

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position X4-042***

Footedale 12kV

August 2012

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, 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 feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

The Interconnection Customer (IC) has proposed a landfill gas generating facility located at Fayette County in McClellandtown, Pennsylvania. The installed facilities will have a total capability of 3.0 MW with 3.0 MW of this output being recognized by PJM as capacity. This means that the remaining 0 MW will be curtailable should a system reliability constraint occur. The proposed in-service date for this project is May 2013. **This study does not imply a First Energy commitment to this in-service date.**

Point of Interconnection

X4-042 will interconnect with the West Penn Power distribution system at one of two options.

Option 1 is to connect via a tap of the 12 kV distribution line along McClellandtown Road on the Footedale feeder at location 5.0 miles from the Footedale substation in McClellandtown, Fayette County, Pennsylvania.

Option 2 is to connect via a tap of the 25 kV distribution line approximately one mile from the developer's site.

Cost Summary

The X4-042 project will be responsible for the following costs:

Description	Total Cost
Transmission Owner facilities	\$ 651,747
Transmission Upgrades	\$ 0
Total Costs	\$ 651,747

Transmission Owner Scope of Work

Generator Protective Equipment

The Interconnection Customer shall design a protective scheme that will provide the protective functions compliant with the inverter standard UL1741 and IEEE 1547 “Standard for Interconnecting Distributed resources with Electrical Power Systems”, in addition to the power quality standards defined by Reliability First and PJM. The Interconnection Customer shall also submit their protective scheme to West Penn Power (“WPP”) Engineering for review & acceptance. The submittal shall include a single line drawing showing the location of instrument transformers (current and voltage), the location of the relays, breakers and fuses and indicate the manufacturer and model number of each type of device. Breaker data shall include continuous and interrupting ampere ratings. If relays are used, they are to indicate function, the tripping source and its voltage.

Point of Interconnection

As defined by the Interconnection Customer and shown on Attachment 1, the connection point for the Footedale 12 kV (X4-042) Project will be from a tap of the 12kV distribution line along McClellandtown Road on the Footedale Feeder at location WPP Pole #532697 in McClellandtown, Fayette County, Pennsylvania.

This area is presently served by the Footedale distribution circuit a three phase 12.47 kV grounded Wye distribution circuit originating from WPP’s Footedale substation located about 5.0 miles from the proposed site.

Circuit Protection and Coordination

Main Line:

Line balancing and removal of capacitor is necessary to eliminate overloads and overvoltage.

At Substation:

No violations identified.

New System Reinforcements

Upgrade existing open-wye section of circuit to 3-phase by installing a third phase wire approximately 2.2 miles from WPP Pole #55381 to Pole #532697.

Three voltage regulators will need to be installed in order to regulate voltage from the generator.

Upgrade overcurrent protection equipment on circuit for adequate loading and coordination. This will include replacing three single phase hydraulic circuit reclosers with an electronic recloser. Replace three fuses at WPP Pole #55551 with three single phase 200amp reclosers and replace three fuses at WPP Pole #541611 with three single phase 140amp reclosers.

10 tap lines will need phasing switched and a capacitor bank removed.

Taps to change are:

WPP Pole #	Phase From	Phase To
276195	C	A
24293	C	A
UF280	A	B
PDLJ139	C	B
404014	A	B
FLL167	A	C
119788	C	B
99409	B	A
541630	B	C
UF259	C	A

The 600 kVAR capacitor will be removed at WPP Pole #54437. A switched capacitor will be installed in its place.

Attachment Facilities

Interconnection of this facility will include installing a primary metering system at location 532697 along McClellandtown Road as shown in Attachment 2.

At Footedale SS, installation of DTT facilities is also required.

The Interconnection Customer will have an estimated cost responsibility for the direct connection of the Footedale 12kV (X4-042) Project to the WPP distribution system of \$483,851 as shown in Attachment 2. This cost includes CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of \$167,896.

Interconnection Customer Requirements

Compliance Issues

The Interconnection Customer will be responsible for meeting all FE criteria as defined in the FE Requirements for Distribution Connected Facilities document:

www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

The Interconnection Customer will also be responsible for following the requirements of the “FirstEnergy Wholesale Generation interconnection (WGI) Manual” and the “FE Approved Vendors and Contractors” documents which are also located at the above link.

The Interconnection Customer must also meet all PJM, ReliabilityFirst and NERC reliability criteria and operating procedures required for standards compliance. For example, the

Interconnection Customer will need to properly locate and report the over and under-voltage and over and under-frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

Other Requirements

In addition to the FE Facilities, the Interconnection Customer will also be responsible for meeting all criteria as specified in the applicable sections of the FE “Technical Requirements For The Interconnection of Customer-Owned Generation To The FirstEnergy Distribution System” document including:

1. The purchase and installation of a fully rated circuit breaker on the high side of the X4-042 step-up transformer.
2. The purchase and installation of a lockable load-break switch at the point of interconnection. This switch must be accessible by FirstEnergy.
3. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
4. The purchase and installation of a 25kV interconnection metering instrument transformer. FE will provide the ratio and accuracy specifications based on the customer load and generation levels.
5. The purchase and installation of a revenue class meter for each unit to measure the power delivered in compliance with the FE standards.
6. The installation of two independent high-speed zones of protection to sense and clear faults on the interconnection transformer.
7. The purchase and installation of supervisory control and data acquisition (SCADA) equipment to provide information in a compatible format to the FE Transmission System Control Center. The RTU, the communications channel and all related equipment will be furnished and maintained by the Interconnection Customer. The RTU must communicate with the FirstEnergy EMS via DNP 3.0 protocol.
8. The following control, status, and metering points will be required:
 - a. Interconnection breaker position status and trip control.
 - b. Generator real and reactive power output measured at the high-side of the generator step-up transformer.
 - c. Generator voltage at the point of interconnection.
 - d. Indication that a direct-transfer trip operation has occurred where DTT is used.

9. The establishment of dedicated communication circuits for SCADA report to the FE Transmission System Control Center.
10. A compliance with the FE and PJM generator power factor and voltage control requirements.
11. The execution of a back-up service agreement to serve the customer load supplied from the X4-042 12 kV interconnection substation when the units are out-of-service. This assumes the intent of the Interconnection Customer is to net the generation with the load.
12. A provision of the necessary generator protection, synchronization controls, and fault detection to initiate a trip to protect the Footdale 12 kV (X4-042) generation project.
13. A compliance with the PJM Manuals and Operating instructions to have a plant operator on call 24/7 to respond within a minute to reduce the output of the Footdale 12 kV (X4-042) generation project when network constraints occur.
14. A compliance with the inverter standard UL1741 and IEEE 1547, “Standard for Interconnecting Distributed Resources with Electrical Power Systems”, in addition to the power quality standards defined by ReliabilityFirst and PJM.
15. The rough grade of the property for the X4-042 12 kV interconnection substation and an access road for the delivery of equipment to this site.

The above requirements are in addition to any metering or other requirements imposed by PJM.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC’s generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

First Energy Requirements

The Interconnection Customer will be required to comply with all FE Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the “FirstEnergy Requirements for Transmission Connected Facilities” document located at the following links:

<http://www.firstenergycorp.com/feconnect>

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

Summary

The estimated cost of the Direct Connection facilities is \$483,851 as shown in Attachment 2. This cost includes CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge of \$167,896. This tax may or may not be charged based on whether or not the project meets the eligibility requirements of IRS Notice 88-129.

Based on the scope of the direct connection, it is expected to take a minimum of six (6) to seven (7) months from the date of a fully executed Interconnection Agreement (“IA”) and Construction Agreement (“CA”) and full payment of the estimated project costs to complete the installation required for the Project. WPP estimates two (2) months after receipt of the IA/CA and estimated costs for design work to be completed and an additional four (4) to five (5) months to complete the identified infrastructure upgrades. It also assumes that the Interconnection Customer will provide all right-of-way, permits, easements, etc. that will be needed for the interconnection of project X4-042. A further assumption is that there will be no environmental issues associated with this project, that there will be no delays in acquiring any necessary permits for implementing the defined direct connection, and that PJM will allow all transmission system outages when requested.

Note that the WPP findings were made from a conceptual review of this project. A more detailed review of the connection facilities and their cost will be identified in the System Impact Study. Further note that the cost estimate data contained on this document should be considered only a ballpark estimate since it was produced without a detailed engineering review. The Interconnection Customer will be responsible for the actual cost of construction. WPP herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any connections to the distribution system.

Network Impacts

The Queue Project #X4-042 was studied as a 3.0 MW (Capacity 3.0 MW) injection in the APS area. Project #X4-042 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Option 1 – 12 kV Tap & Option 2 – 25 kV Tap

Generator Deliverability

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

None.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

None.

Short Circuit

(Summary of impacted circuit breakers)

None.

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)

None.

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

To be determined.

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

Not required.

New System Reinforcements

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

None.

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)

None.

Potential Congestion due to Local Energy Deliverability

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 developer 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 overload conditions associated with the overloaded element(s) identified.

None.

Attachment 1

System Configuration

Attachment 2

Footedale 12 kV (X4-042) Project Costs

Item	Description
1.	Upgrade approximately 2.2 miles of open-wye to 3-phase from 55381 to 532697
2.	Install three voltage regulators near POI
3.	Upgrade circuit overcurrent protection
4.	Tap line changes at WPP Pole #s 276195, 24293, UF280, PDLJ139, FLL167, 404014, 119788, 99409, 541630, UF259.
5.	Replace capacitor at WPP Pole #54437
6.	Install 12kV net meter facility near WPP Pole #532697
7.	Install DTT facilities at Footedale SS
	<p style="text-align: right;">Direct Connection Costs: \$483,851 <u>Taxes (if applicable): \$167,896</u> Total Estimated Costs: \$651,747</p>