

***Generation Interconnection
Facilities Study Report***

For

***PJM Generation Interconnection Request
Queue Position X3-015***

“West Cambridge-Vienna 69 kV”

September 2014

A. Transmission Owner Facilities Study Summary

1. Description of Project

OneEnergy Dorchester, LLC, the Interconnection Customer (IC), has proposed a 19.5 MWE (7.4 MWC; 19.5 MW MFO) solar powered generating facility to be located in Linkwood, Dorchester County, Maryland. PJM studied X3-015 as a 19.5 MW injection into the Delmarva Power and Light (DPL) system as a 50% tap of the West Cambridge-Airey 69 kV circuit and evaluated the project for compliance with reliability criteria for summer peak conditions in 2015. The original planned in-service date, as stated in Attachment N, was December 31, 2012. That date was subsequently revised to December 31, 2015.

2. Amendments to the System Impact Study or System Impact Study Results

The scope of the project has remained relatively unchanged from the System Impact Study. The estimates have been refined based on current material and construction costs. The schedule has been adjusted to meet a standard construction schedule.

The DPL portion of the project is projected to be completed approximately 24-30 months following a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (ICSA). This timeframe assumes a normal land use and environmental permitting and approval process.

3. Interconnection Customer's Milestone Schedule

The planned in-service date of December 31, 2015 *cannot* be met due to the length of time required to construct the Interconnected Transmission Owner facilities. The in-service date will need to be changed to reflect the estimated construction completion time of 24-30 months after receipt of a fully executed Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (CSA).

4. Customer's Scope of Work

The IC assumes full responsibility for design and construction of all facilities associated with the X3-015 generating facility on the IC side of the Point of Interconnection. Site preparation including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report and is the responsibility of the IC. The developer shall supply adequate, buildable high land with access roads for the installation of the substation at no cost to the Company. All applicable permitting, zoning and land use approvals will be obtained by the developer for DPL's proposed substation. DPL will apply for its own building permit for the facilities within its substation fence.

The IC currently plans to interconnect X3-015 with the DPL system via a 69 kV circuit from their substation to the newly constructed DPL 69 kV ring bus substation. The IC is required to construct a 69 kV breaker, which it will own, no more than 500 feet from the Point of Interconnection. Information detailing the interconnection to DPL facilities is outlined in the "Technical Considerations Covering Parallel Operations of Customer Owned Generation Of One (1) Megawatt or Greater And Interconnected with the PHI

Power Delivery System.” The costs outlined in this study do not include construction of the 69 kV equipment from the generating facility to the tap structure.

The IC is responsible for construction of single mode fiber optic cable from the generating site to the POI.

The IC will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM at the POI. The 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. Protective relaying and metering design and installation must comply with the DPL/PHI Applicable Standards. See Section B.5 of this report for further details. The IC will purchase and install all metering instrument transformers as well as construct a metering structure per PHI standards.

The IC is responsible for obtaining all rights necessary for their facilities, up to and including any usage of property in which Pepco Holdings, Inc. may have real property interests. As part of this process, the IC shall provide, for PHI review, surveyed site plans that delineate their intended facilities, and clearly define the facilities relationship to existing rights of way and the electrical facilities contained therein. Upon review, subsequent approval, if acceptable, and associated compensation, PHI will provide the IC with the appropriate legal instrument affording the IC the right to use PHI real property, if necessary.

DPL will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by either a generator breaker, a line recloser, or other method depending upon the specific circumstances and the evaluation of the Company.

The delta high side winding of the customer’s proposed interconnection transformer requires additional measures in order to prevent Temporary-Over-Voltage (TOV) from accidental islanding. Three phase voltage sensing must be done at the Point of Interconnection . Three phase voltage sensing must be installed at the 69 kV side of the generator's transformer. PT’s cannot be installed on lower voltage bus.

Inverter Requirements

This section contains setting requirements for the operation of the Interconnection Customer’s proposed equipment.

The inverter at the DG location shall have the following capabilities:

- Voltage flicker reduction through dynamic VAR response
- Ramp rate control
- SCADA communications
- Curtailment or other mitigation ability if high voltage were to occur
- Low voltage and system disturbance ride through

- Ability to receive and respond to a transfer trip or SCADA signal

The inverter shall operate in accordance with the IEEE 1547 series of standards that have been approved. While inverters should be capable of voltage stabilization thru dynamic VAR response and capable of low voltage and system disturbance ride through, neither of these capabilities shall be implemented until such time that the IEEE 1547 series of standards are revised and approved to include standards for these capabilities. At such time as these revised standards become available, the PV owner/operator shall cooperate with the Company to implement these capabilities with settings acceptable to the Company. Until such time, the inverters shall be capable of operating at a fixed power factor value between 0.95 lead and 0.95 lag as specified by the Company. The value is supplied below:

1. Operate inverters at unity power factor (“PF”)

Note: In the future, the company reserves the right to issue new fixed power factor setting requirements (0.95 lead to 0.95 lag) if necessary.

It is the responsibility of the owner to secure the inverter from any unauthorized access (including physical and remote access) which could alter settings or adversely affect the inverter’s ability to operate as required. Security measures should include utilizing secure password settings and/or physical locks on cabinet doors.

5. Description of Facilities Included in the Facilities Study (DPL’s Scope of Work)

This report describes the electrical interconnection facilities and upgrades to existing DPL facilities necessary at the new three breaker ring bus substation to support the IC’s generation. The IC’s interconnection circuit construction and the IC’s generation facilities are not included in this study.

Attachment Facilities – PJM Network Upgrade Number (n3315)

- Design and construct a new 69 kV three breaker ring bus substation at the generation site. This substation will be built to the Company’s (the “Company” referring to ACE, DPL, or PEPCO) specifications for a transmission substation and be owned and operated by the Company. The substation will consist of a three breaker ring bus and associated relaying, communications equipment and a control house. The Interconnection Customer shall supply adequate, buildable high land with access roads for the installation of the substation at no cost to the Company. All applicable permitting will be obtained by the developer for the proposed substation.
- Create a transmission loop by cutting the West Cambridge - Vienna 69 kV circuit into and out of the newly constructed 69 kV substation at the generation site.

- Install necessary protection and communication upgrades at the West Cambridge substation and at the Vienna substation to coordinate and communicate with the new substation.
- DPL reserves the right to review the electrical protection design and relay settings for interconnecting customer facilities to ensure that the protective relaying equipment will be compatible with that installed at the remote substations. DPL personnel must be present at the time of commissioning to witness proper function of the protection scheme and related coordination.
- A three phase 69 kV revenue metering point needs to be established on the generation side of the IC facility just inside the disconnect switch at the POI. See Section B.5 of this report for IC's scope of work.

6. Total Cost of Transmission Owner Facilities Included in the Facilities Study

Attachment Facilities (PJM Network Upgrade n3315)	\$3,654,303
Attachment Facilities with 15% Contingency	\$4,202,448

7. Summary of the Schedule for Completion of Work for the Facilities Study

The overall estimated timeline for this project is approximately 24-30 months from the date of the PJM release for design/construction. This timeline may be able to be improved with preferred system outages. Since the IC owns the land for the substation and will be performing the land use and environmental permitting for the generator and substation site, the timeline may also be able to be improved with favorable permitting timelines.

Attachment Facility

Substation Design, Procurement and Construction	24-30 months
Transmission Design, Procurement and Construction	24 months
Environmental Permitting	6 months
Outside Plant Comm. Design, Procurement and Construction	12 months
Real Estate	9 months

B. Transmission Owner Facilities Study Results

This section describes facilities identified to be installed, replaced, and/or upgraded by DPL to accommodate the project. During detailed design and analysis other components may be identified for installation or replacement due to this interconnection.

1. Transmission Lines - New

Not applicable

2. Transmission Line – Upgrades

The Tap scope of work listed above on the West Cambridge to Vienna 69 kV line includes the following major equipment:

- Install four (4) steel direct embedded transmission poles, approximately 75’
- Install two (2) self-supporting steel poles with anchor bolt foundations
- Install one (one) steel switch pole for the feed from the Solar facility
- Install 954 ACSR conductor for the two taps into the station, approximate linear distance of 600’
- Install 0.638” OPGW into the station on each tap
- Install insulators and other associated hardware for the tap

All transmission line construction will be designed according to “PJM Transmission and Substation Design Subcommittee Technical Requirements”.

3. New Substation/Switchyard Facilities

A new 69 kV three breaker ring bus substation will be designed and constructed by DPL at the project site. The substation will consist of a three breaker ring bus including three new 69 kV, 2000A, 40kA power circuit breakers with related disconnect switches, structures and foundations; two new line terminals with disconnect switches, surge arresters, capacitor voltage transformers, structures and foundations; one interconnection bus position with a disconnect switch, capacitor voltage transformers, structures and foundations; a pre-fabricated control house with relay, control and communication panels, ground grid, conduit, cable trough, roadway, fence and stoning. At the new substation, the following major equipment items will be installed:

- 3 – 69 kV 2000A, 40 kA circuit breakers
- 8 – 69 kV 2000A disconnect switches
- 1 – 69 kV, 1200A disconnect switch
- 9 – 69 kV CVT’s
- 3 – Breaker control/breaker failure protection panels
- 2 – Front line & back up transmission line relaying protection panels
- 1 – Front line & back up bus relaying protection panel
- 1 – supervisory panel (Orion LX and ethernet switch)
- 2 – Galvanized steel line take-off towers
- 1 – Pre-fabricated control house with AC and DC auxiliary systems
- Lot – control cable
- Lot – station ground conductor and connectors
- Lot – foundations and structures for above mentioned equipment
- Lot – conductors, connectors, and insulators for the bus systems
- Lot – cable trench and conduit for new raceway systems

Drawing Review and Relay test:

DPL will review the IPR cabinet drawing PRIOR TO THE PURCHASE OF EQUIPMENT then test for proper relay operation after installation of the required protection equipment at IC site.

4. Upgrades to Substation/Switchyard Facilities

At Vienna Substation – Install the necessary new relay, protection and communications equipment to support the new station installation. This includes the following:

- 1 – line 6709 front line and back up relay panel
- 1 – CB588 control and breaker failure relay panel
- 1 – Orion LX-based remote terminal unit with Ethernet switch

At West Cambridge Substation – Install the necessary new relay, protection and communications equipment to support the new station installation. This includes the following:

- 1 – line 6709 front line and back up relay panel
- 1 – Ethernet Switch

5. Metering & Communications

Metering

A three phase 69 kV revenue metering point needs to be established on the Generation side of the IC facility just inside the disconnect switch at the POI.

The metering instrument transformers will be specified by DPL but all equipment and labor will be supplied by the IC. The DPL scope would include the programming and installation of the meters, both primary and backup, and all required wiring work needed to connect the secondary wiring conductors at the metering enclosure. The materials that the Meter Department provides would be the meter enclosures, control cable, the meters, the output devices, and miscellaneous material at the cabinet.

The IC will purchase and install all metering instrument transformers as well as construct a metering structure per DPL's specifications. The secondary wiring connections at the instrument transformers will be completed by the interconnection customer's contractors and inspected by DPL, while the secondary wiring work at the metering enclosure will be completed by DPL's Meter technicians. The metering control cable and meter cabinets will be supplied by DPL and installed by the interconnection customer's contractors. DPL's meter technicians will program and install two solid state multi-function meters (Primary & Backup) for the new metering position. Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one meter DNP output.

The IC will be required to make provisions for a voice quality phone line within approximately 3 feet of each Company metering position to facilitate remote interrogation and data collection.

Telemetry

It is the Interconnection Customer's responsibility to send the data that PJM and the Company requires directly to PJM. The Interconnection Customer will grant permission for PJM to send the Company the following telemetry that the Interconnection Customer

sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.

6. Environmental, Real Estate and Permitting Issues

Environmental

This estimate assumes that the IC will procure all necessary permits for their facilities and the new DPL substation. The developer is to provide easements into the facility for DPL facilities at no expense to DPL prior to construction.

DPL's Environmental Planning Department has reviewed the available public sector data for the project area covering the transmission line cut-in from the existing West Cambridge – Vienna 69 kV circuit into the new substation. It is recommended that all new transmission structures be placed outside of any wetlands or wetland buffers. This will avoid permitting and consultation. If the structures cannot be placed outside the wetland areas, then the following studies, permits and approvals may be necessary:

- US Army Corps of Engineers
- Maryland Department of the Environment (MDE)
- Habitat Suitability Assessment, Targeted Species Surveys and Phase 1A Archaeological Assessment

Real Estate

DPL may need to acquire property easements to install the new tap lines from the existing West Cambridge to Vienna circuit onto the IC's property, depending on further land research. Also, it appears that a Railroad permit to cross over the existing railroad will be necessary from the Norfolk Southern Railroad. If DPL is not able to secure the necessary rights, then the IC will be required to obtain them for DPL.

7. Summary of Results of Study

Project Name: X3-015 West Cambridge – Vienna 69 kV Attachment Facilities – PJM Upgrade n3315 – Three breaker ring bus substation and 69 kV into and out of station	Indirect		Direct		TOTAL (\$)
	Material	Labor	Material	Labor	
System Planning		450		3,000	3,450
Project Management & Special Billing		2,100		13,000	15,100
Outside Plant Communications	5,399	6,763	48,591	60,866	121,619
System Protection		600		4,000	4,600
Interconnection Arrangements		550		3,450	4,000
System Operations		550		3,450	4,000
Real Estate	5,000	2,500	45,000	22,500	75,000
Metering	840	825	5,100	4,675	11,440
Environmental Permitting		3,250		29,250	32,500
Transmission Engineering & Construction	18,821	33,199	169,389	298,793	520,202
Substation Engineering & Construction	104,019	102,352	1,151,790	1,504,231	2,862,392
TOTAL COST	134,079	153,139	1,419,870	1,947,215	3,654,303
15% Contingency	20,112	22,971	212,980	292,082	548,145
GRAND TOTAL	154,191	176,110	1,632,850	2,239,297	4,202,448

Generation projects meeting IRS "Safe Harbor" provisions generally do not incur "CIAC"(Contribution in Aid to Construction), a tax collected by the utility for the state or federal government. DPL does not expect to collect CIAC for this project. If for any reason, "CIAC" would be required for this project, it would be the responsibility of the party owning the generator to pay this cost.

DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering facilities, owned by DPL.

Schedules and Assumptions

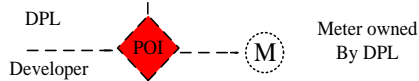
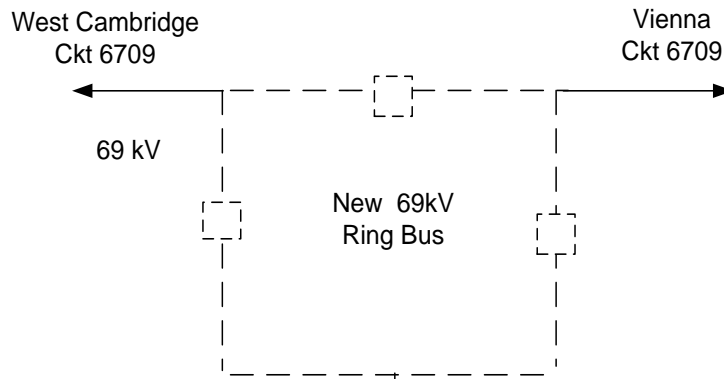
The DPL schedule is based on a 24-30 month lead-time from start of engineering to in-service date, including the assumption that it would not be impacted by storm damage and restoration, time of year limitations, permitting issues, outage scheduling, system emergencies, and contractor and equipment availability.

It is important to note that this project will be incorporated into the existing project work load at DPL at the time of contract execution. If the workload of existing projects is extensive, resource constraints may cause this project to be delayed beyond the projected in-service date.

Construction schedule is dependent upon obtaining an outage on the West Cambridge to Vienna 69 kV line. Line outage on the 69 kV line will not be granted during summer months.

X3-015

West Cambridge – Vienna 69kV New 69kV Ring Bus



If location of generator is greater than 500 feet from Point of Interconnection, an additional Interconnection Customer circuit breaker will be required

