Queue Position # S66 – Downing Avenue 115 kV

Network Impacts

The Queue S66 project was studied as a 96 MW tire fired, steam turbine facility with injection at two distinct Points of Interconnection in the Penelec system. One Point of Interconnection must be chosen for study during the System Impact Study for this proposed project. Option#1 injects into the Downing Ave 115 kV substation, while option#2 injects into the Erie South 230 kV substation. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2012. Note the Warren-Falconer 115 kV line was modeled as normally open and Garrett 138/115 kV transformer was modeled in-service. Potential network impacts were as follows:

Direct Connection

Two Points of Interconnection were considered. Option #1 proposes the project be connected on the 115 kV system. This would require a new 115 kV 4-breaker ring bus be constructed at the existing Downing Avenue Substation and construction of approximately 0.5 miles of 115 kV transmission line from Downing Avenue Substation to the generation plant. See Figure #1.

Option #2 proposes the project be connected on the 230 kV system. This would require a new 230 kV breaker and line exit be constructed at the existing Erie South Substation and construction of approximately 5.0 miles of 230 kV transmission line from Erie South Substation to the generation plant. See figure #1.

The proposed interconnection facility must be designed in accordance with the FirstEnergy "Requirements for Transmission Connected Facilities" document.

http://www.firstenergycorp.com/feconnect/Requirements_for_Transmission_Connected_Facilities.html

Following 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 – 115 kV at Downing Avenue substation

Item	Description	Conceptual Cost Estimate
1	Construction of 115 kV 4-breaker ring bus at existing Downing Avenue substation to serve as interconnection substation	$3,350,000
2	115 kV loop into interconnection substation	$250,000
3	Transmission line extending from Downing Avenue Substation to the generation plant (approximately 0.5 miles of 115 kV line).	N/A Developer cost. Line built, owned and maintained by the developer.
4	Relay and control work at remote terminals.	$500,000

Conceptual Estimate: **$4,100,000**
Estimated Lead Time: 2.0 years from signed ISA

Option 2 – 230 kV at Erie South substation

Item	Description	Conceptual Cost Estimate
1	230 kV connection at existing Erie South substation.	$1,500,000
2	Transmission line extending from the Erie South substation to the generation plant (approximately 5 miles of 230 kV line).	N/A Developer cost. Line built, owned and maintained by the developer. (FE would estimate this line extension to be in the neighborhood of $5,000,000) (See note 2 on figure #1)

Conceptual Estimate: **$6,500,000**
Estimated Lead Time: 2.0 years from signed ISA

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 transmission line.

Option 1 & 2

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

None identified

Multiple Facility Contingency
(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

None 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. Contribution of 6 MW further overloads the S44Copt1 - Juniata 230 kV line from 109% to 110% of its emergency rating (617 MVA) for the **generator** outage of Fordmill90 and Fordmill91 generators at buses 4565 & 4569 (Cont Id. PE506).

2. Contribution of 13 MW further overloads the Homer City – Shelocta 230 kV line from 106% to 107% of its emergency rating (909 MVA) for the **tower** outage of Dauphin-Hummelstown 230 kV line & Dauphin T1 & Dauphin-Juniata 230 & Dauphin T2 (Cont Id. 17_PPL).

3. Contribution of 12 MW further overloads the Shelocta – Keystone 230 kV line from 105% to 106% of its emergency rating (854 MVA) for the **tower** outage of Juniata – Lewistown and Juniata – Dauphin 230 kV line (Cont Id. 20PPL).

New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation)

None identified

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 Impact Study)

4. S44Copt1-Juniata 230 kV Upgrade – To mitigate this overload would require the reconductor/upgrade of approximately 23.64 miles of 230 kV transmission line between Juniata and the S44 Option 1 interconnection substation (estimated to cost approximately $11,820,000) and the replacement/upgrade of a disconnect switch at Juniata substation, which should be confirmed with PP&L..

5. Homer City- Shelocta 230 kV Upgrade – To mitigate this overload would require the reconductor/upgrade of approximately 10.73 miles of 230 kV transmission line (estimated to cost approximately $5,365,000)and replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000) at Shelocta substation and the replacement/upgrade of a CT circuit (estimated to cost approximately $140,000), a line/wave trap (estimated to cost approximately $125,000), and a circuit breaker (estimated to cost approximately $425,000) at Homer City Substation.

6. Shelocta-Keystone 230 kV Upgrade - To mitigate this overload would require the replacement/upgrade of a disconnect switch (estimated to cost approximately $85,000) at Shelocta substation and the replacement/upgrade of a CT circuit (estimated to cost approximately $140,000), and disconnect switch (estimated to cost approximately $85,000) at Keystone Substation.

Short Circuit

PJM analysis found no new breakers to be over-duty in First Energy's transmission area. The study also showed no significant fault current contribution to any breakers which have already been identified as over-duty. This study was performed on the 230kV and above system.

Additional short circuit study will be conducted during the System Impact Study.

Delivery of Energy Portion of Interconnection Request
PJM also studied the delivery of the energy portion of this project in conjunction with other Energy Resources. Any problems identified below may 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. **The upgrades listed below are not required reliability upgrades.**

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

7. The Homer City-Shelocta 230 kV line loads from 121% (865 MVA) to 122% (877 MVA) of its normal rating (718 MVA) under normal operating conditions. Project S66 contributes approximately 11 MW to the facility loading. To mitigate this overload would require the upgrades identified for item #5 and the replacement/upgrade of a disconnect switch at Homer City Substation (estimated to cost an additional $85,000.)

8. The Juniata-S44 230 kV line loads from 105% (521 MVA) to 106% (527 MVA) of its normal rating (499 MVA) under normal operating conditions. Project S66 contributes approximately 5 MW to the facility loading. This overload would mitigated by the upgrades identified for item # 4.

9. The Shelocta-Keystone 230 kV line loads from 117% (809 MVA) to 118% (820 MVA) of its normal rating (694 MVA) under normal operating conditions. Project S66 contributes approximately 11 MW to the facility loading. To mitigate this overload would require the upgrades identified for item #6 and the upgrade/reconductor of approximately 2.26 miles of transmission line (estimated to cost an additional $1,130,000.)

10. The Keystone 500/230 kV transformer #3 loads from 107% (690 MVA) to 109% (699 MVA) of its emergency rating (643 MVA) for the outage of the Keystone 500/230 kV #4 transformer. Project S66 contributes approximately 9 MW to the contingency facility loading. The upgrade is a replacement of the existing 500-230 kV transformer with a new transformer. It is estimated that this upgrade will cost $5,500,000 and take approximately 2 years to complete.

11. The Keystone 500/230 kV transformer #4 loads from 109% (688 MVA) to 110% (697 MVA) of its emergency rating (643 MVA) for the outage of the Keystone 500/230 kV #3 transformer. Project S66 contributes approximately 9 MW to the contingency facility loading. The upgrade is a replacement of the existing 500-230 kV transformer with a new transformer. It is estimated that this upgrade will cost $5,500,000 and take approximately 2 years to complete.