Generation Interconnection Facilities Study Report

for

PJM Generation Interconnection Request Queue Position Z2-077

"Worcester North 25 kV"

(Rev. 2)

January 2016

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A. Transmission Owner Facilities Study Summary

1. Description of Project

Gateway Solar II LLC, the Interconnection Customer (IC), has proposed a 6.0 MWE (3.99 MWC; 6.0 MW MFO) solar powered generating facility to be located in Whaleyville, Maryland. PJM studied Z2-077 as a 6.0 MW injection into the Delmarva Power and Light (DPL) system at the Worcester 25 kV substation and evaluated the project for compliance with reliability criteria for summer peak conditions in 2018. The requested in-service date, as stated in the Attachment N, is May 1, 2016. The Interconnection Customer revised the in-service date to September 30, 2017 to better align with DPL's construction schedule.

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

The scope of the project as stated in the Impact Study, submitted on March 2015, has remained relatively unchanged. In addition, the estimates herein provided were performed in more detail than those provided in the Impact Study.

The Delmarva Power & Light (DPL) portion of the project is projected to be completed approximately 12-18 months following receipt of a fully executed interconnection agreement. This timeframe assumes a standard land use and environmental permitting and approval process.

3. Interconnection Customer's Milestone Schedule

The planned in-service date requested by the Interconnection Customer, as identified in Attachment N, is May 1, 2016. This in-service date is not attainable and was revised to September 30, 2017 to better reflect the DPL estimated construction completion time of 12-18 months.

4. Customer's Scope of Work

The Interconnection Customer proposes the construction of a 6 MWE (3.99 MWC; 6 MW MFO) solar powered generating facility to be located in Whaleyville, Maryland.

The Interconnection Customer assumes full responsibility for design, permitting and construction of all facilities associated with the Z2-077 generating station on their side of the Point of Interconnection (POI.) Z2-077 will interconnect with the Delmarva Power and Light (DPL) distribution system as a tap of the existing MD2224 25 kV feeder emanating from the 69/25 kV T2 transformer at the Worcester substation. The Point of Interconnection (POI) will be located at a recloser located outside of the generator site.

This proposed interconnection will be required to satisfy the requirements outlined in IEEE1547 including but not limited to over/under voltage, over/under frequency and anti-islanding requirements. DPL's system protection group will need to receive the proposed settings for review to ensure compliance with this standard.

This proposed interconnection will be required to satisfy the requirements outlined in DPL's "Technical Considerations Covering Parallel Operations of Customer Owned Generation" document for

units greater than 1 MW. DPL's system protection group will need to receive the proposed settings and associated schemes for review to ensure compliance with this standard.

If the IC elects to use a step up transformer with a delta high side winding, additional measures are required in order to prevent Temporary-Over-Voltage (TOV) during abnormal conditions. Three phase voltage sensing must be installed at the 25 kV side of the generator's transformer. PT's cannot be installed on lower voltage bus. This requirement can be avoided by using a grounded-wye/grounded-wye step up transformer.

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 a leading power factor ("PF") of **(0.99)**

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 Interconnection Customer 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.

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, line recloser, or other method depending upon the specific circumstances and the evaluation of the Company.

A mutually acceptable means of interrupting and disconnecting the generator with a visible break, able to be tagged and locked out, shall be worked out with Company Distribution Engineering.

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 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 – Substation

- Installation of 69 kV PTs on the existing T1 and T2 bus.
- Installation of a new feeder protection relay panel (SEL451 & SEL751A)

Attachment Facilities –Distribution

- Install utility grade primary metering.
- Replace existing line voltage regulator to accommodate reverse power flow.
- Install utility operated recloser.
- Install recloser control SEL-651R with one (1) SEL transceiver.

Attachment Facilities – Telecommunication

- Creation of a fiber path from Worcester substation to the POI.
- Generation meter telemetry (MWH & MVARH) and remote trip capability will be provided to DPL's Energy Management System with future capability to adjust output and power factor if needed.
- Transfer trip and remote trip will be required.
- Install one (1) SEL transceiver to handle communications between DPL and the DNP meter.

Note: If PJM queue project Z2-076 is executed, the PTs will have already been established and can be struck from this scope. Additionally, the distribution scope would no longer include the establishment of a new pole line.

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 25 kV revenue metering point needs to be established on the Interconnection Customer side of the recloser at the POI. See Section B.7 of this report for a detailed scope of work. DPL will send meter interval data (MWH and MVARH) to its control center via the fiber path.

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

Item	*Total Cost*
Attachment Facilities	$ 889,942
Attachment Facilities with Contingency 15%	$133,491

Total Cost	**$1,023,433**

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

The overall estimated timeline for this project, including upgrades, is approximately 12-18 months from the date of execution of the interconnection agreement. This timeline may be able to be improved with preferred system outages.

Attachment Facility	*Timeframe*
Engineering, Procurement and Construction	12 – 18 months

B. Transmission Owner Facilities Study Results

This section describes facilities identified to be installed (attachment facilities), replaced, and/or upgraded (upgrade facilities) 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 Lines - Upgrade

Not applicable

3. New Substation/Switchyard Facilities

Not applicable

4. Substation/Switchyard Facility Upgrades

- Install six (6) new 69 kV PTs on the existing T1 and T2 bus including structures
- Install one (1) 20’ relay panel, feeder protection, SEL451 & SEL751A

5. Distribution Facilities – Upgrades

- Perform any necessary tree trimming and removal along ROW
- Labor and material associated with installing a utility operated automatic circuit recloser with proper relaying and communications
- Install one (1) aerial primary metering cluster on the customer side of the new recloser

6. Telecommunications Facilities - Upgrades

- Install approximately 3.4 miles of 48SM ADSS fiber optic cable in conduit from Worcester Substation to the POI.

It is DPL's practice to use separate contractors for the installation of foundations, all primary and relaying work and testing and commissioning.

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.

7. Metering & Communications

Metering

A three phase 25 kV revenue metering point needs to be established on the Customer side of the IC facility just to the customer side of the disconnect switch at the POI.

The metering instrument transformers (CT/PT Combo Ritz units) as well as all equipment and labor to install will be specified and supplied by DPL. DPL's scope also includes the construction of a metering structure per DPL's specifications, 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, instrument transformers, and miscellaneous material at the cabinet.

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 three (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, non-interval MWH and MVARH (from revenue meter output), and generator breaker position. Meter interval data (MWH and MVARH) will be brought back to the Company's System Operations facility via the Company's telecommunications network.

8. Environmental, Real Estate and Permitting

Permitting and Real Estate

The feeder upgrades are dependent upon obtaining any necessary easements for the new pole line. If there are setbacks obtaining the proper right of way for poles required for interconnection, this will delay construction schedule. Customer may have to obtain right of way for DPL. The Interconnection Customer is to provide easements into the solar facility for DPL facilities at no expense to DPL prior to construction.

Environmental

Environmental permits will be secured to interconnect the solar facility to the Worcester substation. This estimate assumes that all the applicable permitting will be obtained for the solar facility by the Interconnection Customer.

9. Summary of Results of Study

Project Name: Z2-077 Worcester 25kV 6.0 MW	***Indirect***		***Direct***		***TOTAL ($)***
Attachment Facilities	**Material**	**Labor**	**Material**	**Labor**	
System Planning		$105.00		$1,500.00	$1,605.00
Project Management & Special Billing		$350.00		$5,000.00	$5,350.00
Outside Plant Communications		$350.00		$5,000.00	$5,350.00
System Protection		$350.00		$5,000.00	$5,350.00
Interconnection Arrangements		$140.00		$2,000.00	$2,140.00
System Operations		$105.00		$1,500.00	$1,605.00
Real Estate		$700.00		$10,000.00	$10,700.00
Metering		$490.00	$10,000.00	$7,000.00	$17,490.00
Environmental Permitting		$700.00		$10,000.00	$10,700.00
Distribution Engineering & Construction		$40,000.00	$60,000.00	$20,000.00	$120,000.00
Telecommunication Engineering and Constrcution		$72,000.00	$100,000.00	$20,000.00	$192,000.00
Substation Engineering & Construction		$137,138.00	$81,796.00	$298,718.00	$517,652.00
TOTAL COST	$0.00	$252,428.00	$251,796.00	$385,718.00	$889,942.00
15% Contingency	$0.00	$37,864.20	$37,769.40	$57,857.70	$133,491.30
GRAND TOTAL	$0.00	$290,292.20	$289,565.40	$443,575.70	**$1,023,433.30**

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.

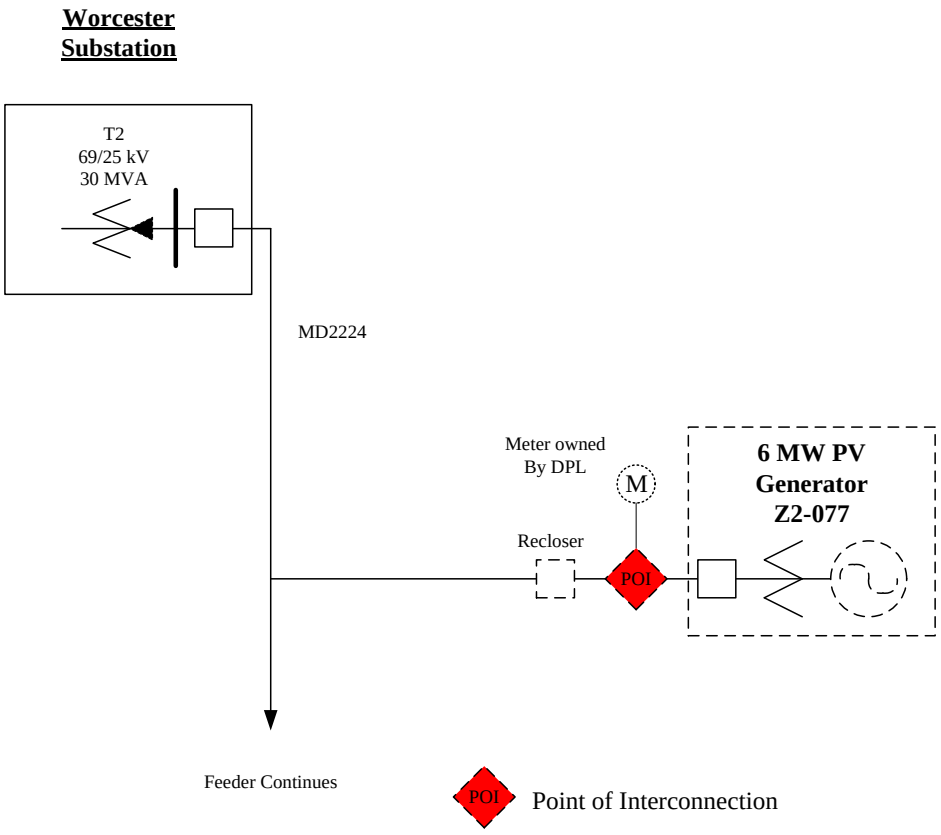
10. Schedules and Assumptions

The DPL schedule is based on an 12 – 18 months 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. Outages will be required at L9 Willard's 25 kV feeder (2224) and Worcester SS T2.

Attachment #1

Worcester North 25kV
Z2-077



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December 2015

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Inverter Requirements

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A mutually acceptable means of interrupting and disconnecting the generator with a visible break, able to be tagged and locked out, shall be worked out with Company Distribution Engineering.

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 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 – Substation

- Installation of 69 kV PTs on the existing T1 and T2 bus.
- Installation of a new feeder protection relay panel (SEL451 & SEL751A)

Attachment Facilities –Distribution

- Install utility grade primary metering.
- Extend MD2282 approx. 4500 ft. from Logtown Rd. to the POI
- Replace existing line voltage regulator to accommodate reverse power flow.
- Install utility operated recloser.
- Install recloser control SEL-651R with one (1) SEL transceiver.

Attachment Facilities – Telecommunication

- Creation of a fiber path from Worcester substation to the POI.
- Generation meter telemetry (MWH & MVARH) and remote trip capability will be provided to DPL's Energy Management System with future capability to adjust output and power factor if needed.
- Transfer trip and remote trip will be required.
- Install one (1) SEL transceiver to handle communications between DPL and the DNP meter.

Note: If PJM queue project Z1-076 is executed, the PTs will have already been established and can be struck from this scope. Additionally, the distribution scope would no longer include the establishment of a new pole line.

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 25 kV revenue metering point needs to be established on the Interconnection Customer side of the recloser at the POI. See Section B.7 of this report for a detailed scope of work. DPL will send meter interval data (MWH and MVARH) to its control center via the fiber path.

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

Item	*Total Cost*
Attachment Facilities	$1,269,942
Attachment Facilities with Contingency 15%	$190,491

Total Cost	**$1,460,433**

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

The overall estimated timeline for this project, including upgrades, is approximately 12-18 months from the date of execution of the interconnection agreement. This timeline may be able to be improved with preferred system outages.

Attachment Facility	*Timeframe*
Engineering, Procurement and Construction	12 – 18 months

B. Transmission Owner Facilities Study Results

This section describes facilities identified to be installed (attachment facilities), replaced, and/or upgraded (upgrade facilities) 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 Lines - Upgrade

Not applicable

3. New Substation/Switchyard Facilities

Not applicable

4. Substation/Switchyard Facility Upgrades

- Install six (6) new 69kV PTs on the existing T1 and T2 bus including structures
- Install one (1) 20' relay panel, feeder protection, SEL451 & SEL751A

5. Distribution Facilities - Upgrades

- Establish approximately 4,500 ft. of new three-phase OH primary with 954 AAC conductor along Logtown Road to the POI. Inclusive of twenty (20) poles.
- Perform any necessary tree trimming and removal along ROW
- Labor and material associated with installing a utility operated automatic circuit recloser with proper relaying and communications
- Install one (1) aerial primary metering cluster on the customer side of the new recloser

6. Telecommunications Facilities - Upgrades

- Install approximately 3.4 miles of 48SM ADSS fiber optic cable in conduit from Worcester Substation to the POI.

It is DPL's practice to use separate contractors for the installation of foundations, all primary and relaying work and testing and commissioning.

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.

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8. Environmental, Real Estate and Permitting

Permitting and Real Estate

The feeder upgrades are dependent upon obtaining any necessary easements for the new pole line. If there are setbacks obtaining the proper right of way for poles required for interconnection, this will delay construction schedule. Customer may have to obtain right of way for DPL. The Interconnection Customer is to provide easements into the solar facility for DPL facilities at no expense to DPL prior to construction.

Environmental

Environmental permits will be secured to interconnect the solar facility to the Worcester substation. This estimate assumes that all the applicable permitting will be obtained for the solar facility by the Interconnection Customer.

9. Summary of Results of Study

Project Name: Z2-077 Worcester 25 kV 6.0 MW	***Indirect***		***Direct***		***TOTAL ($)***
Attachment Facilities	**Material**	**Labor**	**Material**	**Labor**	
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Interconnection Arrangements		$140.00		$2,000.00	$2,140.00
System Operations		$105.00		$1,500.00	$1,605.00
Real Estate		$700.00		$10,000.00	$10,700.00
Metering		$490.00	$10,000.00	$7,000.00	$17,490.00
Environmental Permitting		$700.00		$10,000.00	$10,700.00
Distribution Engineering & Construction		$300,000.00	$180,000.00	$20,000.00	$500,000.00
Telecommunication Engineering and Constrcution		$72,000.00	$100,000.00	$20,000.00	$192,000.00
Substation Engineering & Construction		$137,138.00	$81,796.00	$298,718.00	$517,652.00
TOTAL COST	$0.00	$512,428.00	$371,796.00	$385,718.00	$1,269,942.00
15% Contingency	$0.00	$76,864.20	$55,769.40	$57,857.70	$190,491.30
GRAND TOTAL	$0.00	$589,292.20	$427,565.40	$443,575.70	**$1,460,433.30**

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10. Schedules and Assumptions

The DPL schedule is based on an 12 – 18 months 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. Outages will be required at L9 Willard's 25 kV feeder (2224) and Worcester SS T2.

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Worcester North 25kV
Z2-077