PJM Generator Interconnection Request
Queue #Q59
S. Reading-Birdsboro (Pioneer Landfill) 69kV
Feasibility/Impact Study Report

September 2006
#387623

S. Reading-Birdsboro (Pioneer Landfill) 69kV (Q59) Feasibility/Impact Study

General

G.A.S.-Access Pioneer Crossing Energy, LLC has proposed a project consisting of four 1600 kW Caterpillar G3520C generators (a fifth generator may be added in the future) to be installed at the Pioneer Crossing Landfill in Birdsboro, Berks County, Pennsylvania that will use landfill gas (methane) as fuel. The queue request was originally for nine – 1 MW units. This project has been assigned position Q59 in the PJM Generation Interconnection Queue. The project is to be evaluated as a capacity resource. The proposed in-service date is June 30, 2007.

The intent of the feasibility / impact study is to determine system reinforcements and associated costs and construction time estimates required to facilitate the addition of the new generating plant to the transmission system. The reinforcements include the direct connection of the generator to the system and any network upgrades necessary to maintain the reliability of the transmission system.

Direct Connection

The generators are to be connected to the Metropolitan Edison system by a tap to the existing 817 69 kV circuit (see Figure #1). The 817 line connects the South Reading and Birdsboro 69kV substations.

A 3-way, SCADA controlled switch and approximately 500 foot long line extension will be installed at the interconnecting point on the 817 69kV circuit and a direct transfer trip (DTT) scheme will be installed to trip the proposed generators whenever the South Reading and Birdsboro 817 69 kV substation breakers open. In addition, to accommodate the addition of the generators on the 817 69kV line the protective relays at the terminals need to be replaced.

The FE direct connection and system upgrade costs (excluding CIAC and taxes) are estimated as:

- South Reading Substation – Install DTT to Pioneer Crossing Substation: (Upgrade # n0452) **$65,000**

- Birdsboro Substation – Install DTT to Pioneer Crossing Generation Substation: (Upgrade # n0453) **$65,000**

- Replace relays on the Birdsboro terminal of the 817 69 kV line. (Upgrade #n0455) **$70,000**

- 69 kV Trans. Tap – Install 3-way SCADA controlled motor operated switches (Upgrade #n0456) **$215,000**

- 69 kV Trans. Tap – Install an estimated 500ft 69kV extension to the generation. **$80,000**

- Pioneer Crossing Gen Sub – Substation, metering, SCADA & protection checkout: **$15,000**

The total estimated cost for the direct connection facilities to be supplied by FirstEnergy/Jersey Central is estimated to be **$510,000** and it is estimated that it will take 9 months to design and install the above facilities from the signing of an Interconnection or Construction Service Agreement.

Details of FirstEnergy Work

South Reading*:*

(1) RFL 9745 Teleprotection Channel. RFL Part No. "TSHK65500X". 2 tone audio, 125 VDC, single I/O relay/solid state, test panel option. To be used for dual channel transfer trip from South Reading to Pioneer Crossing over a leased line telephone circuit.

Birdsboro*:*

(1) RFL 9745 Teleprotection Channel. RFL Part No. "TSHK65500X". 2 tone audio, 125 VDC, single I/O relay/solid state, test panel option. To be used for dual channel transfer trip from Birdsboro to Pioneer Crossing over a leased line telephone circuit.
(2) SEL 321-1 Phase, Ground Distance, and Directional Overcurrent Relay. Model # 321113256HGB3X4. To be used for primary line relay protection.
(3) NXTPHASE Line Protection Relay. To be used for back-up line protection and reclosing. Model # 2100.
(4) SEL 501 Overcurrent Relay. To be used for breaker failure.
(5) Bitronics Multicom Meter. Model No. MTWIE1B-VD4A (Specify protocol compatible with SCADA).

The Interconnection Customer will be responsible for:

Meeting all criteria as specified in the applicable sections of the FE "Requirements for Transmission Connected Facilities" document including and for providing the facilities listed below:

Pioneer Crossing

- (2) RFL 9745 Teleprotection Channel. RFL Part No. "TSHK65500X". 2 tone audio, 125
  VDC, single I/O relay/solid state, test panel option. To be used for dual channel transfer trip from South Reading and Birdsboro to Pioneer Crossing over a leased line telephone circuit. Devices to trip high side transformer breaker.

- Transformer 69 kV Terminal
  Install 3 Potential Transformers or CCVT's with dual secondary windings. Primary winding connected Grounded Wye.

  Secondary winding X connected grounded wye to detect under-frequency, overfrequency, undervoltage and overvoltage conditions. Devices to trip high side transformer breaker after a time delay. A separate time delay is to be used for abnormal frequency tripping and abnormal voltage tripping.

Secondary winding Y connected Open Corner Delta for use as a ground detection scheme. Devices to trip high side transformer breaker.

- Purchase and installation of the 69 kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based upon the customer load and generation levels. FE will provide the meter socket for installation by the customer and will supply and install the meter.

- Supervisory control (RTU) and data acquisition (SCADA) equipment to provide information in a compatible format to the FE System Control Center.

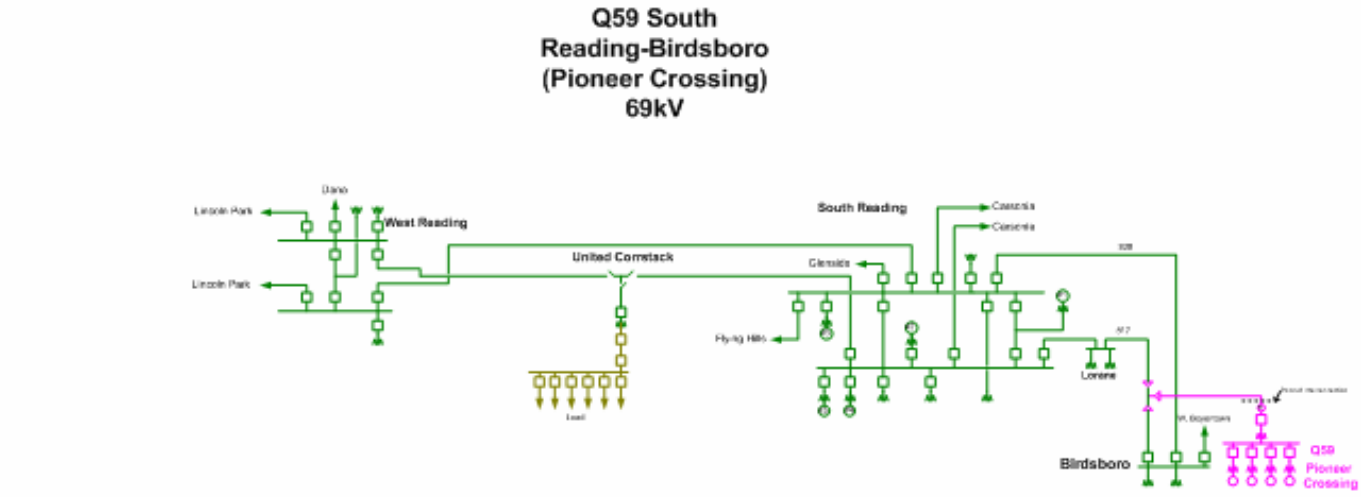
- The communications circuits for the plant's SCADA to FirstEnergy and PJM and for the transfer trip between the plant and FirstEnergy.

Note: It will also be necessary to install a synchronizing relay on the generator breakers in order to parallel the generators with the FirstEnergy system.

Station Service

This can be accomplished with a bi-directional meter and a separate contract with Met-Ed. If an additional interconnection is required for station service a separate Met-Ed contract subject to Reserve Capacity rate considerations would be needed.

Figure #1



Network Impacts

The #Q59 project was studied as an injection of 9 MW into a tap of the Birdsboro – South Reading 69 kV circuit. Project #Q59 was evaluated for compliance with reliability criteria for summer peak conditions in 2008. Potential network impacts were as follows:

Generator Deliverability

No identified problems

Multiple Facility Contingency – Tower Line Outages
No identified problems

Contribution to Previously Identified Overloads
None

Short Circuit
No identified problems

Stability
No analysis required

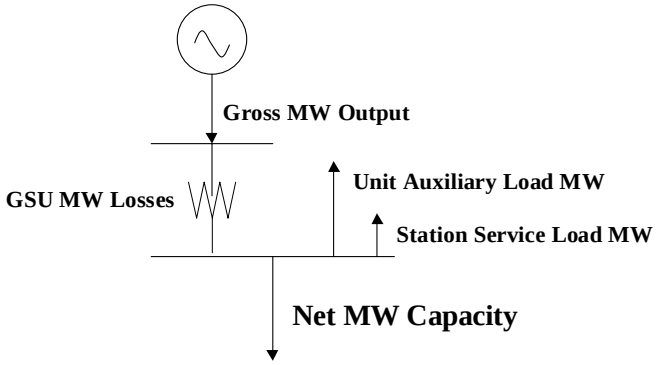
New System Reinforcements
None

Contribution to Previously Identified System Reinforcements
None

Cost Allocation
The Q59 project is responsible for 100% of the cost of the attachment facilities estimated to be **$95,000**. The Q59 project is also responsible for 100% of the cost of the network upgrades estimated to cost **$415,000**.

ATTACHMENT #2

Unit Capability Data



Net MW Capacity = (Gross MW Output - GSU MW Losses* – Unit Auxiliary Load MW - Station Service Load MW)

Queue Letter/Position/Unit ID: _____Q59(4 units each of 1.6 MW)

Primary Fuel Type: _____ Landfill Gas (Methane)

Maximum Summer (92º F ambient air temp.) Net MW Output**: _____6.4

Maximum Summer (92º F ambient air temp.) Gross MW Output:_____6.4

Minimum Summer (92º F ambient air temp.) Gross MW Output: _____

Maximum Winter (30º F ambient air temp.) Gross MW Output: _____

Minimum Winter (30º F ambient air temp.) Gross MW Output: _____

Gross Reactive Power Capability at Maximum Gross MW Output – Please include Reactive Capability Curve (Leading and Lagging): _____

Individual Unit Auxiliary Load at Maximum Summer MW Output (MW/MVAR): ____

Individual Unit Auxiliary Load at Minimum Summer MW Output (MW/MVAR): _____

Individual Unit Auxiliary Load at Maximum Winter MW Output (MW/MVAR): _____

Individual Unit Auxiliary Load at Minimum Winter MW Output (MW/MVAR): _____

Station Service Load (MW/MVAR): _____

* GSU losses are expected to be minimal.

** Your project's declared MW, as first submitted in Attachment N, and later confirmed or modified by the Impact Study Agreement, should be based on either the 92º F Ambient Air Temperature rating of the unit(s) or, if less, the declared Capacity rating of your project.

Unit Generator Dynamics Data

Queue Letter/Position/Unit ID: _____Q59

MVA Base (upon which all reactances, resistance and inertia are calculated): _____ 2

Nominal Power Factor: _____0.80

Terminal Voltage (kV): _____0.480

Unsaturated Reactances (on MVA Base)

- Direct Axis Synchronous Reactance, $X_{d(i)}$: _____1.684
- Direct Axis Transient Reactance, X'd(i):_____0.226
- Direct Axis Sub-transient Reactance, X"d(i): _____0.139
- Quadrature Axis Synchronous Reactance, Xq(i): _____0.92
- Quadrature Axis Transient Reactance, X'q(i):_____N/A
- Quadrature Axis Sub-transient Reactance, X"q(i): _____0.139
- Stator Leakage Reactance, Xl: _____N/A
- Negative Sequence Reactance, X2(i): _____0.139
- Zero Sequence Reactance, X0: _____0.009

Saturated Sub-transient Reactance, X"d(v) (on MVA Base):_____N/A

Armature Resistance, Ra (on MVA Base): _____N/A

Time Constants (seconds)

- Direct Axis Transient Open Circuit, T'_{do}: _____3.629
- Direct Axis Sub-transient Open Circuit, T''_{do}:_ _____0.017
- Quadrature Axis Transient Open Circuit, T'_{qo}:_ _____N/A
- Quadrature Axis Sub-transient Open Circuit, T''_{qo}: _____0.012
- Inertia, H (kW-sec/kVA, on KVA Base): _____N/A

Speed Damping, D:_____N/A

Saturation Values at Per-Unit Voltage [S(1.0), S(1.2)]: _____N/A

Units utilize a *Generator model*

Unit GSU Data

Queue Letter/Position/Unit ID: Q59
Generator Step-up Transformer MVA Base: 1.50
Generator Step-up Transformer Impedance (R+jX, or %, on transformer MVA Base): 5.75%
Generator Step-up Transformer Reactance-to-Resistance Ration (X/R): N/A
Generator Step-up Transformer Rating (MVA): 2
Generator Step-up Transformer Low-side Voltage (kV): 0.480
Generator Step-up Transformer High-side Voltage (kV): 13.2
Generator Step-up Transformer Off-nominal Turns Ratio: N/A
Generator Step-up Transformer Number of Taps and Step Size: N/A

Main Step-Up Transformer Data

Queue Letter/Position/Unit ID: Q59
Generator Step-up Transformer MVA Base: 10
Generator Step-up Transformer Impedance (R+jX, or %, on transformer MVA Base): 8%
Generator Step-up Transformer Reactance-to-Resistance Ration (X/R): N/A
Generator Step-up Transformer Rating (MVA): 10
Generator Step-up Transformer Low-side Voltage (kV): 13.2
Generator Step-up Transformer High-side Voltage (kV): 69
Generator Step-up Transformer Off-nominal Turns Ratio: N/A
Generator Step-up Transformer Number of Taps and Step Size: H.V. +/-5%, +/-2.5%