circuit. The Interconnection Customer shall provide Penelec with contact information for the person or persons responsible for meter programming and Metering Equipment maintenance.

The Interconnection Customer shall consult with Penelec regarding the revenue quality metering system design and provide the following information:

- Facility one line and revenue metering installation drawings (schematics, wiring diagrams, etc.)
- Estimated power flows to and from the facility at all revenue metering points
- Current transformer and voltage transformer specifications, including manufacturer, type, nameplate drawings, and certified accuracy test reports
- Revenue meter specifications including manufacturer, type, model number, and accuracy

- Revenue meter program information including but not limited to billing data recorder channel assignments, recorder pulse weights (Ke), and read-only password for access to interval data by the FirstEnergy billing data collection system (MV-90)
- Revenue meter telephone number
- Revenue meter loss compensation data (if applicable)

The Interconnection Customer shall provide Penelec with prior notification of any modifications at the facility that will affect the revenue meter measurements, including substation reconfigurations and meter program changes.

The revenue metering system at each location shall be tested for accuracy by the Interconnection Customer once every two years. The Interconnection Customer shall give reasonable notice to Penelec of the time when the testing is scheduled so that Penelec may have representatives present. Penelec shall have the right to audit the revenue Metering Equipment and/or related documents. The Interconnection Customer shall be given a reasonable period of time to comply with any requests associated with an audit.

Design Requirements

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

Penelec will complete detailed relay coordination studies to identify off-site relay setting changes required due to this generation interconnection during the Facilities Study on construction 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 Interconnection Customer.

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.

Cost Estimates provided in this report were derived from estimates received in association with other similar projects.

Direct Connection Facilities

was studied as a(n) 200MW(Capacity=26MW) injection at/near Punxsutawney 115 kV substation in the PenElec area. Project U1-050 was evaluated for compliance with reliability criteria in accordance with the procedures set forth in PJM Manual 14A and the FirstEnergy planning criteria for summer peak conditions in 2012.

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. The cost below is based on U3-010 being the only project to connect at this substation.

Option 1: South Troy – East Towanda 115kV line (see Figure 1)

Item	Description	Conceptual Cost Estimate
1	New 115 kV 3-breaker ring bus termination point at/near Punxsutawney substation	$3,656,000
2	New 115 kV loop into interconnection substation	$70,000
3	Relaying, fiber optic cable and miscellaneous	$1,912,800
4	New 115 kV 3-breaker ring bus at Trade City substation	$3,794,000
5	115 kV transmission line extending from the new interconnection substation structure to the generation plant substation	N/A

Conceptual Estimate: $9,432,800
Estimated Lead Time: 2.0 years from signed CSA

Notes:
Detailed Engineering & Construction Estimates to be determined during subsequent phase(s) of this projects development.
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 Interconnection Customer, 3) interconnection metering

and generation SCADA to be provided by the Interconnection Customer, 4) engineering and field activities for design review and commissioning of the Interconnection Customer's facilities, and 5) Real estate costs that may be required for right-of-way easements to extend the 115 kV line.

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 from 111.51% to 117.7% (DC power flow) of its summer emergency rating (841MVA) for the tower line outage (83) (Loyalhanna-Luxor, Loyalhanna-Social Hall). This project contributes approximately 52.1MW to the thermal violation. 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 two CT circuits (estimated to cost $280,000) at Keystone Substation. Further upgrades would require the upgrade/reconductor of 2.26 miles of transmission line (estimated to cost $1,356,000).

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 or Facilities Study phase of the study of this project.

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 Interconnection Customer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant 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 overloaded 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 BLRSVL E-BLAIRSVL 115/138kV transformer loads from 179% to 186% (DC power flow) of its emergency rating (174MVA) for the single line contingency outage (PN33A). This project contributes approximately 11.6MW to the thermal congestion.

2. The TRADE CI-TIMBLIN 115kV line loads from 63.8% to 111.7% (DC power flow) of its emergency rating (191MVA) for the single line contingency outage (PN33A). This project contributes approximately 91.3MW to the thermal congestion.

3. The TIMBLIN-PINEY 115kV line loads from 58.3% to 106.2% (DC power flow) of its emergency rating (191MVA) for the single line contingency outage (PN33A). This project contributes approximately 91.3MW to the thermal congestion.

4. The BLRSVL E-BLAIRSVL 115/138kV transformer loads from 192.8% to 201.8% (DC power flow) of its normal rating (129MVA) for non-contingency condition. This project contributes approximately 11.6MW to the thermal congestion.

5. The BLAIRSVL-01SOCIAL 138kV line loads from 147.9% to 154.9% (DC power flow) of its normal rating (168MVA) for non-contingency condition. This project contributes approximately 11.6MW to the thermal congestion.

6. The 01SOCIAL-01VASC T 138kV line loads from 151.4% to 159.7% (DC power flow) of its emergency rating (129MVA) for the single line contingency outage (APS-SB-293). This project contributes approximately 10.7MW to the thermal congestion.

7. The 01SHINGL-LEWISTWN 230kV line loads from 97.9% to 100.5% (DC power flow) of its emergency rating (505MVA) for the single line contingency outage (GROVER_TWANDA_B). This project contributes approximately 13.1MW to the thermal congestion.

8. The ROCKWOOD-PENN-MAR 115kV line loads from 156.4% to 161.0% (DC power flow) of its emergency rating (143MVA) for the single line contingency outage (PN41). This project contributes approximately 6.5MW to the thermal congestion.

9. The 01SOCIAL-01VASC T 138kV line loads from 115.3% to 124.4% (DC power flow) of its normal rating (106MVA) for non-contingency condition. This project contributes approximately 9.7MW to the thermal congestion.

10. The 01VASC T-01EDGEWT 138kV line loads from 129.5% to 137.8% (DC power flow) of its emergency rating (129MVA) for the single line contingency outage (APS-SB-293). This project contributes approximately 10.7MW to the thermal congestion.

11. The ALTOONA-RAYSTOWN 230kV line loads from 114.2% to 116.6% (DC power flow) of its emergency rating (554MVA) for the single line contingency outage (PN41). This project contributes approximately 13.4MW to the thermal congestion.

12. The HOMER CT-SHELOCTA 230kV line loads from 152.5% to 155.4% (DC power flow) of its emergency rating (841MVA) for the single line contingency outage (PN33A). This project contributes approximately 23.6MW to the thermal congestion.

13. The RAYSTOWN-LEWISTWN 230kV line loads from 111.2% to 113.7% (DC power flow) of its emergency rating (554MVA) for the single line contingency outage (PN41). This project contributes approximately 13.9MW to the thermal congestion.

14. The 01EDGEWT-01LOYALH 138kV line loads from 120.6% to 128.9% (DC power flow) of its emergency rating (129MVA) for the single line contingency outage (APS-SB-293). This project contributes approximately 10.7MW to the thermal congestion.

15. The S44COP1-JUNIATA 230kV line loads from 113.4% to 116.6% (DC power flow) of its normal rating (499MVA) for non-contingency condition. This project contributes approximately 16.3MW to the thermal congestion.

16. The Punxsutawny – Trade City 115 kV line loads from 13% to 131% (DC power flow) of its normal rating (139 MVA) for non-contingency conditions. This project contributes approximately 200 MW to the thermal congestion.

17. The N39 – Altoona 230 kV line loads from 109.5% to 111.3% (DC power flow) of its emergency rating (617 MVA) for the single line contingency outage of Homer City – Shelocta – Keystone 230 kV (PN41). This project contributes approximately 10.5 MW to the thermal congestion.

18. The Keystone 500/230 kV transformer #3 loads from 96% to 101.5% (DC power flow) of its emergency rating (642 MVA) for the single contingency outage of Keystone 500/230 kV #4. This project contributes approximately 33 MW to the thermal congestion.

19. The Keystone 500/230 kV transformer #4 loads from 97% to 102% (DC power flow) of its emergency rating (634 MVA) for the single contingency outage of Keystone 500/230 kV #3. This project contributes approximately 33 MW to the thermal congestion.

20. The Lewistown – S44 Option 1 230 kV line loads from 101% to 104% (DC power flow) of its emergency rating (617 MVA) for the single line contingency outage of Grover – T100 230 kV (Grover_Twanda_B). This project contributes approximately 18 MW to the thermal congestion.

Figure 1

Existing 115 kV

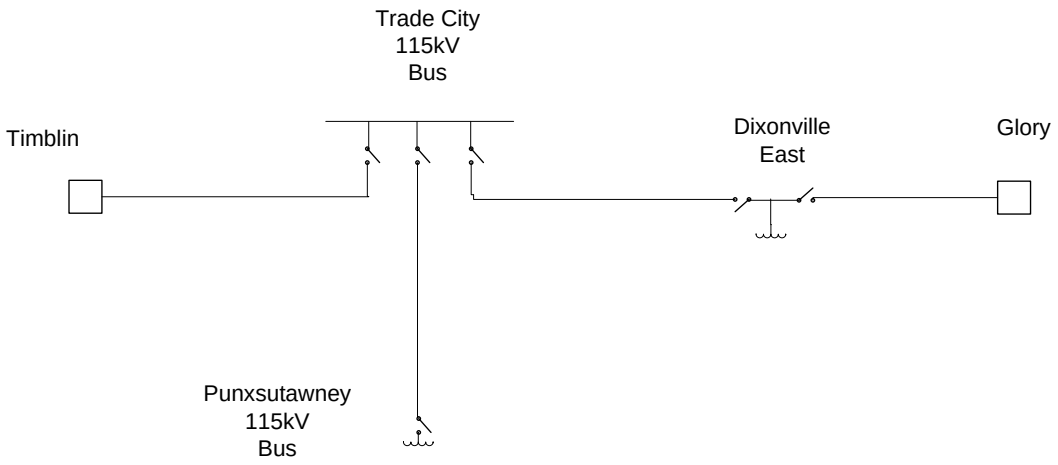
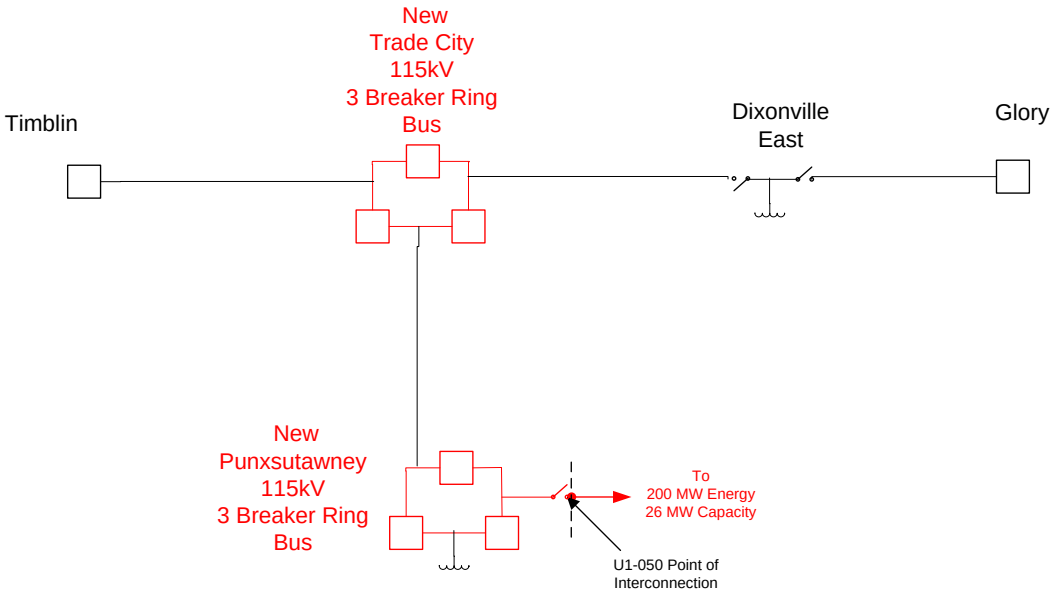


Figure 2

New 115 kV



Note - For simplicity and clarity of the drawing at Trade City and Punxsutawney only the disconnect switch at the point of interconnection is shown. Disconnect switches are also required between breakers at Trade City and Punxsutawney.