Generation Interconnection Feasibility Study Report

PJM Generation Interconnection Request Queue Position #R09 Summit-Claysburg 115kV

48 MW

(9.6 MW 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 #R09 project was studied as a 48 MW (9.6 MW of capacity) injection at two distinct points of the Penelec system. Option #1 studies the interconnection to tap on Summit – Claysburg 115 kV line, while option #2 studies the interconnection to tap on Johnstown – Altoona 230 kV line. Project #R09 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 2011. Potential network impacts were as follows:

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

To be specified during the System Impact Study phase of the project.

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 Summit – Claysburg 115 kV line would be through a 115 kV substation with a 3 breaker ring bus (see Figure 1).

Connection to the Johnstown – Bear Rock - Altoona 230kV line would be through a 230 kV substation with a 3 breaker ring bus (see Figure 2).

These substations 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 change to the 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 Summit – Claysburg 115 kV

Item	Description	Conceptual Cost Estimate
1	New 115 kV 3-breaker ring bus termination point at a new interconnection substation.	$2,763,000
2	New 115 kV loop into interconnection substation.	$250,000
3	115 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.

Conceptual Estimate: $3,013,000
Estimated Lead Time: 2.0 years from signed CSA

Option 2 Johnstown – Altoona 230 kV

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.

Conceptual Estimate: $3, 480,000
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 115 or 230 kV line.

R09 – Option #1:

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)

1. The Cooper – Seward 115 kV line is overloaded from 99% to 103% (190 MVA) of its emergency rating (184 MVA) for the **tower** outage of Homer City to Quemahoning and Seward to Tower 230 kV line (Cont Id. 2PN). The R09 project contributes approximately 7 MW to cause this thermal violation. Mitigation of this overload would require the replacement of a line trap at Cooper Substation, having an estimated cost of $115,000.

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)

2. The Hillclay – Hilltop 115 kV line is overloaded at 230% (412 MVA) of its emergency rating (179 MVA) for the **tower** outage of Homer City to Quemahoning and Seward to Tower 230 kV line (Cont Id. 2PN). The R09 project contributes approximately 8 MW to this overload. To mitigate this overload would require the construction of 4.73 miles of NEW transmission line (estimated to cost approximately $2,365,000) and the replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000), two CT circuit (estimated to cost approximately $250,000), a line/wave trap (estimated to cost approximately $115,000), a circuit breaker (estimated to cost approximately $225,000), and substation conductor (estimated to cost approximately $125,000) at Hilltop Substation. The total estimate is $3,160,000.

3. The Hilltop – Rosedale 115 kV line is overloaded at 141% (252 MVA) of its emergency rating (179 MVA) for the **tower** outage of Homer City to Quemahoning and Seward to Tower 230 kV line (Cont Id. 2PN). The R09 project contributes approximately 7 MW to this overload. To mitigate this overload would require the replacement/upgrade of a disconnect switch (estimated to cost approximately $80,000), a CT circuit (estimated to cost approximately $125,000), a line/wave trap (estimated to cost approximately $115,000), and substation conductor (estimated to cost approximately $125,000) at Hilltop Substation. The total estimated cost is $445,000.

4. The Rosedale – Cooper 115 kV line is overloaded at 109% (196 MVA) of its emergency rating (180 MVA) for the **tower** outage of Homer City to Quemahoning and Seward to Tower 230 kV line (Cont Id. 2PN). The R09 project contributes approximately 7 MW to this overload. To mitigate this overload would require the replacement/upgrade of a CT

circuit (estimated to cost approximately $125,000) and a line/wave trap (estimated to cost approximately $115,000) at Cooper Substation. The total estimated cost is $240,000.

5. The R09OPT1 - Summit 115 kV line is overloaded at 223% (400 MVA) of its emergency rating (179 MVA) for the **tower** outage of Homer City to Quemahoning and Seward to Tower 230 kV line (Cont Id. 2PN). The R09 project contributes approximately 34 MW to this overload. To mitigate this overload would require the replacement / upgrade of two disconnect switches (estimated to cost approximately $160,000), the replacement/upgrade of a CT circuit (estimated cost approximately $125,000), the replacement of a circuit breaker (estimated cost approximately $225,000), a line/wave trap (estimated to cost approximately $115,000), and substation conductor (estimated to cost approximately $125,000) at Summit Substation and the building of approximately 1.5 miles of transmission line (estimated cost approximately $750,000). The total estimate is $1,500,000.

Short Circuit

PJM studied the 230kV and above system, and found no breakers to be over-duty as a result of the project. Additional short circuit study will be performed during the System Impact Study phase of the project.

Potential Congestion Issues

There are several wind generation plants proposed in the general area of the Queue Position # R09-Option#1 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 plants are at their maximum out put 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 # R09-Option#1) of potential congestion issues (operational restrictions) that may occur and affect the Queue Position # R09-Option#1 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 # R09-Option#1 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 Altoona – Raystown 230 kV line is overloaded at 139% of its emergency rating (554 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R09 project contributes approximately 10 MW to this overload.

2. The Raystown – Lewistown 230 kV line is overloaded at 139% of its emergency rating (554 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R09 project contributes approximately 10 MW to this overload.

3. The Summit – Q53 115 kV line is overloaded at 120% of its emergency rating (229 MVA) for the outage of Altoona – N39 230 kV line and Altoona 230/46 kV transformer (Cont Id. PN48A). The R09 project contributes approximately 9 MW to this overload.

4. The PhillipsB – Shaw.2 115 kV line is overloaded at 103% of its emergency rating (146 MVA) for the outage of Altoona – Raystown – Lewistown 230 kV line (Cont Id. PN38). The R09 project contributes approximately 7 MW to this overload.

5. The Rockwood – Penn-Mar 115 kV line is overloaded at 210% of its emergency rating (143 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R09 project contributes approximately 5 MW to this overload.

6. The Penn-Mar – Garrett 115 kV line is overloaded at 183% of its emergency rating (167 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R32 project contributes approximately 5 MW to this overload.

7. The Homer City - Shelocta 230 kV line is overloaded at 176% of its emergency rating (854 MVA) for the outage of Erie West – Wayne 345 kV line and Wayne 345/115 kV transformer (Cont Id. PN32). The R09 project contributes approximately 18 MW to this overload.

8. The Shelocta – Keystone 230 kV line is overloaded at 180% of its emergency rating (854 MVA) for the outage of Erie West – Wayne 345 kV line and Wayne 345/115 kV transformer (Cont Id. PN32). The R09 project contributes approximately 22 MW to this overload.

9. The Hooversville – Quemahoning 230 kV line is overloaded at 143% of its emergency rating (312MVA) for the outage of Garrett – Deep Creek – Penn Mar 115 kV line (Cont Id. 585). The R09 project contributes approximately 6 MW to this overload.

10. The Keystone 500/230 kV ckt#3 transformer is overloaded at 207% of its emergency rating (643 MVA) for the outage of Keystone 500/230 kV ckt#4 transformer (Cont Id. PJM31). The R09 project contributes approximately 16 MW to this overload.

11. The Keystone 500/230 kV ckt#4 transformer is overloaded at 209% of its emergency rating (634 MVA) for the outage of Keystone 500/230 kV ckt#3 transformer (Cont Id. PJM30). The R09 project contributes approximately 16 MW to this overload.

12. The Lewistown – Juniata 230 kV line is overloaded at 140% of its emergency rating (617 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R09 project contributes approximately 11 MW to this overload.

13. The Q36 – PhillipsB 115 kV line is overloaded at 137% of its emergency rating (146 MVA) for the outage of Altoona – Raystown – Lewistown 230 kV line (Cont Id. PN38). The R09 project contributes approximately 7 MW to this overload.

14. The Q53 – Westfall 115 kV line is overloaded at 132% of its emergency rating (229 MVA) for the outage of Altoona – N39 230 kV line and Altoona 230/46 kV transformer (Cont Id. PN48A). The R09 project contributes approximately 9 MW to this overload.

15. The Garrette – N33C 138 kV line is overloaded from 99% at 101% of its emergency rating (201 MVA) for the outage of Carlos 138 kV bus (Cont Id. 584). The R09 project contributes approximately 3 MW to cause the thermal violation.

R09 Option #2:

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)

No problems were identified

Short Circuit

PJM studied the 230kV and above system, and found the potential that the Lewistown-Yeagerstown#1 and #2 230kV breakers may be overdutied due to this project. Additional short circuit study will be performed during the System Impact Study phase of the project.

Potential Congestion Issues

There are several wind generation plants proposed in the general area of the Queue Position #R09-Option#2 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 plants are at their maximum out put 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 #R09-Option#2) of potential congestion issues (operational restrictions) that may occur and affect the Queue Position # R09-Option#2 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 # R09-Option#2 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 Altoona – Raystown 230 kV line is overloaded at 141% of its emergency rating (554 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R09 project contributes approximately 17 MW to this overload.

2. The Raystown - Lewistown 230 kV line is overloaded at 140% of its emergency rating (554 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R09 project contributes approximately 17 MW to this overload.

3. The Homer City - Shelocta 230 kV line is overloaded at 177% of its emergency rating (854 MVA) for the outage of Erie West – Wayne 345 kV line and Wayne 345/115 kV

transformer (Cont Id. PN32). The R09 project contributes approximately 20 MW to this overload.

4. The Shelocta – Keystone 230 kV line is overloaded at 180% of its emergency rating (854 MVA) for the outage of Erie West – Wayne 345 kV line and Wayne 345/115 kV transformer (Cont Id. PN32). The R09 project contributes approximately 21 MW to this overload.

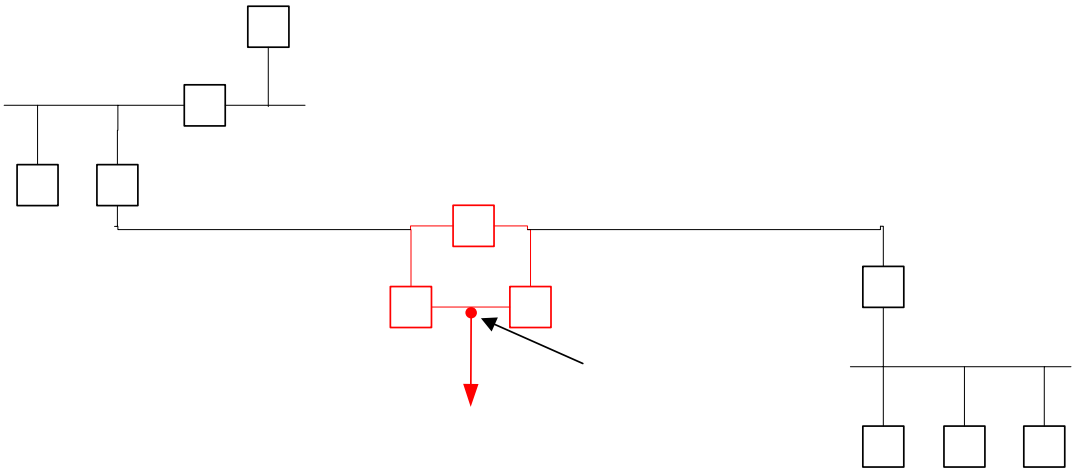
5. The Keystone 500/230 kV ckt#3 transformer is overloaded at 207% of its emergency rating (643 MVA) for the outage of Keystone 500/230 kV ckt#4 transformer (Cont Id. PJM31). The R09 project contributes approximately 10 MW to this overload.

6. The Keystone 500/230 kV ckt#4 transformer is overloaded at 209% of its emergency rating (634 MVA) for the outage of Keystone 500/230 kV ckt#3 transformer (Cont Id. PJM30). The R09 project contributes approximately 10 MW to this overload.

7. The Lewistown – Juniata 230 kV line is overloaded at 141% of its emergency rating (617 MVA) for the outage of Shelocta – Homer CT – Keystone 230 kV line (Cont Id. PN41). The R09 project contributes approximately 14 MW to this overload.

8. The N39 – Altoona 230 kV line is overloaded at 116% of its normal rating (499 MVA) at base case condition. The R09 project contributes approximately 16 MW to this overload.

Figure #1



Option #1

Figure 2