

***Generation Interconnection Feasibility Study  
Report***

***PJM Generation Interconnection Request  
Queue Position #S11  
Seward-Tower 51 115kV***

**August 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 #S11 project was studied as a 70 MW (14 MW of capacity) injection along the Tower 51 – Seward 115 kV line in FirstEnergy’s Penelec territory. Queue Position #S11 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*

Specific reactive power requirements, and any upgrades required as a result of the stability and Low Voltage Ride Through studies will be provided during the System Impact Study or the Facilities Study phase of the project development.

## **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

<b>Item</b>	<b>Description</b>	<b>Conceptual cost estimate (\$)</b>
1	New 115 kV 3-breaker ring bus termination point at a new interconnection substation.	\$2,763,000
2	New 115V kV loop into interconnection substation.	\$250,000
3	115 kV transmission line extending from the new tap structure to the generation plant interconnection substation.	N/A Developer cost. Line built, owned and maintained by the developer.
4	Relay and control work at Tower 51 115kV Substation.	\$250,000
5	Relay and control work at Seward 115 kV Substation.	\$250,000
6	Fiber optic cable installation from the S11 interconnection substation to Tower 51 Substation. (Approximately 1.25 miles)	\$125,000
7	Fiber optic cable may also be required between the S11 interconnection substation and Seward Substation.	To be determined in the System Impact Study

Conceptual Estimate:

**\$3,638,000**

Estimated Lead Time:

2.0 years from signed CSA

Notes:

- Detailed Engineering & Construction Estimates TBD via Facilities 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.

Potential network impacts were as follows:

**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)*

1. The Rosedale – Cooper 115 kV line is overloaded from 99% to 108% (194 MVA) of its emergency rating (180 MVA) for the **tower** outage of Homer Ct to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This project contributes approximately 16 MW to cause the thermal violation.
2. The Cooper – Seward 115 kV line is overloaded from 95% to 106% (195 MVA) of its emergency rating (184 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This project contributes approximately 21 MW to cause the thermal violation.

**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)*

3. Contribution of 41 MW further overloads the Hooversville - Scalp Level 115 kV line from 237% to 260% of its emergency rating (179 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A).
4. Contribution of 41 MW further overloads the Scalp Level – Rachel Hill 115 kV line from 230 % to 253% of its emergency rating (179 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08.
5. Contribution of 41 MW further overloads the Rachel Hill - Hillclay 115 kV line from 205% to 227% of its emergency rating (184 MVA) for the **tower** outage of Homer Ct to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project.
6. Contribution of 34 MW further overloads the Hillclay – Hilltop 115 kV line from 215% to 234% of its emergency rating (179 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project.

7. Contribution of 7 MW further overloads the P60 – Bedford North 115 kV line from 106% to 111% (167 MVA) of its emergency rating (150 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project.
8. Contribution of 17MW further overloads the Rockwood – Penn-Mar 115 kV line from 166% to 178% (254 MVA) of its emergency rating (143 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08.
9. Contribution of 17 MW further overloads the Penn-Mar – Garrett 115 kV line from 142% to 152% (253MVA) of its emergency rating (167 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project.
10. Contribution of 25 MW further overloads the Hilltop - Rosedale 115 kV line from 129% to 143% of its emergency rating (179 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A).This overload was previously identified with the R08 Project.
11. Contribution of 17 MW further overloads the Garrett 138/115 kV transformer from 113% to 121% (266 MVA) of its emergency rating (220 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project.

### **New System Reinforcements**

1. Overload of the Rosedale – Cooper 115 kV line for the **tower** outage of Homer Ct to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). To mitigate this overload would require the upgrade/replacement of a CT circuit and the replacement of a line/wave trap at Cooper Substation, estimated to cost approximately \$240,000.
2. Overload of the Cooper – Seward 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). To mitigate this overload would require the replacement of a line/wave trap at Cooper Substation, estimated to cost approximately \$125,000.

### **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)*

3. Overload of the Hooversville - Scalp Level 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A).

This and other overloads associated with the Homer City-Quemahoning 230 kV and Seward-Tower51 115 kV tower outage and were previously identified with the R08 Project. S11 may or may not contribute to this overload depending on the location of their Point of Interconnection on the Seward-Tower51 115 kV line. It is believed that if the S11 project Point of Interconnection along the Seward-Tower51 115kV line lies within 6.95 miles of the Seward Substation, then this project may avoid this overload as well as overloads 4, 5, 6, 7, 8, 9, 10, & 11 below. Assuming S11 does contribute to the overload, the proposed reinforcement is the construction of approximately 20 miles of new 230 kV transmission line from Hooversville to Johnstown, estimated to cost approximately **\$20,000,000**. Details will be provided in the System Impact Study following confirmation from the Interconnection Customer as to the exact Point of Interconnection. The Interconnection Customer will be responsible for acquiring right of way necessary to reach the Point of Interconnection.

4. Overload of the Scalp Level – Rachel Hill 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the upgrades in item #3 above.
5. Overload of the Rachel Hill - Hillclay 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the upgrades in item #3 above.
6. Overload of the Hillclay – Hilltop 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the upgrades in item #3 above.
7. Overload of the P60 – Bedford North 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the upgrades in item #3 above.
8. Overload of the Rockwood – Penn-Mar 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the replacement / upgrade of a 115kV disconnect switch (estimated to cost approximately

\$80,000) at Rockwood substation. It also requires the replacement/upgrade of a 115kV CT circuit (estimated cost approximately \$125,000), the replacement of a 115kV circuit breaker (estimated cost approximately \$225,000) and the reconductor of approximately 14.7 miles of 115kV transmission line (estimated cost approximately \$4,042,500). It must be noted that this reinforcement may not be necessary as discussed in #3 above dependent upon the location of the Point of Interconnection along the Seward-Tower51 115kV line.

9. Overload of the Penn-Mar – Garrett 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the reconductor of approximately 14.95 miles of transmission line between Penn Mar substation and Garrett Tap (estimated cost approximately \$4,111,250). It must be noted that this reinforcement may not be necessary as discussed in #3 above dependent upon the location of the Point of Interconnection along the Seward-Tower51 115kV line.
10. Overload of the Hilltop - Rosedale 115 kV line for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the upgrades in item #3 above.
11. Overload of the Garrett 138/115 kV transformer from 113% to 121% (266 MVA) of its emergency rating (220 MVA) for the **tower** outage of Homer City to Quemahoning 230 kV line and Seward to S11 115 kV line (Cont Id. 2PN\_with\_S11A). This overload was previously identified with the R08 Project and would be mitigated by the upgrades in item #3 above.

### **Potential Congestion Issues**

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 upgrades listed below are not required reliability upgrades for the Queue Position #S11 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 #S11 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.

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

1. Contribution of 58 MW further overloads the S11C-SEWARD 115 kV line from 222.7% to 259.4% (DC power flow) of its emergency rating (159MVA) for the single line contingency outage of Quemahoning – Homer Ct 230 kV line, Quemahoning – R56 230 kV line (PN37\_WITH\_R56OP1\_A).

2. Contribution of 11 MW further overloads the Altoona – Raystown 230 kV line from 108.5% to 110.6% (DC power flow) of its emergency rating (554 MVA) for the single line contingency outage of Homer City – Shelocta – Keystone 230 kV line (PN41).
3. Contribution of 6 MW further overloads the Lewistown – Juniata 230 kV line from 105.2% to 106.5% (DC power flow) of its normal rating (499 MVA).
4. Contribution of 12 MW further overloads the Raystown – Lewistown 230 kV from 105.2% to 107.3% (DC power flow) of its emergency rating (554 MVA) for the single line contingency outage of Homer City – Shelocta – Keystone 230 kV line (PN41).
5. Contribution of 9 MW further overloads the Blairsville 138/115 kV transformer from 170.0% to 176.7% (DC power flow) of its emergency rating (140 MVA) for the single line contingency outage of Altoona – Raystown – Lewistown 230 kV line (PN38).
6. Contribution of 13 MW further overloads the Seward – Florence 115 kV line from 156.1% to 162.5% (DC power flow) of its emergency rating (202 MVA) for the single line contingency outage of Homer City – Shelocta – Keystone 230 kV line (PN41).
7. Contribution of 9 MW further overloads the Blairsville – Social 138 kV line from 135.1% to 140.5% (DC power flow) of its emergency rating (176 MVA) for the single line contingency outage of Altoona – Raystown – Lewistown 230 kV line (PN38).
8. Contribution of 13 MW further overloads the Florence – Blairsville 115 kV line from 107.2% to 111.6% (DC power flow) of its emergency rating (294MVA) for the single line contingency outage of Homer City – Shelocta – Keystone 230 kV line (PN41).
9. Contribution of 26 MW further overloads the Homer City – Shelocta 230 kV line from 130.8% to 133.8% (DC power flow) of its emergency rating (854MVA) for the single line contingency outage of Handsome Lake – Wayne 345 kV line (PN33A).
10. Contribution of 29 MW further overloads the Shelocta – Keystone 230 kV line from 118.5% to 121.9% (DC power flow) of its emergency rating (854MVA) for the single line contingency outage of Handsome Lake – Wayne 345 kV line (PN33A).
11. Contribution of 8 MW further overloads the Edgewater – Loyalh 138 kV line from 102.2% to 108.6% (DC power flow) of its emergency rating (129 MVA) for the single line contingency outage of Homer City – Shelocta – Keystone 230 kV line (PN41).
12. Contribution of 8 MW further overloads the VASC T- EDGEWT 138 kV line from 111.1% to 117.5% (DC power flow) of its emergency rating (129 MVA) for the single line contingency outage of Homer City – Shelocta – Keystone 230 kV line (PN41).

## **Short Circuit**

PJM performed the short circuit analysis for S11 associated with 230kV and higher breakers. No breaker(s) have been identified as overdutied because of this project. Additional short circuit study and analysis will be performed during the System Impact Study phase of the project.

Figure #1

Note: Distances are approximate and must be confirmed during the System Impact Study following receipt of information from the Interconnection Customer

