

DELMARVA POWER & LIGHT COMPANY

COMPLIANCE FILING IN THE MATTER OF THE
ADOPTION OF RULES AND REGULATIONS TO IMPLEMENT
THE PROVISIONS OF 26 *DEL. C. CH. 10* RELATING TO THE
CREATION OF A COMPETITIVE MARKET FOR RETAIL
ELECTRIC SUPPLY SERVICE (OPENED APRIL 27, 1999;
RE-OPENED JANUARY 7, 2003; RE-OPENED SEPTEMBER 22,
2009; RE-OPENED SEPTEMBER 7, 2010)

PSC REGULATION DOCKET NO. 49

**BEFORE THE
PUBLIC SERVICE COMMISSION
OF THE STATE OF DELAWARE**

COVER LETTER
RIDER "NEM"
TARIFF APPLICATION FORM FOR NEM
RIDER "ANEM"
TARIFF APPLICATION FORM FOR ANEM
RIDER "CEF"
TARIFF APPLICATION FORM FOR CEF
INTERCONNECTION STANDARDS FOR DE
INTERCONNECTION APPLICATION FORM (LEVEL 1)
INTERCONNECTION APPLICATION FORM (LEVEL 2)
TECHNICAL CONSIDERATIONS <1MW
TECHNICAL CONSIDERATIONS >1MW

JULY 25, 2011



A PHI Company

Todd L. Goodman
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July 22, 2011

Via Overnight Delivery

Ms. Alisa C. Bentley, Secretary
Delaware Public Service Commission
861 Silver Lake Boulevard
Cannon Building, Suite 100
Dover, DE 19904

RE: PSC Docket No. 49 – IN THE MATTER OF THE ADOPTION OF RULES AND REGULATIONS TO IMPLEMENT THE PROVISIONS OF 26 DEL. C. CH. 10 RELATING TO THE CREATION OF A COMPETITIVE MARKET FOR RETAIL ELECTRIC SUPPLY SERVICE

Dear Ms. Bentley:

Enclosed for filing are the original and ten copies of Delmarva Power's compliance filing as required in Order 7984, dated June 7, 2011 related to Net Energy Metering, Aggregated Meters and Community Energy Facilities in the above referenced Docket.

Due to the extensive changes to the Rules as a result of Senate Bill 267, signed July 29, 2010, the Company has converted the RIDER "NEM" into three separate Riders: "NEM" (Net Energy Metering), "ANEM" (Aggregated Net Energy Metering), and "CEF" (Community Energy Facilities). Each tariff section is included with this filing, including the updated customer application forms for each rider.

The above Order also called for the Company to update the Interconnection Standards, using Delmarva Power State of Maryland Interconnection Standards as a model. This document is also included in this filing and two related interconnection application forms.

In all three Riders, Delmarva has included links to a "Technical Considerations" document related to interconnecting generation equipment to the Company's electric grid for systems above and below one mega watt. Links are created to provide convenient access to these documents, and others, for on-line readers. Copies of these

Ms. Alisa Bentley, Secretary
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documents are included in this filing. Links are also included to allow customers to locate application forms and review the Interconnection Standards, as needed.

Please contact me or Len Beck at (302) 454-4839 with any questions related to this matter.

Sincerely,

A handwritten signature in black ink, appearing to be 'Todd Goodman', with a long horizontal flourish extending to the right.

Todd Goodman

cc: John Farber, DE Public Service Commission
Michael Sheehy, Public Advocate
Heather G. Hall, DPL
Len Beck, DPL

RIDER "NEM"
NET ENERGY METERING RIDER

A. Availability

This Rider is available to any Customer with an individual meter served under Service Classifications "R", "R-TOU", "R-TOU-ND", "R-TOU-SOP", "SGS-ND", "MGS-S", "LGS", "GS-P" or "GS-T". (For groups of Customers wishing to participate in Aggregated Net Energy Metering (ANEM) or a Community Energy Facility (CEF), refer to the Rider "ANEM" or Rider "CEF" sections of this tariff.) Rider "NEM" is available to an individual Customer who owns and operates; leases and operates; or contracts with a third party who owns and operates the electric generation facility that:

1. For residential Customers which has a capacity of not more than 25 kilowatts_{AC}, for non-residential Customers, a capacity of not more than 2 megawatts_{AC}, and for farm Customers, a capacity that will not exceed 100 kW_{AC} unless granted exception to this limitation by the Delaware Energy Office;
2. Uses as its primary source of fuel: solar, wind, hydro, a fuel cell, or gas from the anaerobic digestion of organic material;
3. Is interconnected and operated in parallel with the Company's transmission and/or distribution facilities;
4. Is designed to produce no more than 110% of the Customer's expected individual meter electrical consumption, calculated on the average of the two previous 12 month periods of actual electrical usage at the time of installation of the energy generating equipment and subject to the capacity limits specified above. For new building construction or in instances where less than two previous 12 month periods of actual usage is available, electrical consumption will be estimated at 110% of the consumption of units of similar size and characteristics at the time of installation of the energy generating equipment and subject to the same capacity limits specified above. However, if the Net Energy Metering Facility is designed to produce over 100% of its expected consumption as outlined above, the customer, at its expense, must enter the generator queue to be studied by PJM, the regional transmission operator (www.PJM.com), and receive written approval to interconnect with the Company's electrical distribution or transmission system;
5. If the total generating capacity of all Customer-generation using net metering systems served by the Company exceeds 5 percent (5%) of the capacity necessary to meet the electric utility's aggregated Customer monthly peak demand for a particular calendar year, the Company may elect not to provide net metering services to any additional Customer-generators; and
6. Nothing in this tariff is intended in any way to limit eligibility for net energy metering services based upon direct ownership, joint ownership, or third-party ownership or financing agreement related to an electric generation facility, where net energy metering would otherwise be available.

This Rider is not available to Customers served under Service Classification "X", Cogeneration and Small Power Production.

RIDER "NEM"
NET ENERGY METERING RIDER

B. Connection to the Company's System

Except as noted in paragraph A.4 above, any Customer who elects this Rider must submit a completed tariff application with the Company available at: <http://www.delmarva.com/home/requests/interconnection/>, to be reviewed by the Company prior to installation of the electric generation facility. The electric generation facility shall not be connected and operated in parallel to the Company's system unless it meets all applicable safety and performance standards established by the National Electric Code, The Institute of Electrical and Electronics Engineers, including compliance with IEEE 1547, Underwriters Laboratories, and as currently detailed in the Technical Considerations Covering Parallel Operations of Customer Owned Generation for less than or over one megawatt, and the applicable codes of the local public authorities. Special attention should be given to the National Electrical Code Sections 690 and 705. The Customer must obtain, at the Customer's expense, all necessary inspections and approvals required by the local public authorities before the electric generation facility is connected to the Company's electric system. The electric generation facility shall be connected in parallel operation with the Company's electric system and shall have adequate protective equipment as described in Section G below.

C. Delivery Voltage

The delivery voltage of the electric generation facility shall be at the same voltage level and at the same delivery point as if the Customer were purchasing all of its electricity from the Company.

D. Contract Term

The contract term shall be same as that under the Customer's applicable Service Classification.

E. Monthly Rates, Rate Components and Billing Unit Provisions

The monthly rates, rate components and billing unit provisions shall be those as stated under the Customer's applicable Service Classification. During any billing period when a Customer-Generator Facility produces more energy than that consumed by the Customer, the Company will credit the Customer in kWh's, valued at an amount per kWh equal to the sum of volumetric energy (kWh) components of the delivery service charges and supply service charges for residential Customers and the sum of the volumetric energy (kWh) components of the delivery service charges and supply service charges for non-residential Customers for any excess energy production of their Customer-Generator Facility in the applicable billing period. During any billing period prior to the end of the Annualized Billing Period, the crediting of excess energy kWh will result in the reduction of cost paid by the Customer for the equivalent volumetric energy kWh of delivery service charges, if applicable, and supply service charges.

Excess kWh credits shall be credited to subsequent billing periods to offset a Customer's consumption in those billing periods until all credits are used. During any subsequent billing period prior to the end of the Annualized Billing period, the crediting of excess energy kWh will result in the reduction of cost paid by the Customer for the equivalent volumetric energy kWh of delivery service charges, if applicable, and supply service charges.

RIDER "NEM"
NET ENERGY METERING RIDER

E. Monthly Rates, Rate Components and Billing Unit Provisions – (Continued)

At the end of the Annualized Billing Period, a Customer may request a payment from the Company for any excess kWh credits. The payment for the residential Customer accounts shall be calculated by multiplying the excess kWh credits by the Customer's Supply Service Charges based on a weighted average of the first block of the summer (June through September) and winter (October through May) Supply Service Charges in effect at the end of the Customer's Annualized Billing Period and the preceding 11 billing periods, excluding non-volumetric charges, such as the transmission capacity charge and/or demand charges. The payment for the non-residential customer accounts shall be calculated by multiplying the excess kWh credits by the Customer's Supply Service Charges that would otherwise be applicable at the end of the Customer's Annualized Billing Period. If such payment would be less than \$25.00, the Electric Supplier may credit the Customer's account through monthly billing.

- 1) Any excess kWh credits shall not reduce any fixed monthly Customer charges imposed by the Electric Supplier.
- 2) The Customer shall retain ownership of Renewable Energy Credits (RECs) associated with electric energy produced from all eligible energy resources of the Customer-Generator Facility and consumed by the Customer unless the Customer has relinquished such ownership by contractual agreement with a third party.
- 3) The electric suppliers shall provide net-metered Customers electric service at nondiscriminatory rates that are identical, with respect to rate structure and monthly charges, to the rates that a Customer who is not net-metering would be charged. Electric Suppliers shall not charge a net-metering Customer any stand-by fees or similar charges.
- 4) If a Net Metering Customer terminates its service with the Electric Distribution Company or changes Electric Supplier, the Electric Supplier terminating service shall treat the end of service period as if it were the end of the Annualized Billing Period for any excess kWh credits.
- 5) Until the Company has issued a written approval to the Customer-Generator Facility authorizing connection to the distribution and /or transmission system, **no current or past excess credits will be issued to the Customer account(s).**

F. Metering

The watt-hour energy meter at the Customer's location shall measure the net energy consumed by the Customer or the net energy delivered by the Customer's electric generation facility for the monthly billing period. The Company shall furnish, install, maintain and own all the metering equipment needed for measurement of the service supplied. Under this Rider, the Company shall provide, at no additional direct charge to the Customer, a watt-hour energy meter programmed to measure the net watt-hours consumed by the Customer or the net watt-hours delivered by the Customer to the Company for the monthly billing period. Where a larger capacity meter is required to serve the Customer that has an electric generation facility, or a larger capacity meter is requested by the Customer, the Customer shall pay the Company the difference between the larger capacity meter investment and the metering investment normally provided under the Customer's Service Classification.

RIDER "NEM"
NET ENERGY METERING RIDER

G. Protective Equipment and Cessation of Parallel Operation

Interconnection with the Company's system requires the installation of protective equipment which provides safety for personnel, affords adequate protection against damage to the Company's system or to the Customer's property, and prevents any interference with the Company's supply of service to other Customers. Such protective equipment shall be installed, owned and maintained by the Customer at the Customer's expense. The Customer's equipment must be installed and configured so that parallel operation must cease immediately and automatically during system outages or loss of the Company's primary electric source. The Customer must also cease parallel operation upon notification by the Company of a system emergency, abnormal condition, or in cases where such operation is determined to be unsafe, interferes with the supply of service to other Customers, or interferes with the Company's system maintenance or operation. Generation systems and equipment that comply with the standards established in Section B shall be deemed by the Company to have generally complied with the requirements of this section. For systems not covered by the standards in Section B, the "Technical Requirements" shall apply.

H. Modification of the Company's System and Liability

If it is necessary for the Company to extend or modify portions of its systems to accommodate the delivery of electricity from the electric generation facility, such extension or modification shall be performed by the Company at the Customer's expense. For new services, such expense shall be determined by the difference between total costs and the investment the Company would make to install a normal service without the Customer's electric generation facility.

The Company accepts no responsibility whatsoever for damage or injury to any person or property caused by failure of the Customer to operate in compliance with Company's requirements. The Company shall not be liable for any loss, cost, damage or expense to any party resulting from the use or presence of electric current or potential which originates from the Customer's electric generation facility, except as the Company would otherwise be liable under the Company's Delaware electric tariff. Connection by the Utility under this Rider does not imply that the Utility has inspected or certified that any Customer-generator's facility has complied with any necessary local codes or applicable safety or performance standards. All inspections, certifications and compliance with applicable local codes and safety requirements are the sole responsibility of the Customer-generator and must be provided to the Company prior to system acceptance and parallel operation with the utility system.

Any requirements necessary to permit interconnected operations between the Net Energy Metering Customer and the Company, and the costs associated with such requirements, shall be dealt with in a manner consistent with a standard tariff filed with the Commission by the Company. The Company's Interconnection Standards were developed using the Interstate Renewable Energy Council's Model Interconnection Rules and best practices identified by the U.S. Department of Energy. The Company's current Interconnection Standards agreement, including applicable fees, is on file with the Commission and available on the Company web site at: <http://www.delmarva.com/home/requests/interconnection/>.

The Company shall not require eligible Net Energy Metering customers who meet all applicable safety and performance standards to install excessive controls, perform or pay for unnecessary tests, or purchase excessive liability insurance.

RIDER "NEM"
NET ENERGY METERING RIDER

I. Failure to Comply

If the Customer fails to comply with any of the requirements set forth in sections G and H above, **the Company may disconnect the Customer's service** from the Company's electric system until the requirements are met, or the electric generation facility is disconnected from the Customer's electric system.

J. Public Utilities Tax

In addition to the charges provided for in this Service Classification, the Delaware State Public Utilities Tax shall apply to all services, including any applicable electric supply services, rendered hereunder, unless the Customer is exempt from such tax.

K. Rules and Regulations

The Commission shall periodically review the impact of net-metering rules in this section and recommend changes or adjustments necessary for the economic health of utilities.

The Rules and Regulations set forth in this tariff shall govern the provision of service under this Service Classification.

L. Disputes

Net metering disputes heard before the Delaware Public Service Commission shall be limited to the correct application of Commission-approved tariffs to be resolved by the Commission. All other disputes with the Company shall be resolved by the appropriate governing body with jurisdiction over such disputes.



A PHI Company

**APPLICATION FOR DELAWARE
NET ENERGY METERING (NEM) TARIFF
FOR SYSTEMS GENERATING GREATER THAN 100% AND LESS
THAN OR EQUAL TO 110% OF ANNUAL ENERGY NEEDS**

The Green Power Connection™ Team
Delmarva Power
A PHI Company
(866) 634-5571 - Phone
(856) 351-7523 - FAX
gpc-north@pepcoholdings.com

(Send applications via Email, FAX, or Mail to Delmarva Power, GPC Team)

Mailing Address: 5 Collins Drive, Mail Stop 84CP22, Carneys Point, NJ 08069

INTERCONNECTION CUSTOMER CONTACT INFORMATION

Customer Contact Information:

Customer Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
DPL Account #: _____
Contact Person (if other than above): _____
Mailing Address (if other than above): _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address (Required): _____

Alternate Contact Information:

Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address: _____

FACILITY INFORMATION (Facilities with Customer Owned Generation)

DPL Account #: _____
Facility Address: _____
City: _____ State: _____ Zip Code: _____
Maximum Facility Output Rating: _____ kW AC
Estimated Gross Annual Energy Production: _____ kWh
Primary Source of Fuel: *Insert Pull-Down Box*
PJM Queue # (required within 90 days of application): _____

CUSTOMER SIGNATURE

I hereby certify that: 1) I have read and understand the Delmarva Power Net Energy Metering Tariff ("NEM") which can be found on DPL's website and is a part of this Agreement; 2) I hereby agree to comply with the NEM tariff; and 3) to the best of my knowledge, all of the information provided in this application form is complete and true. I consent to permit the PSC and Delmarva Power to exchange information regarding the generating system and customer to which this application applies.

Customer Signature: _____ Date: _____
Printed Name: _____ Title: _____

.....

FINAL APPROVAL FOR DPL ANEM TARIFF (for DPL use only)

Entry in the ANEM tariff is hereby approved by Delmarva Power. The date specified here represents the date the customer was entered into the tariff.

DPL Signature: _____ Date: _____

Printed Name: _____ Title: _____

RIDER "ANEM"
AGGREGATED NET ENERGY METERING RIDER

A. Availability

This Rider is available to any Customer with multiple meters served under Service Classifications "R", "R-TOU", "R-TOU-ND", "R-TOU-SOP", "SGS-ND", "MGS-S", "LGS", "GS-P" and/or "GS-T". (For groups of Customers wishing to participate in a Community Energy Facility (CEF), refer to the Rider "CEF" section of this tariff.) Rider "ANEM" is available to individual Customers who own and operate; lease and operate; or contract with a third party who owns and operates the electric generation facility that:

1. For residential Customers which have a capacity of not more than 25 kilowatts_{AC} per Company meter, for non-residential Customers, a capacity of not more than 2 megawatts_{AC} per Company meter, and for farm Customers, a capacity that will not exceed 100 kW_{AC} per Company meter unless granted exception to this limitation by the Delaware Energy Office. When the Customer's multiple meters include multiple service classifications, the maximum facility capacity will be the cumulative total of these meter capacity limits subject to the limit described in Section A (4) below;
2. Uses as its primary source of fuel: solar, wind, hydro, a fuel cell, or gas from the anaerobic digestion of organic material;
3. Is interconnected and operated in parallel with the Company's transmission and/or distribution facilities;
4. Is designed to produce no more than 110% of the Host Customer's expected aggregated meters electrical consumption, calculated on the average of the two previous 12 month periods of actual electrical usage at the time of installation of the energy generating equipment and subject to the capacity limits specified above. For new building construction or in instances where less than two previous 12 month periods of actual usage is available, electrical consumption will be estimated at 110% of the consumption of units of similar size and characteristics at the time of installation of the energy generating equipment and subject to the same capacity limits specified above;
5. Is owned by one Customer that is the same person or legal entity which has multiple meters under the same account or different accounts, regardless of the physical location and rate class. The Customer may aggregate the meters for the purpose of net metering regardless of which individual meter receives energy from a Customer Generator Facility provided that:
 - i) Delmarva Power shall allow meter aggregation for Customer accounts of which Delmarva Power provides electric supply service; and
 - ii) The Customer-Generator Facility complies with Sections 1 through 5 above; and
 - iii) At least ninety days before a Customer can participate under this tariff, the Customer shall file a tariff application with the Company available at:
<http://www.delmarva.com/home/requests/interconnection/>; and include the following information:
 - a) a list of individual meters the Customer seeks to aggregate, identified by name, address, rate schedule, and account number, and ranked according to the order in which the Customer desires to apply credit; and

RIDER "ANEM"
AGGREGATED NET ENERGY METERING RIDER

A. Availability - (Continued)

- b) a description of the Customer-Generator Facility, including the facility's location, capacity, and fuel type or generating technology, and;
- c) PJM queue number(s) for the Customer's generator(s);
- iv) The Customer may change its list of aggregated meters no more than once annually by providing ninety days' written notice; and
 - a) Credit shall be applied first to the meter through which the Customer-Generator Facility supplies electricity, then through the remaining meters for the Customer's accounts according to the rank order as specified in accordance with Section A 5(iii)a; and
 - b) Credit in kilowatt-hours (kWh) shall be valued according to Section E and each account's rate schedule as specified in Section A 5(iii)a; and
 - c) Delmarva Power may require that a Customer's aggregated meters be read on the same billing cycle;
- 6. If the total generating capacity of all Customer-generation using net metering systems served by the Company exceeds 5 percent (5%) of the capacity necessary to meet the electric utility's aggregated Customer monthly peak demand for a particular calendar year, the Company may elect not to provide net metering services to any additional Customer-generators; and
- 7. Nothing in this tariff is intended in any way to limit eligibility for Aggregated Net Energy Metering services based upon direct ownership, joint ownership, or third-party ownership or financing agreement related to an electric generation facility, where Aggregated Net Energy Metering would otherwise be available.

This Rider is not available to Customers served under Service Classification "X", Cogeneration and Small Power Production.

B. Connection to the Company's System

Customer-generator(s) participating in Aggregated Net Energy Metering must, at its expense, enter the generator queue to be studied by PJM, the regional transmission operator (www.PJM.com), and receive written approval to interconnect with the Company's electrical distribution or transmission system. The customer-generator(s) shall be connected in parallel operation with the Company's electric system and shall have adequate protective equipment as described in Section G below.

RIDER “ANEM”
AGGREGATED NET ENERGY METERING RIDER

C. Delivery Voltage

The delivery voltage of the electric generation facility shall be at the same voltage level and at the same delivery point as if the Customer were purchasing all of its electricity from the Company.

D. Contract Term

The contract term shall be same as that under the Customer’s applicable Service Classification.

E. Monthly Rates, Rate Components and Billing Unit Provisions

The monthly rates, rate components and billing unit provisions shall be those as stated under the Customer’s applicable Service Classification. During any billing period when a Customer-Generator Facility produces more energy than the Customer’s aggregate total kWh consumed, the Company will credit the Customer in kWh’s, valued at an amount per kWh equal to the sum of volumetric energy (kWh) components of the delivery service charges and supply service charges for residential Customers and the sum of the volumetric energy (kWh) components of the delivery service charges and supply service charges for non-residential Customers in the applicable billing period. Excess credits beyond those consumed by the Host account will be applied to the Customer’s other meters in the sequence requested in the Customer’s application form for ANEM service. During any billing period prior to the end of the Annualized Billing Period, the crediting of excess energy kWh will result in the reduction of cost paid by the Customer for the equivalent volumetric energy kWh of delivery service charges, if applicable, and supply service charges.

Excess kWh credits shall be credited to subsequent billing periods to offset a Customer's consumption in those billing periods until all credits are used. During any subsequent billing period prior to the end of the Annualized Billing period, the crediting of excess energy kWh will result in the reduction of cost paid by the Customer for the equivalent volumetric energy kWh of delivery service charges, if applicable, and supply service charges.

At the end of the Annualized Billing Period, a Customer may request a payment from the Company for any excess kWh credits. The payment to the residential Host Customer account shall be calculated by multiplying the excess kWh credits by the Customer’s Supply Service Charges based on a weighted average of the first block of the summer (June through September) and winter (October through May) Supply Service Charges in effect at the end of the Customer’s Annualized Billing Period and the preceding 11 billing periods, excluding non-volumetric charges, such as the transmission capacity charge and/or demand charges. The payment for the non-residential Host Customer account shall be calculated by multiplying the excess kWh credits by the Customer’s Supply Service Charges that would otherwise be applicable at the end of the Customer’s Annualized Billing Period. If such payment would be less than \$25.00, the Electric Supplier may credit the Customer’s account through monthly billing.

RIDER "ANEM"
AGGREGATED NET ENERGY METERING RIDER

E. Monthly Rates, Rate Components and Billing Unit Provisions - (Continued)

- 1) Any excess kWh credits shall not reduce any fixed monthly Customer charges imposed by the Electric Supplier.
- 2) The Customer shall retain ownership of Renewable Energy Credits (RECs) associated with electric energy produced from all eligible energy resources of the Customer-Generator Facility and consumed by the Customer unless the Customer has relinquished such ownership by contractual agreement with a third party.
- 3) The electric suppliers shall provide Aggregated Net Energy Metering Customers electric service at nondiscriminatory rates that are identical, with respect to rate structure and monthly charges, to the rates that a Customer who is not net-metering would be charged. Electric Suppliers shall not charge a net-metering Customer any stand-by fees or similar charges.
- 4) If an Aggregated Net Metering Customer terminates its service with the Electric Distribution Company or changes Electric Supplier, the Electric Supplier terminating service shall treat the end of service period as if it were the end of the Annualized Billing Period for any excess kWh credits.
- 5) Until the participating customer-generator(s) has received written approval authorizing connection to the Company's distribution and /or transmission system and the customer has met all other requirements of this Rider, no current or past excess credits will be issued to the Customer account(s).

F. Metering

Unless otherwise specified under the PJM interconnection process, the watt-hour energy meter at the Customer's location shall measure the net energy consumed by the Customer or the net energy delivered by the Customer's electric generation facility for the monthly billing period. The Company shall furnish, install, maintain and own all the metering equipment needed for measurement of the service supplied. Under this Rider, the Company shall provide, at no additional direct charge to the Customer, a watt-hour energy meter programmed to measure the net watt-hours consumed by the Customer or the net watt-hours delivered by the Customer to the Company for the monthly billing period. Where a larger capacity meter is required to serve the Customer that has an electric generation facility, or a larger capacity meter is requested by the Customer, the Customer shall pay the Company the difference between the larger capacity meter investment and the metering investment normally provided under the Customer's Service Classification.

RIDER "ANEM"
AGGREGATED NET ENERGY METERING RIDER

G. Protective Equipment and Cessation of Parallel Operation

Interconnection with the Company's system requires the installation of protective equipment which provides safety for personnel, affords adequate protection against damage to the Company's system or to the Customer's property, and prevents any interference with the Company's supply of service to other Customers. Such protective equipment shall be installed, owned and maintained by the Customer at the Customer's expense. The Customer's equipment must be installed and configured so that parallel operation must cease immediately and automatically during system outages or loss of the Company's primary electric source. The Customer must also cease parallel operation upon notification by the Company of a system emergency, abnormal condition, or in cases where such operation is determined to be unsafe, interferes with the supply of service to other Customers, or interferes with the Company's system maintenance or operation.

H. Modification of the Company's System and Liability

If it is necessary for the Company to extend or modify portions of its systems to accommodate the delivery of electricity from the electric generation facility, such extension or modification shall be performed by the Company at the Customer's expense. Unless otherwise specified under the PJM interconnection process for new services, such expense shall be determined by the difference between total costs and the investment the Company would make to install a normal service without the Customer's electric generation facility.

The Company accepts no responsibility whatsoever for damage or injury to any person or property caused by failure of the Customer to operate in compliance with Company's requirements. The Company shall not be liable for any loss, cost, damage or expense to any party resulting from the use or presence of electric current or potential which originates from the Customer's electric generation facility, except as the Company would otherwise be liable under the Company's Delaware electric tariff. Connection by the Utility under this Rider does not imply that the Utility has inspected or certified that any Customer-generator's facility has complied with any necessary local codes or applicable safety or performance standards. All inspections, certifications and compliance with applicable local codes and safety requirements are the sole responsibility of the Customer-generator and must be provided to the Company prior to system acceptance and parallel operation with the utility system.

The Company shall not require eligible Aggregated Net Energy Metering Customers who meet all applicable safety and performance standards to install excessive controls, perform or pay for unnecessary tests, or purchase excessive liability insurance.

RIDER "ANEM"
AGGREGATED NET ENERGY METERING RIDER

I. Failure to Comply

If the Customer fails to comply with any of the requirements set forth in sections G and H above, **the Company may disconnect the Customer's service** from the Company's electric system until the requirements are met, or the customer-generator(s) is disconnected from the Customer's electric system.

J. Public Utilities Tax

In addition to the charges provided for in this Service Classification, the Delaware State Public Utilities Tax shall apply to all services, including any applicable electric supply services, rendered hereunder, unless the Customer is exempt from such tax.

K. Rules and Regulations

The Commission shall periodically review the impact of net-metering rules in this section and recommend changes or adjustments necessary for the economic health of utilities.

The Rules and Regulations set forth in this tariff shall govern the provision of service under this Service Classification.

L. Disputes

Aggregated Net metering disputes heard before the Delaware Public Service Commission shall be limited to the correct application of Commission-approved tariffs to be resolved by the Commission. All other disputes with the Company shall be resolved by the appropriate governing body with jurisdiction over such disputes.



A PHI Company

**APPLICATION FOR DELAWARE
AGGREGATED NET ENERGY METERING (ANEM) TARIFF**

The Green Power Connection™ Team
Delmarva Power
A PHI Company
(866) 634-5571 - Phone
(856) 351-7523 - FAX
gpc-north@pepcoholdings.com

(Send applications via Email, FAX, or Mail to Delmarva Power, GPC Team)

Mailing Address: 5 Collins Drive, Mail Stop 84CP22, Carneys Point, NJ 08069

INTERCONNECTION CUSTOMER CONTACT INFORMATION

Customer Contact Information:

Customer Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
DPL Account #: _____
Contact Person (If other than above): _____
Mailing Address (If other than above): _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address (Required): _____

Alternate Contact Information:

Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address: _____

FACILITY INFORMATION¹ (Facilities with Customer Owned Generation)

Facility #1:

DPL Account #: _____
Facility Address: _____
City: _____ State: _____ Zip Code: _____
Maximum Facility Output Rating: _____ kW AC
Estimated Gross Annual Energy Production: _____ kWh
Primary Source of Fuel: _____
PJM Queue # (required within 90 days of application): _____
Or check here if already an NEM facility

Facility #2 (if applicable):

DPL Account #: _____
Facility Address: _____
City: _____ State: _____ Zip Code: _____
Maximum Facility Output Rating: _____ kW AC
Estimated Gross Annual Energy Production: _____ kWh
Primary Source of Fuel: _____
PJM Queue # (required within 90 days of application): _____
Or check here if already an NEM facility

¹ Attach additional sheets if necessary with additional facilities.

AGGREGATED ACCOUNTS² (in the order which the customer desires to apply the credits)

#1

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

#2

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

#3

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

#4

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

#5

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

#6

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

#7

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

#8

Account #: _____
Address: _____
City: _____ State: _____ Zip Code: _____

² May or may not include host facilities listed above. Attach additional sheets if necessary with additional accounts.

CUSTOMER SIGNATURE

I hereby certify that: 1) I have read and understand the Delmarva Power Aggregated Net Energy Metering Tariff ("ANEM") which can be found on DPL's website and is a part of this Agreement; 2) I hereby agree to comply with the ANEM tariff; and 3) to the best of my knowledge, all of the information provided in this application form is complete and true. I consent to permit the PSC and Delmarva Power to exchange information regarding the generating system and customer to which this application applies.

Customer Signature: _____ Date: _____

Printed Name: _____ Title: _____

.....

FINAL APPROVAL FOR DPL ANEM TARIFF *(for DPL use only)*

Entry in the ANEM tariff is hereby approved by Delmarva Power. The date specified here represents the date the customer was entered into the tariff.

DPL Signature: _____ Date: _____

Printed Name: _____ Title: _____

RIDER "CEF"
COMMUNITY ENERGY FACILITY RIDER

A Community Energy Facility (CEF) is an energy generating facility located in Delmarva Power's Delaware service territory that has multiple owners or customers who share the energy production of the Community Energy Facility, which is designed as a stand-alone facility with its own meter, or behind the meter of a subscriber that is an owner or customer designated as a 'Host'.

A. Availability

This Rider is available to any customer who becomes one of multiple owners or customers, as the Host or Subscriber, who share the energy production of a Community Energy Facility with meters served under Service Classifications "R", "R-TOU", "R-TOU-ND", "R-TOU-SOP", "SGS-ND", "MGS-S", "LGS", "GS-P", "GS-T" and lighting accounts. This Rider is available to any Community Energy Facility that:

1. For residential customers which have a capacity of not more than 25 kilowatts_{AC} per Company meter, for non-residential customers, a capacity of not more than 2 megawatts_{AC} per Company meter, and for farm customers, a capacity that will not exceed 100 kW_{AC} per Company meter unless granted exception to this limitation by the Delaware Energy Office;
2. A CEF may include technologies defined under §352(6)(a-h) of Title 26 of the Delaware Code, which include the following energy sources located within or imported into the PJM region:
 - a. Solar photovoltaic or solar thermal energy technologies that employ solar radiation to produce electricity or to displace electricity use;
 - b. Electricity derived from wind energy;
 - c. Electricity derived from ocean energy including wave or tidal action, currents, or thermal differences;
 - d. Geothermal energy technologies that generate electricity with a steam turbine, driven by hot water or steam extracted from geothermal reservoirs in the earth's crust;
 - e. Electricity generated by a fuel cell powered by renewable fuels;
 - f. Electricity generated by the combustion of gas from the anaerobic digestion of organic material;
 - g. Electricity generated by a hydroelectric facility that has a maximum design capacity of 30 megawatts or less from all generating units combined that meet appropriate environmental standards as determined by DNREC;
 - h. Electricity generated from the combustion of biomass that has been cultivated and harvested in a sustainable manner as determined by DNREC, and is not combusted to produce energy in a waste to energy facility or in an incinerator, as that term is defined in Title 7 of the Delaware Code;
3. Is interconnected and operated in parallel with the Company's transmission and/or distribution facilities;

RIDER "CEF"
COMMUNITY ENERGY FACILITY RIDER

A. Availability – (Continued)

4. A Community Energy Facility is designed to produce no more than 110% of the community's aggregate electrical consumption of its individual Host and Subscriber(s), calculated on the average of the two previous 12 month periods of actual electrical usage. For new building construction or in instances where less than two previous 12 month periods of actual usage is available, electrical consumption will be estimated at 110% of the consumption of units of similar size and characteristics at the time of installation of energy generating equipment. Each generator participating in/as a Community Energy Facility under this tariff must, at its expense, must enter the generator que to be studied by PJM, the regional transmission operator (www.PJM.com), and receive written approval to interconnect with the Company's electrical distribution or transmission system;
5. If the total generating capacity of all customer-generation using net metering systems served by an electric utility exceeds 5% of the capacity necessary to meet the Electric Supplier's aggregated customer monthly peak demand for a particular calendar year, the Electric Supplier may elect not to provide Net Metering services to additional customers;
6. A community includes customers sharing a unique set of interests;
7. All CEF Subscribers will select Delmarva Power to provide electric supply service, and Delmarva Power may require all meters to be read on the same billing cycle;
8. Before a Community Energy Facility may be formed and served by Delmarva Power, the community proposing a Community Energy Facility shall file with the Delaware Energy Office and Delmarva Power the following information:
 - (i) a list of individual meters the community is entitled to aggregate identified by name, address, rate schedule, and account number; and
 - (ii) a description of the Community Energy Facility, including the facility's physical location, the Host customer's physical location, capacity, fuel type or generating technology, and how the Subscribers share a unique set of interests;
 - (iii) the share of kWh credits to be attributed to each meter;
9. At least ninety days before a Community Energy Facility can participate under this Rider the Host must submit a completed tariff application available at: <http://www.delmarva.com/home/requests/interconnection/>, to be reviewed and approved by the Company;
10. Each generator participating as a Community Energy Facility shall be connected in parallel operation with the Company's electric system and shall have adequate protective equipment as described in Section D below;

RIDER "CEF"
COMMUNITY ENERGY FACILITY RIDER

A. Availability – (Continued)

11. A community proposing a Community Energy Facility may change its list of aggregated meters as specified in Section A8(i) no more than quarterly by providing ninety days' written notice to Delmarva Power;
12. If the community proposing a Community Energy Facility removes individual customer/Subscribers from the list of aggregated meters as specified in Section A8(i), then that community shall either replace the removed customer Subscriber(s), reduce the generating capacity of the Community Energy Facility to remain compliant with the provisions provided under Section A (1) above, or default to the monthly average Locational Marginal Price (LMP), or hourly LMP if advanced metering technology is installed, for any excess kWh credit;
13. Delmarva Power requires the installation of a separate meter on the generation equipment of the Community Energy Facility; and
14. Neither Host customers nor owners of Community Energy Facility shall be subject to regulation as either public utilities or an Electric Supplier.

B. Credit calculation for excess generation

The Company will compute and make direct payment to the Community Energy Facility for the value of excess generation at the end of each monthly billing period. The value for generated electricity is established by the Public Service Commission as the otherwise applicable supply service charge of each Host customer. Additionally, for the Host customer and Subscribers located on the same distribution feeder as the Community Energy Facility, the Company shall also include in the monthly payment to the Community Energy Facility the value for the volumetric kWh delivery service charges.

The Community Energy Facility retains ownership of all the Renewable Energy Credits (RECs) associated with electric energy produced unless the customers participating in the Community Energy Facility have relinquished such ownership by contractual agreement with a third party.

The Company shall assess the stand-alone Community Energy Facility a customer charge equivalent to the load and energy output characteristics of the generating facility which would be equivalent to the load and energy characteristics of a similarly situated retail electric customer in its Commission-approved tariff, i.e., an equivalent retail tariff.

Until the Community Energy Facility's generating unit(s) has received written approval authorizing connection to the Company's distribution and /or transmission system and the Community Energy Facility has meet all other requirements of this Rider, **no payment will be made for generation to the Community Energy Facility.**

C. Rules and Regulations

Nothing in these Rules is intended in any way to limit eligibility for net energy metering services based upon direct ownership, joint ownership, or third-party ownership or financing agreement related to a Community Energy Facility, where net energy metering would otherwise be available.

RIDER "CEF"
COMMUNITY ENERGY FACILITY RIDER – (Continued)

C. Rules and Regulations - (Continued)

Community Energy Facility disputes limited to the correct application of Commission-approved tariffs shall be resolved by the Commission. All other disputes with the Company shall be resolved by the appropriate governing body with jurisdiction over such disputes.

D. Interconnection with the Company's System

Interconnection with the Company's system requires the installation of protective equipment which, in the Company's judgment, provides safety for personnel; affords adequate protection against damage to the Company's system or to its customer's property; and prevents any interference with the Company's delivery and supply of service to others. The Company shall not be liable for any loss, cost, damage or expense to any party resulting from the use or presence of electric current or potential which originates from a Community Energy Facility, except as the Company would be liable in the normal course of business. Such protective equipment shall be installed, owned and maintained by the owners of the Community Energy Facility at its expense.

E. Metering

Unless otherwise specified under the PJM interconnection process, a smart meter shall measure the generation output energy for each hour during the monthly billing period. The Company shall furnish, install, maintain and own all the metering equipment needed for measurement of the service supplied. Where a larger capacity meter is required to serve the Host customer's Community Energy Facility, or a larger capacity meter is requested by the Host customer, the Host customer shall pay the Company the difference between the larger capacity meter investment and the metering investment normally provided under the customer's Service Classification.

F. Modification of the Company's System and Liability

If it is necessary for the Company to extend or modify portions of its systems to accommodate the delivery of electricity from the Community Energy Facility, such extension or modification shall be performed by the Company at the CEF's expense. Unless otherwise specified under the PJM interconnection process, for new services, such expense shall be determined by the difference between total costs and the investment the Company would make to install a normal service without the Community Energy Facility's electric generator(s).

RIDER "CEF"
COMMUNITY ENERGY FACILITY RIDER – (Continued)

F. Modification of the Company's System and Liability – (Continued)

If it is necessary for the Company to extend or modify portions of its systems to accommodate the delivery of electricity from the Community Energy Facility, such extension or modification shall be performed by the Company at the Community Energy Facility's expense. For new services, such expense shall be determined by the difference between total costs and the investment the Company would make to install a normal service without the CEF's generator(s).

The Company accepts no responsibility whatsoever for damage or injury to any person or property caused by failure of the CEF and its generator(s) to operate in compliance with Company's requirements. The Company shall not be liable for any loss, cost, damage or expense to any party resulting from the use or presence of electric current or potential which originates from the CEF's generator(s) Facility, except as the Company would otherwise be liable under the Company's Delaware electric tariff. Connection by the Utility under this Rider does not imply that the Utility has inspected or certified that any Community Energy Facility has complied with any necessary local codes or applicable safety or performance standards. All inspections, certifications and compliance with applicable local codes and safety requirements are the sole responsibility of the Community Energy Facility and must be provided to the Company prior to system acceptance and parallel operation with the utility system.

The equivalent retail tariff shall also be used to assess the stand-alone Community Energy Facility non-volumetric charges to recover the otherwise applicable supply, transmission, and distribution delivery costs. Subscribers to the stand-alone Community Energy Facility remain subject to only their otherwise applicable Commission-approved tariff.

Any requirements necessary to permit interconnected operations between the Community Energy Facility and the Company, and the costs associated with such requirements, shall be dealt with in a manner consistent with a standard tariff filed with the Commission by the Company.

The Company shall not require eligible CEF customers who meet all applicable safety and performance standards to install excessive controls, perform or pay for unnecessary tests, or purchase excessive liability insurance.

Connection by the Utility under this Rider does not imply that the Utility has inspected or certified that any Community Energy Facility has complied with any necessary local codes or applicable safety or performance standards. All inspections, certifications and compliance with applicable local codes and safety requirements are the sole responsibility of the Community Energy Facility and must be provided to the Company prior to system acceptance and parallel operation with the utility system.

RIDER "CEF"
COMMUNITY ENERGY FACILITY RIDER – (Continued)

G. Protective Equipment and Cessation of Parallel Operation

The Community Energy Facility's equipment must be installed and configured so that parallel operation must cease immediately and automatically during system outages or loss of the Company's primary electric source. The Community Energy Facility's generators must also cease parallel operation of the Community Energy Facility upon notification by the Company of a system emergency, abnormal condition, or in cases where such operation is determined to be unsafe, interferes with the supply of service to other customers, or interferes with the Company's system maintenance or operation.

H. Failure to Comply

If the Community Energy Facility fails to comply with any of the requirements set forth in sections G and H above, **the Company may disconnect the CEF's generator(s)** from the Company's electric system until the requirements are met, or the Community Energy Facility is disconnected from the electric distribution or transmission system.

I. Public Utilities Tax

In addition to the charges provided for in this Service Classification, the Delaware State Public Utilities Tax shall apply to all services, including any applicable electric supply services, rendered hereunder, unless the Community Energy Facility is exempt from such tax.

J. Rules and Regulations

The Commission shall periodically review the impact of net-metering rules in this section and recommend changes or adjustments necessary for the economic health of utilities.

The Rules and Regulations set forth in this tariff shall govern the provision of service under this Service Classification.

K. Disputes

Net metering disputes heard before the Delaware Public Service Commission shall be limited to the correct application of Commission-approved tariffs to be resolved by the Commission. All other disputes with the Company shall be resolved by the appropriate governing body with jurisdiction over such disputes.



A PHI Company

**APPLICATION FOR DELAWARE
COMMUNITY ENERGY FACILITY (CEF) TARIFF**

The Green Power Connection™ Team
Delmarva Power
A PHI Company
(866) 634-5571 - Phone
(856) 351-7523 - FAX
gpc-north@pepcoholdings.com

(Send applications via Email, FAX, or Mail to Delmarva Power, GPC Team)

Mailing Address: 5 Collins Drive, Mail Stop 84CP22, Carneys Point, NJ 08069

COMMUNITY ENERGY FACILITY INFORMATION

Corporate Information:

Corporate Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address (Required): _____
EIN or SSN: _____

Contact Information:

Name: _____ Title: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address (Required): _____

Alternate Contact Information:

Name: _____ Title: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address: _____

Banking Information:

Bank Name: _____
Bank Address (city, state, zip): _____
ABA Transit Routing #: ACH: _____ Fed Wire: _____
Swift Code (international only): _____
Bank Account #: _____
Name on Bank Account: _____
Type of Account: Checking Savings

GENERATOR INFORMATION¹

Facility #1:

DPL Account # (if applicable): _____

Facility Address: _____

City: _____ State: _____ Zip Code: _____

Maximum Facility Output Rating: _____ kW AC

Estimated Gross Annual Energy Production: _____ kWh

Primary Source of Fuel:

PJM Queue # (required within 90 days of application): _____

Customer Sited Standalone

STATEMENT OF QUALIFICATION

Statement of Qualification as a "community of customers sharing a unique set of interests":

SUBSCRIBER INFORMATION AND SIGNATURES²

1
Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

¹ Attach additional sheets if necessary with additional generators.
² Attach additional sheets if necessary with additional subscribers.

2

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

3

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

4

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

5

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

6

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

7

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

8

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

9

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

10

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

11

Name: _____

Account #: _____

Residential Non-Residential Agricultural

Address: _____

City: _____ State: _____ Zip Code: _____

Subscriber Signature: _____ Date: _____

CEF AUTHORIZED SIGNATURE

I hereby certify that: 1) I have read and understand the Delmarva Power Community Energy Facility Tariff ("CEF") which can be found on DPL's website and is a part of this Agreement; 2) I hereby agree to comply with the CEF tariff; and 3) to the best of my knowledge, all of the information provided in this application form is complete and true. I consent to permit the PSC and Delmarva Power to exchange information regarding the generating system and the customers to which this application applies.

Customer Signature: _____ Date: _____

Printed Name: _____ Title: _____

.....

FINAL APPROVAL FOR DPL CEF TARIFF *(for DPL use only)*

Entry in the CEF tariff is hereby approved by Delmarva Power. The date specified here represents the date the customer was entered into the tariff.

DPL Signature: _____ Date: _____

Printed Name: _____ Title: _____

Interconnection Standards for Delmarva Power & Light Company's Delaware Operating Territory

Authority: This Interconnection Standard is filed in compliance with the Delaware Public Utility Commission in PSC Regulation Docket No. 49 and Order Numbers 7832 (September 7th, 2010) and 7984 (06-07-2011). These Orders were issued as necessitated by the Delaware State Senate, 145th General Assembly, Senate Bill No. 267 as Amended by Senate Amendment No. 2, which prompted the Commission Staff to update Title 26 - Public Utilities – Chapter 10. Electric Utility Restructuring §1014. Public purpose programs and consumer education; specifically the Net Energy Metering section (d). Senate Bill No. 267 was signed into law July 28, 2010 by Governor Markell.

In the Rules update process, Commission Staff scheduled and held two public comment workshops to discuss the Rule edits and resolve conflicts that arose when interested parties filed comments and reply comments on this topic. The resulting rewrite of the Delaware Interconnection Standard is a byproduct of these workshops. The Maryland Interconnection Standard, which is the basis of the new Delaware Interconnection Standard, was developed in a similar workshop fashion in 2008 with parties from Delmarva Power, the Maryland Public Service Commission and the Interstate Renewable Energy Council (IREC) among other interested parties. Delaware Commission Staff, IREC and Delmarva Power agreed during the workshop held on March 24, 2011 to proceed in this Delaware Interconnection Standard update process, which would be the most expedient path forward and save time and expense for Delaware ratepayers.

Effective Date: All Interconnection Standards and application fees described herein become effective 08-08-2011.

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Section 1 Scope.

This section applies to a small electricity generator facility seeking to interconnect to the electric distribution system which meets the following criteria:

- A. The nameplate capacity of the small generator facility is equal to or less than 10 MW (for Rate X, 1 MW or less); and
- B. The small generator facility is not subject to the interconnection requirements of PJM Interconnection, LLC; and
- C. The small generator facility is designed to operate in parallel with the electric distribution system; and
- D. The applicant will not operate the small generator facility until the Company's application and inspection process is completed. **Unauthorized system interconnection and operation will result in no payment for excess generation credits and the danger of disconnection of service until the application is approved.**

Section 2 Definitions.

In this section, the following terms have the meanings indicated.

Terms Defined.

"Adverse system impact" means a negative effect, due to technical or operational limits on conductors or equipment being exceeded, that may compromise the safety or reliability of the electric distribution system.

"Affected system" means a Delmarva Power distribution system that is affected by the interconnection of a small generator to another distribution company's distribution system without impacting a transmission system regulated by the Federal Energy Regulatory Commission.

"Aggregated Meters" refers to an individual customer with multiple accounts and single or multiple premises where a single customer can aggregate Net Metering generation credits to multiple accounts and/or premises under the provisions of Delmarva Power's Commission approved Net Energy Metering tariff.

"Applicant" means a person who has submitted an interconnection request to interconnect a small generator facility to Delmarva Power's electric distribution system.

"Application Approval" means the Company has received and acknowledged a completed application, and processed the request for interconnection based on the provisions contained in the Delmarva Power's Commission Approved Interconnection Standards. All applicable safety, local building codes and interconnection requirements have been met and the Company has issued final written authorization to begin energy generation connected to the Company's distribution system.

“Area network” means a type of electric distribution system served by multiple transformers interconnected in an electrical network circuit, often used in large, densely populated metropolitan areas.

“Certificate of completion” means a certificate on a form approved by the Commission containing information about the interconnection equipment to be used, its installation and local inspections.

“Commissioning test” mean one of several tests applied to a small generator facility by the applicant after construction is completed to verify that the facility does not create adverse system impacts, including the test specified in section 5.4 of IEEE Standard 1547.

“Community Energy Facility” refers to a host customer and one or more subscribers covering multiple premises where a Community Energy Facility, either behind the meter of a Subscriber or as a stand-alone facility, provides Net Metering for multiple Subscribers and multiple premises.

“Distribution upgrade” means a required addition or modification to Delmarva Power’s electric distribution system, excluding the interconnection facilities, necessary to accommodate the interconnection of a small generator facility.

“Draw-out type circuit breaker” means a molded case switching device that can be inserted into or removed from its enclosure during no-load conditions. This switching device is capable of making, carrying and breaking currents under normal and abnormal circuit conditions.

“Electric distribution system” means the facilities and equipment used to transmit electricity generally at less than 69 kV to ultimate usage points such as homes and industries from interchanges with higher voltage transmission networks that transport bulk power over longer distances, and same meaning as the term Area EPS as defined in section 3.1.6.1 of IEEE Standard 1547.

“Fault current” means the electrical current that flows through a circuit during an electrical fault condition, such as when one or more electrical conductors contact ground or each other.

“IEEE Standard 1547 and 1547.1” means the international electric standard developed by Institute of Electrical and Electronics Engineers, or IEEE. Unless otherwise specified by the Commission, Delmarva Power shall use the applicable provisions in the latest revised version of the referenced publications listed below as standards of accepted good engineering practice:

- A. National Electrical Safety Code, ANSI C2-2002;
- B. National Electrical Code, ANSI/NFPA 70—2005;
- C. American National Standard for Electric Meters—Code for Electricity Metering, ANSI C12.1—2001;
- D. American Standard Requirements, Terminology and Test Code for Instrument Transformers, ANSI/IEEE C57.13—1993;

- E. Standard for Interconnecting Distributed Resources with Electric Power Systems, IEEE Standard 1547—2003;
- F. Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems, IEEE Standard 1547.1—2005; and
- G. NEMA Standards Publication TP 1-2002.

“Interconnection customer” means an entity that proposes to interconnect a small generator facility to an electric distribution system.

Interconnection:

(a) “Interconnection equipment” means a group of components or integrated system, owned by either the Interconnection Customer, or the Local Electric Power System (Delmarva Power), to accommodate the interconnection of a small generator facility with a local electric power system or an electric distribution system.

(b) Interconnection Customer “Interconnection facilities/equipment” means facilities and equipment, owned by the Interconnection Customer, required by Delmarva Power to interconnect the small generation facility to the Delmarva Power Distribution System and includes all interface equipment including switchgear, protective devices, inverters or other interface devices, including equipment installed as part of an integrated equipment package that includes a generator or other electric source.

(c) Delmarva Power “Interconnection facilities” includes all facilities and equipment, owned by Delmarva Power, between the small generator Interconnection Customer’s Interconnection Facilities and the electric distribution system and includes modifications, additions, or upgrades that are necessary to physically and electrically interconnect the small generator facility to the electric distribution system.

(d) The Interconnection Customer Interconnection Facilities and the Delmarva Power Interconnection facilities are connected at the Point of Interconnection.

“Interconnection request” means an applicant’s request on a form approved by the Commission for the interconnection of a new small generator facility, or to increase the capacity or operating characteristics of an existing small generator facility that is interconnected with the Delmarva Power’s electric distribution system.

“Interconnection study” means an interconnection feasibility study, interconnection system impact study, or interconnection facilities study as described in Section 12 of this document.

“Line section” means that portion of a Delmarva Power electric distribution system connected to an interconnection customer, bounded by automatic sectionalizing devices or the end of the distribution line.

“Local electric power system” means those facilities that deliver electric power to a load that are contained entirely within a single premises or group of premises, and has the same meaning as the term local electric power system as defined in section 3.1.6.2 of IEEE Standard 1547.

“Minor equipment modification” means a change to the proposed small generator facility that does not have a significant impact on safety or reliability of the electric distribution system.

“Nameplate capacity” means the maximum rated output of a generator, prime mover, Inverter_{AC}, or other electric power production equipment under specific conditions designated by the manufacturer and is usually listed on a nameplate physically attached to the power production equipment.

“Nationally recognized testing laboratory (NRTL)” means a qualified private organization recognized by the Occupational Safety and Health Administration to perform independent safety testing and product certification.

“Parallel operation” means the sustained state of operation over 100 milliseconds which occurs when a small generator facility is connected electrically to the electric distribution system and thus has the ability for electricity to flow from the small generator facility to the electric distribution system.

“Point of interconnection” means the point where the Interconnection Customer's Interconnection Facilities are electrically connected to the Delmarva Power Interconnection Facilities or the electric distribution system, having the same meaning as the term “point of common coupling” as defined in section 3.1.13 of IEEE Standard 1547.

“Primary line” means a distribution line rated at greater than 600 volts.

“Queue position” means the order of a completed interconnection request, relative to all other pending completed interconnection requests, that is established based upon the date and time of receipt of the completed interconnection request by Delmarva Power.

“Radial distribution circuit” means a circuit configuration in which independent feeders branch out radially from a common source of supply.

“Rate X or Service Classification X” refers to a Commission approved, cogeneration and small power production Delmarva Power tariff that is available to customers throughout the territory served by the Company in the State of Delaware and is applicable to purchases of non-renewable generated electricity by the Company from cogenerators or small power producers which meet Federal qualifying standards and have a generating capacity of 1,000 kW or less.

“Scoping meeting” means a meeting between the applicant and Delmarva Power conducted for the purpose of discussing alternative interconnection options, exchanging information including any electric distribution system data and earlier study evaluations that would be reasonably expected to impact interconnection options, analyzing information, and determining the potential feasible points of interconnection.

“Secondary line” means a service line subsequent to the primary line that is rated for 600 volts or less, also referred to as the customer's service line.

“Shared transformer” means a transformer that supplies secondary source voltage to more than one customer.

Small generator facility:

(a) “Small generator facility” means the equipment used to generate or store electricity that operates in parallel with the electric distribution system with a nameplate capacity equal to or less than 10 MW.

(b) “Small generator facility” includes an electric generator, prime mover, and the interconnection equipment required to safely interconnect with the electric distribution system or local electric power system.

“Spot network” means a type of electric distribution system that uses two or more inter-tied transformers to supply an electrical network circuit generally used to supply power to a single customer or a small group of customers, and has the same meaning as the term is defined in 4.1.4 of IEEE Standard 1547.

“Standard small generator interconnection agreement” means a set of standard forms approved by the Commission of interconnection agreements which are applicable to interconnection requests pertaining to small generating facilities.

“UL Standard 1741” means the Underwriters Laboratories’ standard titled “Inverters Converters, and Controllers for Use in Independent Power Systems”, November 7, 2005 edition.

“Witness test” means, for lab certified or field approved equipment, verification either by an on-site observation or review of documents by Delmarva Power that the interconnection installation evaluation required by Section 5.3 of IEEE Standard 1547 and the commissioning test required by Section 5.4 of IEEE Standard 1547 have been adequately performed.

Section 3 Acceptable Standards.

- A. The technical standard to be used in evaluating all interconnection requests under Level 1, Level 2, Level 3 and Level 4 reviews, unless otherwise provided for in this document, is IEEE Standard 1547.
- B. Attachment H to the PJM Interconnection Planning Manual, available from the website www.pjm.com, shall be used to detail and illustrate the interconnection protection requirements that are provided in IEEE Standard 1547.

Section 4 Interconnection Requests.

- A. Applicants seeking to interconnect a small generator facility shall submit an interconnection request using a standard form approved by the Commission to Delmarva Power that owns the electric distribution system to which interconnection is sought.

- B. Delmarva Power shall establish processes for accepting interconnection requests electronically on the utility's website. Available at the 'Green Power Connection' information website: <http://www.delmarva.com/energy/renewable/connection/>

Section 5 Interconnection Request Processing Fees.

- A. Delmarva Power may only charge a small generator interconnection application fee for a Level 2, Level 3, or Level 4 interconnection.
- B. The small generator facility interconnection fees under Section 5 (A) may not exceed the following:
 - (1) No charge for Level 1 applications;
 - (2) \$50 plus \$1 per kW of rated generating facility output for Level 2 applications; and
 - (3) \$100 plus \$2 per kW of rated generating facility output for Level 3 and 4 applications.
- C. Delmarva Power shall specify the interconnection processing fees charged in its application forms.

Section 6 General Requirements.

- A. When an interconnection request for a small generator facility includes multiple energy production devices at a site for which the applicant seeks a single point of interconnection, the interconnection request shall be evaluated on the basis of the aggregate nameplate capacity of the multiple devices.
- B. When an interconnection request is for an increase in capacity for an existing small generator facility, the interconnection request shall be evaluated on the basis of the new total nameplate capacity of the small generator facility.
- C. Utility Provided Information.
 - (1) Delmarva Power shall designate a contact person and provide contact information on its website and for the Commission's website for submission of all interconnection requests and from whom information on the interconnection request process and the utility's electric distribution system can be obtained.
 - (2) The information provided by the utility on its website: <http://www.delmarva.com/energy/renewable/connection/> shall include studies and other materials useful to an understanding of the feasibility of interconnecting a small generator facility on Delmarva Power's electric distribution system, except to the extent providing the materials would violate security requirements or confidentiality agreements, or be contrary to law.
 - (3) In appropriate circumstances, the Delmarva Power may require an applicant to execute an appropriate confidentiality agreement prior to release or access to confidential or restricted information.
- D. When an interconnection request is deemed complete, a modification other than a minor equipment modification that is not agreed to in writing by Delmarva Power, shall require submission of a new interconnection request.

- E. When an applicant is not currently a customer of Delmarva Power at the location for the proposed generation facility, upon request from the utility the applicant shall provide proof of site control evidenced by a property tax bill, deed, lease agreement, contract, or other acceptable document.
- F. Connection of Multiple Small Generators by Single Interconnection.
- (1) To minimize the cost of interconnecting multiple small generator facilities, Delmarva Power or the applicant may propose a single point of interconnection for multiple small generator facilities located at a single site.
 - (2) If an applicant rejects Delmarva Power's proposal for a single point of interconnection, the applicant shall pay any additional cost of providing separate points of interconnection for each small generator facility.
 - (3) If Delmarva Power unreasonably rejects a customer proposal for a single point of interconnection without providing a written technical explanation, the utility shall pay any additional cost of providing separate points of interconnection for each small generator facility.
- G. Electrical Isolation of Generators.
- (1) Small generator facilities shall be capable of being isolated from Delmarva Power's distribution system.
 - (2) For small generator facilities interconnecting to a primary line, the isolation shall be by means of a lockable, visible-break isolation device accessible by the utility.
 - (3) For small generator facilities interconnecting to a secondary line, the isolation shall be by means of a lockable isolation device whose status is clearly indicated and is accessible by the utility.
 - (4) The isolation device shall be installed, owned and maintained by the owner of the small generation facility and located electrically between the small generation facility and the point of interconnection.
 - (5) A draw-out type circuit breaker with a provision for padlocking at the draw-out position satisfies the requirement for an isolation device.
- H. Use of Lockbox for Access to Isolation Device.
- (1) An interconnection customer may elect to provide Delmarva Power access to an isolation device that is contained in a building or area that may be unoccupied and locked or not otherwise readily accessible to the utility, by installing a lockbox provided by Delmarva Power that shall allow ready access to the isolation device.
 - (2) The lockbox shall be in a location that is readily accessible by the utility and the interconnection customer shall permit Delmarva Power to affix a placard in a location of its choosing that provides clear instructions to utility operating personnel on access to the isolation device.
 - (3) In the event the interconnection customer fails to comply with the terms of this section and Delmarva Power needs to gain access to the isolation device, the utility shall not be held liable for any damages resulting from any necessary utility action to isolate the small generator.

- I. Metering.
- (1) Any metering necessitated by a small generator interconnection shall be installed, operated and maintained in accordance with the applicable Delmarva Power tariff.
 - (2) Any small generator metering requirements shall be clearly identified as part of the standard small generator interconnection agreement executed by the interconnection customer and Delmarva Power.
- J. Utility Monitoring and Control of Small Generator.
- (1) Delmarva Power monitoring and control of a small generator facility shall be required only if the nameplate rating is greater than 2 MW, with the exception of the normal data collection for monthly meter reading with 'Advanced' or 'Smart' meters.
 - (2) Any monitoring and control requirements shall be consistent with Delmarva Power's published requirements and shall be clearly identified as part of an interconnection agreement executed by the interconnection customer and the utility.
- K. Witness Test of Small Generator.
- (1) Delmarva Power shall have the option of performing a witness test after construction of the small generator facility is completed.
 - (2) The applicant shall provide the utility at least 5 business days notice of the planned commissioning test for the small generator facility.
 - (3) If Delmarva Power elects to perform a witness test, the utility shall contact the applicant to schedule the witness test at a mutually agreeable time within 10 business days of the scheduled commissioning test.
 - (4) If Delmarva Power does not perform the witness test within 10 business days of the commissioning test, the witness test is deemed waived unless the utility and applicant agree to extend the time for conducting the witness test.
 - (5) If the results of the witness test are not acceptable to the utility, the applicant shall address and resolve any deficiencies within 30 business days, which may be extended upon the request of the applicant prior to the expiration of the 30 business day period. A request for extension may not be unreasonably denied by Delmarva Power's.
 - (6) If the applicant fails to address and resolve the deficiencies to the satisfaction of the utility, the interconnection request shall be deemed withdrawn.
 - (7) If a witness test is not performed by Delmarva Power or an entity approved by the utility, the applicant shall satisfy the interconnection test specifications and requirements set forth in Section 5 of IEEE Standard 1547.
 - (8) For interconnection equipment that has not been lab certified or field approved under Section 7, the witness test shall also include the verification by the utility of the on-site design tests as required by Section 5.1 of IEEE Standard 1547 and of production tests required by Section 5.2 of IEEE Standard 1547.
 - (9) All tests verified by Delmarva Power are to be performed in accordance with the test procedures specified in IEEE Standard 1547.1.
 - (10) The applicant shall, if requested by the utility, provide a copy of all documentation in its possession regarding testing conducted under IEEE Standard 1547.1.

- L. Interconnection Studies and Applicant Information.
 - (1) If requested by the applicant, Delmarva Power shall provide the applicant copies of any interconnection studies performed in analyzing an interconnection request.
 - (2) An applicant may provide any other prospective applicant copies of interconnection studies to aide in streamlining a future utility review.
 - (3) Delmarva Power has no obligation to provide any prospective applicant any information regarding prior interconnection requests, including a prior applicant's name, copies of prior interconnection studies performed by the utility, or any other information regarding a prior applicant or request.

Section 7 Lab Certified and Field Approved Equipment.

- A. An interconnection request may be eligible for expedited interconnection review if the small generator facility uses lab certified or field approved interconnection equipment.
- B. Interconnection equipment shall be deemed to be lab certified upon establishment of the following:
 - (1) The interconnection equipment has been tested in accordance IEEE Standard 1547.1 in compliance with the appropriate codes and standards referenced in Section 7 (B7) by any NRTL recognized by the United States Occupational Safety and Health Administration to test and certify interconnection equipment under the relevant codes and standards listed in §B(7).
 - (2) The interconnection equipment has been labeled and is publicly listed by the NRTL at the time of the interconnection application.
 - (3) The NRTL testing the interconnection equipment makes readily available, such as by posting on its website, copies of all test standards and procedures utilized in performing equipment certification, and, with applicant approval, the test data itself.
 - (4) The applicant verifies that the intended use of the interconnection equipment falls within the use or uses for which the interconnection equipment was labeled, and listed by the NRTL.
 - (5) If the interconnection equipment is an integrated equipment package such as an inverter, then the applicant shall show that the generator or other electric source being utilized is compatible with the interconnection equipment and is consistent with the testing and listing specified for this type of interconnection equipment.
 - (6) If the interconnection equipment includes only interface components such as switchgear, multi-function relays, or other interface devices, then the applicant shall show that the generator or other electric source being utilized is compatible with the interconnection equipment and is consistent with the testing and listing specified for this type of interconnection equipment.
 - (7) To meet the requirements for lab certification, interconnection equipment shall be:
 - (a) Evaluated by a NRTL in accordance with the following codes and standards:
 - (1) IEEE Standard 1547, including use of IEEE Standard 1547.1 testing protocols to establish conformity; and

- (2) National Electrical Code; and
 - (b) Certified by Underwriters Laboratories under UL Standard 1741.
 - (8) Lab certified interconnection equipment may not require further design testing or production testing, as specified by Sections 5.1 and 5.2 of IEEE Standard 1547, or additional interconnection equipment modification to meet the requirements for expedited review; however, nothing herein shall preclude the need for an interconnection installation evaluation, commissioning tests or periodic testing as specified by Sections 5.3, 5.4 and 5.5 of IEEE Standard 1547 or for a witness test that may be conducted by a utility.
 - (9) To meet the requirements for lab certification, interconnection equipment shall be tested and listed by a NRTL in accordance with the codes and standards listed in this section as those codes and standards appeared on the date when the interconnection equipment was manufactured.
 - (10) Interconnection equipment manufactured prior to January 1, 2007 do not require testing and listing based on IEEE Standard 1547.1.
- C. Interconnection equipment shall be deemed to be field approved if within the previous 36 months of the date of the interconnection request, it has been previously approved for use with the proposed small generator facility and the following criteria are met:
- (1) Delmarva Power has previously approved interconnection equipment identical to that being proposed under the Level 4 study review process described in Section 12 in a materially identical system application, or the utility has agreed to accept a Level 4 study review conducted for identical interconnection equipment and system application by another utility; and
 - (2) The prior approval process included a successful witness test; and
 - (3) The applicant provided as part of its interconnection request the following:
 - (a) A copy of the final certificate of completion from the prior approval process;
 - (b) A written statement that the proposed interconnection equipment is identical to what was previously approved; and
 - (c) Documentation or drawings indicating the system interconnection details.

Section 8 Determination of Level of Utility Review of Interconnection Request.

- A. Delmarva Power shall determine on an expedited basis the level of review required for an interconnection request.
- B. Delmarva Power shall use a **Level 1** procedure to evaluate an interconnection request to connect an inverter-based small generation facility when:
 - (1) The small generator facility has an nameplate capacity of 10 kW or less; and
 - (2) The customer interconnection equipment is lab certified.
- C. Delmarva Power shall use a **Level 2** procedure to evaluate an interconnection request when:
 - (1)(a) The small generation facility has a nameplate capacity rating of 2 MW or less;

- (b) The interconnection equipment is lab certified or field approved;
- and
- (c) The proposed interconnection is to a radial distribution circuit, or a spot network limited to serving one customer; or
- (2) Alternatively, the small generator facility was reviewed under Level 1 review procedures but not approved and the applicant has submitted a new interconnection request for consideration.

- D. Delmarva Power shall use a **Level 3** review procedure to evaluate an interconnection request to area networks and radial distribution circuits when electric power is not exported to the electric distribution system based on the following criteria:
 - (1) For interconnection requests to the load side of an area network:
 - (a) The nameplate capacity of the small generator facility is less than or equal to 50 kW;
 - (b) The proposed small generator facility utilizes a lab certified inverter-based equipment package;
 - (c) The small generator facility utilizes reverse power relays and/or other protection functions that prevent the export of power into the area network;
 - (d) The aggregate of all generation on the area network does not exceed the smaller of 5% of an area network's maximum load or 50 kW; and
 - (e) Construction of facilities by the electric distribution company is not required to accommodate the small generator facility; or
 - (2) For interconnection requests to a radial distribution circuit:
 - (a) The small generator facility has a nameplate capacity of 10 MW or less;
 - (b) The aggregated total of the nameplate capacity of all of the generators on the circuit, including the proposed small generator facility, is 10 MW or less;
 - (c) The small generator will use reverse power relays or other protection functions that prevent power flow onto the electric distribution system;
 - (d) The small generator is not served by a shared transformer; and
 - (e) Construction of facilities by the utility on its own electric distribution system is not required to accommodate the small generator facility.
- E. Delmarva Power shall use the **Level 4** study review procedures for evaluating interconnection requests when:
 - (1) The nameplate capacity of the small generation facility is 10 MW or less; and
 - (2) The interconnection request cannot be approved under a Level 1, Level 2, or Level 3 review and the applicant has submitted an interconnection request for consideration under a Level 4 study review; and
 - (3) The interconnection request does not meet the criteria for qualifying for a review under Level 1, Level 2 or Level 3 review procedures.

Section 9 Level 1 Review.

- A. Delmarva Power's shall evaluate a Level 1 small generating facility for the potential for adverse system impacts using the following:

- (1) For interconnection of a proposed small generator facility:
 - (a) To a radial distribution circuit, the aggregated generation on the circuit, including the proposed small generator facility, may not exceed 15% of the line section annual peak load as most recently measured at the substation or calculated for the line section; or
 - (b) To a spot network:
 - (i) On the load side of spot network protectors, the proposed small generator facility shall utilize an inverter-based equipment package;
 - (ii) The interconnection equipment proposed for the small generator facility is lab certified; and
 - (iii) When aggregated with other generation, may not exceed 5% of the spot network's maximum load if the spot network serves more than one customer; and
- (2) When a proposed small generator facility is to be interconnected on a single-phase shared secondary line, the aggregate generation capacity on the shared secondary line, including the proposed small generator facility, may not exceed 20 kW;
- (3) When a proposed small generator facility is single-phase and is to be interconnected on a center tap neutral of a 240 volt service, its addition may not create an imbalance between the two sides of the 240 volt service of more than 20% of the nameplate rating of the service transformer; and
- (4) Modification or construction of additional facilities by Delmarva Power on its distribution system, except for metering, is not required to accommodate the small generator facility.

- B. Delmarva Power in conducting a Level 1 interconnection review shall:
 - (1) Within 5 business days after receipt of the interconnection request, inform the applicant that the interconnection request is:
 - (a) Complete; or
 - (b) Incomplete and what materials are missing; and
 - (2) Within 15 business days after the utility notifies the applicant that the application is complete in paragraph (1), verify that the small generator facility equipment can be interconnected safely and reliably under Section 9 (A).
- C. Unless the utility determines and demonstrates that a small generator facility cannot be interconnected safely or reliably to its electric distribution system, the utility shall approve the interconnection request subject to the following conditions:
 - (1) The small generator facility has been approved by local or municipal electric code officials with jurisdiction over the interconnection;
 - (2) A certificate of completion has been returned to Delmarva Power;
 - (3) The witness test has been successfully completed or waived by the utility;
 - (4) The applicant has signed a standard small generator interconnection agreement.
- D. If an applicant does not sign the standard small generator interconnection agreement within 30 business days after receipt from Delmarva Power, the interconnection request be deemed withdrawn unless the applicant requests to

have the deadline extended. A request for extension may not be unreasonably denied by the utility.

E. Level 1 Review Failure.

- (1) If the small generator facility is not approved under a Level 1 review, Delmarva Power shall provide the applicant a letter explaining its reasons for denying the interconnection request.
- (2) When a small generator facility is not approved under a Level 1 review, the applicant may submit a new interconnection request for consideration under Level 2, Level 3 or Level 4 procedures.

Section 10 Level 2 Review.

A. Delmarva Power shall evaluate a Level 2 small generator facility for the potential for adverse system impacts using the following:

- (1) For interconnection of a proposed small generator facility:
 - (a) To a radial distribution circuit, the aggregated generation on the circuit, including the proposed small generator facility, may not exceed 15% of the line section annual peak load most recently measured at the substation or calculated for the line section; or
 - (b) To a spot network:
 - (i) When the interconnection of a proposed small generator facility is to the load side of spot network protectors, the proposed small generator facility shall utilize an inverter-based equipment package;
 - (ii) The applicant's interconnection equipment proposed for the small generator facility shall be lab certified or field approved; and
 - (iii) A small generating facility, when aggregated with other generation on the spot network, may not exceed 5% of a spot network's maximum load if the spot network serves more than one customer; and
- (2) Fault current limitations:
 - (a) The proposed small generator facility, in aggregation with other generation on the distribution circuit, may not contribute more than 10% to the electric distribution circuit's maximum fault current at the point on the primary line nearest the point of interconnection;
 - (b) The proposed small generator facility, in aggregate with other generation on the distribution circuit, may not cause any distribution protective devices and equipment including substation breakers, fuse cutouts, and line reclosers, or other customer equipment on the electric distribution system to be exposed to fault currents exceeding 90% of the short circuit interrupting capability; and
 - (c) The interconnection request may not request interconnection on a circuit that already exceeds 90% of the short circuit interrupting capability; and
- (3) The proposed small generator facility's point of interconnection may not be on a transmission line;
- (4) When a customer-generator facility is to be connected to 3 phase, 3 wire primary utility distribution lines, a 3 phase or single-phase generator shall be connected phase-to-phase;

- (5) When a customer-generator facility is to be connected to 3 phase, 4 wire primary utility distribution lines, a 3 phase or single phase generator will be connected line-to-neutral and will be effectively grounded;
 - (6) When the proposed small generator facility is to be interconnected on single-phase shared secondary line, the aggregate generation capacity on the shared secondary line, including the proposed small generator facility, shall not exceed 20 kW;
 - (7) When a proposed small generator facility is single-phase and is to be interconnected on a center tap neutral of a 240 volt service, its addition may not create an imbalance between the two sides of the 240 volt service of more than 20% of the nameplate rating of the service transformer;
 - (8) A small generator facility, in aggregate with other generation interconnected to the distribution side of a substation transformer feeding the circuit where the small generator facility proposes to interconnect, may not exceed 10 MW in an area where there are known or posted transient stability limitations to generating units located in the general electrical vicinity; and
 - (9) Except as permitted by an additional review in Section 10 (G), no modification or construction of additional facilities by Delmarva Power of its distribution system, with the exception of metering, shall be required to accommodate the small generator facility.
- B. Delmarva Power shall, within 5 business days after receipt of the interconnection request, inform the applicant that the interconnection request is:
- (a) Complete; or
 - (b) Incomplete and what materials are missing;
- C. Queue Position.
- (1) When an interconnection request is complete, Delmarva Power shall assign a queue position if there is more than one interconnection request pending for the same line section.
 - (2) The queue position of the interconnection request shall be used to determine the potential adverse system impact of the small generator facility based on the relevant screening criteria.
 - (3) The utility shall notify the applicant of any other higher queue position applicants on the same line section or spot network for which interconnection is sought.
 - (4) Queue position may not be forfeited or otherwise impacted by the submission of a dispute under the provisions of Section 13.
- D. When Delmarva Power determines additional information is required to complete an evaluation:
- (1) The utility shall request the information;
 - (2) The time necessary to complete the evaluation may be extended, but only to the extent of the delay required for receipt of the additional information; and
 - (3) When additional information is required, the utility may not revert to the start of the review process or alter the applicant's queue position.
- E. Within 20 business days after the utility notifies the applicant it has received a completed interconnection request, Delmarva Power shall:

- (a) Evaluate the interconnection request using the Level 2 screening criteria;
 - (b) Review the applicant's analysis, if provided by applicant, using the same criteria;
 - (c) Provide the applicant with Delmarva Power's evaluation, including a comparison of the results of its own analyses with those of applicant, if applicable; and
 - (d) When Delmarva Power does not have a record of receipt of the interconnection request and the applicant can demonstrate that the original interconnection request was delivered, expedite its review to complete the evaluation of the interconnection request within 20 business days.
- F. The utility is not obligated to comply with the 20 business day limit of Section 10 (E) for reviewing the interconnection request until such time as the utility has completed the review of all other interconnection requests that have a higher queue position.
- G. Failure to Meet Level 2 Criteria.
- (1) Additional review may be appropriate when a small generator facility has failed to meet one or more of the Level 2 criteria of Section 10 (A).
 - (2) Delmarva Power shall:
 - (a) Offer to perform additional review to determine whether minor modifications to the electric distribution system would enable the interconnection to be made consistent with safety, reliability and power quality criteria; and
 - (b) Provide the applicant with a nonbinding, good faith estimate of the costs of additional review and minor modifications.
 - (3) Delmarva Power shall undertake the additional review only if the applicant agrees within 10 business days to pay for the cost of the review, which may be extended at the request of the applicant. A request for extension may not be unreasonably denied by the utility.
 - (4) If the review identifies the need for modifications to the distribution system, the utility shall make the necessary modifications only if the interconnection customer agrees to pay for the cost of the modifications.
- H. Interconnection Agreement.
- (1) When Delmarva Power determines that the interconnection request passes the Level 2 screening criteria, or fails one or more of the Level 2 screening criteria but determines that the small generator facility can be interconnected safely and reliably, the utility shall provide the applicant a standard small generator interconnection agreement within 5 business days after the determination.
 - (2) The applicant shall have either 30 calendar days, or another mutually agreeable timeframe after receipt of the standard small generator interconnection agreement, to sign and return the standard small generator interconnection agreement.
 - (3) If the applicant does not sign the standard small generator interconnection agreement within 30 calendar days, the request shall be deemed withdrawn unless the applicant and utility mutually agree to extend the time period for executing the standard small generator interconnection agreement prior to the

expiration of the 30 business day period. A request for extension may not be unreasonably denied by Delmarva Power.

(4) After the standard small generator interconnection agreement is signed by the applicant and utility, interconnection of the small generator facility shall proceed according to any milestones agreed to by the applicant and utility in the standard small generator interconnection agreement.

(5) The interconnection agreement will not be final until:

(a) Any milestones agreed to in the standard small generator interconnection agreement are satisfied;

(b) The small generator facility is approved by electric code officials with jurisdiction over the interconnection;

(c) The applicant provides a certificate of completion to the utility; and

(d) There is a successful completion of the witness test, if conducted by Delmarva Power.

I. Level 2 Review Failure.

(1) If the small generator facility is not approved under a Level 2 review, Delmarva Power shall provide the applicant a letter explaining its reasons for denying the interconnection request.

(2) The applicant may submit a new interconnection request for consideration under a Level 3 or Level 4 interconnection review; however, the queue position assigned to the Level 2 interconnection request shall be retained provided the request is made within 15 business days of notification that the current Level 2 interconnection request is denied.

Section 11 Level 3 Review.

A. Delmarva Power shall use the Level 3 review procedure for an interconnection request that meets the Level 3 criteria in Section 8.

B. Queue Position.

(1) Once the interconnection request is deemed complete by the utility, the utility shall assign a queue position based upon the date and time the interconnection request is determined to be complete if there is more than one interconnection request pending for the same line section.

(2) The queue position of each interconnection request shall be used to determine the potential adverse system impact of the small generator facility based on the relevant screening criteria.

(3) Delmarva Power shall notify the applicant of any other higher queue position applicants on the same radial line or area network that the applicant is seeking to interconnect to.

(4) Queue position may not be forfeited or otherwise impacted by any pending dispute submitted under the provisions of Section 14.

C. Interconnection requests meeting the requirements set forth in Section 8 for non-exporting small generator facilities interconnecting to an area network shall be presumed by the utility to be appropriate for interconnection. Delmarva Power shall process the interconnection request to area networks using the following procedures:

(1) Delmarva Power shall evaluate the interconnection request under Level 2 interconnection review procedures as set forth in Section 10 (C) except that the utility shall have 25 business days to conduct an area network impact study to determine any potential adverse system impacts of interconnecting to the utility's area network; however, the utility may not be obligated to meet the 25 business day limit for reviewing the interconnection request until such time as the utility has completed the review of all other interconnection requests that have a higher queue position.

(2) In the event the area network impact study identifies potential adverse system impacts, Delmarva Power may determine at its sole discretion that it is inappropriate for the small generator facility to interconnect to the area network in which case the interconnection request shall be denied; however, the applicant may elect to submit a new interconnection request for consideration under Level 4 procedures in which case the queue position assigned to the Level 3 interconnection request will be retained provided the request is made within 15 business days of notification that the current application is denied.

(3) Delmarva Power will conduct the area network impact study at its own expense.

(4) In the event the utility denies the interconnection request, the utility shall provide the applicant with a copy of its area network impact study and written justification for denying the interconnection request.

D. For an interconnection request meeting the requirements of Section 8 for non-exporting small generator facilities interconnecting to a radial distribution circuit, Delmarva Power shall:

(1) Evaluate the interconnection request using the Level 2 review in Section 10; and

(2) Approve the interconnection request if all of the applicable Level 2 screens are satisfied except that the peak line section value indicated in Section 10 (A) shall be 25% instead of 15%.

E. Interconnection Agreement.

(1) When a small generator facility that satisfies the criteria in Section 11 (C & D), the utility shall approve the interconnection request and provide a standard interconnection agreement for the applicant to sign.

(2) The applicant shall have 30 calendar days, or other mutually agreeable timeframe after receipt of the standard small generator interconnection agreement, to sign and return the standard small generator interconnection agreement.

(3) If the applicant does not sign the standard small generator interconnection agreement within 30 calendar days, the interconnection request shall be deemed withdrawn unless the applicant and utility mutually agree to extend the time period for executing the standard small generator interconnection agreement prior to the expiration of the 30 business day period. A request for extension may not be unreasonably denied by Delmarva Power.

(4) After the standard small generator interconnection agreement is signed by the applicant and utility, interconnection of the small generator facility shall proceed according to any milestones agreed to by the applicant and utility in the standard small generator interconnection agreement.

- (5) The interconnection agreement will not be final until:
- (a) Any milestones agreed to in the standard small generator interconnection agreement are satisfied;
 - (b) The small generator facility is approved by electric code officials with jurisdiction over the interconnection;
 - (c) The applicant provides a certificate of completion to the utility; and
 - (d) There is a successful completion of the witness test, if conducted by Delmarva Power.

F. Level 3 Review Failure.

- (1) If the small generator facility is not approved under a Level 3 review, the utility shall provide the applicant a letter explaining its reasons for denying the interconnection request.
- (2) If the small generator facility is not approved under a Level 3 review, the applicant may submit a new interconnection request for consideration under the Level 4 procedures; however, the queue position assigned to the Level 3 interconnection request shall be retained provided the request is submitted within 15 business days of the notice that the current Level 3 request was not approved.

Section 12 Level 4 Study Review.

- A. Delmarva Power shall use the Level 4 study review procedure for an interconnection request that meets the Level 4 criteria in Section 8.

B. Interconnection Request.

- (1) Within 5 business days from receipt of an interconnection request, the utility shall notify the applicant whether the request is
- (a) Complete; or
 - (b) Incomplete.
- (2) When the interconnection request is not complete:
- (a) Delmarva Power shall provide the applicant a written list detailing information that shall be provided to complete the interconnection request;
 - (b) The applicant shall have 10 business days, which may be extended at the request of the applicant and not unreasonably denied by the utility, to provide appropriate data in order to complete the interconnection request or the interconnection request shall be considered withdrawn; and
 - (c) The interconnection request shall be deemed complete:
 - (i) When the required information has been provided by the applicant, or
 - (ii) The utility and applicant have agreed that the applicant may provide additional information at a later time.

C. Queue Position.

- (1) When an interconnection request is complete, the utility shall assign a queue position if there is more than one interconnection request pending for the same line section.

- (2) Delmarva Power shall use the queue position of an interconnection request to determine the cost responsibility necessary for the facilities to accommodate the interconnection.
- (3) The utility shall notify the applicant of other higher-queued applicants on the same line section of the new interconnection request.
- (4) Any required interconnection studies shall not begin until the utility has completed its review of all other interconnection requests that have a higher queue position.
- (5) Queue position shall not be forfeited or otherwise impacted by any pending dispute submitted under the provisions of Section 13.

D. Scoping Meeting.

- (1) By mutual agreement of Delmarva Power and applicant, the scoping meeting, interconnection feasibility study, interconnection impact study, or interconnection facilities studies provided for in a Level 4 review and discussed in this section may be waived.
- (2) If agreed to by the utility and applicant, a scoping meeting will be held within 10 business days, or other mutually agreed to time, after the utility has notified the applicant that the interconnection request is deemed complete, or the applicant has requested that its interconnection request proceed after failing the requirements of a Level 2 review or Level 3 review.
- (3) The purpose of the meeting is to review the interconnection request, existing studies relevant to the interconnection request, and the results of the Level 1, Level 2 or Level 3 screening criteria.
- (4) When the utility and applicant agree at a scoping meeting that an interconnection feasibility study shall be performed, the utility shall provide to the applicant, no later than 5 business days after the scoping meeting:
 - (a) An interconnection feasibility study agreement,
 - (b) An outline of the scope of the study, and
 - (c) A nonbinding, good faith estimate of the cost to perform the study.
- (5) When the applicant and Delmarva Power agree at a scoping meeting that an interconnection feasibility study is not required, the utility shall provide to the applicant, no later than 5 business days after the scoping meeting:
 - (a) An interconnection system impact study agreement,
 - (b) An outline of the scope of the study, and
 - (c) A nonbinding, good faith estimate of the cost to perform the study.
- (6) When the utility and applicant agree at the scoping meeting that an interconnection feasibility study and system impact study are not required, the utility shall provide to the applicant, no later than 5 business days after the scoping meeting:
 - (a) An interconnection facilities study agreement,
 - (b) An outline of the scope of the study, and
 - (c) A nonbinding, good faith estimate of the cost to perform the study.

E. Interconnection Feasibility, Impact, and Facilities Studies.

- (1) Interconnection Feasibility Study.
 - (a) An interconnection feasibility study shall include any necessary analyses for the purpose of identifying a potential adverse system impact to

Delmarva Power's electric distribution system that would result from the interconnection from among the following:

- (i) Initial identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection;
- (ii) Initial identification of any thermal overload or voltage limit violations resulting from the interconnection;
- (iii) Initial review of grounding requirements and system protection; and
- (iv) Description and nonbinding estimated cost of facilities required to interconnect the small generator facility to the utility's electric distribution system in a safe and reliable manner.

(b) When an applicant requests that the interconnection feasibility study evaluate multiple potential points of interconnection, additional evaluations may be required. Additional evaluations shall be conducted at the expense of the applicant.

(c) An interconnection system impact study is not required when the interconnection feasibility study concludes there is no adverse system impact, or when the study identifies an adverse system impact and the utility is able to identify a remedy without the need for an interconnection system impact study.

(d) Delmarva Power and applicant shall use an interconnection feasibility study agreement form approved by the Commission.

(e) The utility shall avoid duplicating previously conducted interconnection studies to the extent possible.

(2) Interconnection Impact Study.

(a) A distribution interconnection system impact study shall be performed when a potential distribution system adverse system impact is identified in the interconnection feasibility study.

(b) Scope of Interconnection System Impact Study.

(i) An interconnection system impact study shall evaluate the impact of the proposed interconnection on both the safety and reliability of the utility's electric distribution system.

(ii) The interconnection system impact study shall identify and detail the system impacts that result when a small generator facility is interconnected without project or system modifications, focusing on the adverse system impacts identified in the interconnection feasibility study, or potential impacts including those identified in the scoping meeting.

(iii) The interconnection system impact study shall consider all generating facilities that, on the date the interconnection system impact study is commenced, are directly interconnected with the utility's system, have a pending higher queue position to interconnect to the system, or have a signed a standard small generator interconnection agreement.

(iv) As part of its impact study, the utility shall agree to evaluate and consider any separate studies prepared by the applicant that evaluate alternatives for interconnecting the small generator facility including the applicant's assessment of potential impacts of the small generator facility on the electric distribution system.

(v) Delmarva Power shall provide the applicant with the utility's final impact study evaluation including a comparison of the results of its own analyses with those provided by the applicant.

- (c) Within 5 business days of transmittal of the interconnection feasibility study report, the utility shall send the applicant:
 - (i) An interconnection system impact study agreement using a form approved by the Commission;
 - (ii) An outline of the scope of the interconnection system impact study; and
 - (iii) A good faith estimate of the cost to perform the study.
 - (d) The impact study shall include any necessary elements from among the following:
 - (i) A load flow study;
 - (ii) Identification of affected systems;
 - (iii) An analysis of equipment interrupting ratings;
 - (iv) A protection coordination study;
 - (v) Voltage drop and flicker studies;
 - (vi) Protection and set point coordination studies;
 - (vii) Grounding reviews; and
 - (viii) Impact on system operation.
 - (e) An interconnection system impact study shall consider any necessary criteria from among the following:
 - (i) A short circuit analysis;
 - (ii) A stability analysis;
 - (iii) Alternatives for mitigating adverse system impacts on affected systems;
 - (iv) Voltage drop and flicker studies;
 - (v) Protection and set point coordination studies; and
 - (vi) Grounding reviews.
 - (f) The final interconnection system impact study shall provide the following:
 - (i) The underlying assumptions of the study;
 - (ii) The results of the analyses;
 - (iii) A list of any potential impediments to providing the requested interconnection service;
 - (iv) Required distribution upgrades; and
 - (v) A nonbinding good faith estimate of cost and time to construct any required distribution upgrades.
- (3) Interconnection Facilities Study.
- (a) Within 5 business days of completion of the interconnection system impact study, the utility shall provide to the applicant:
 - (i) A report of the impact study;
 - (ii) An interconnection facilities study agreement using a form approved by the Commission;
 - (iii) An outline of the scope of the interconnection facilities study; and
 - (iv) A nonbinding good faith estimate of the cost to perform the facilities study.
 - (b) The interconnection facilities study shall identify:
 - (i) The electrical switching configuration of the equipment, including transformer, switchgear, meters and other station equipment;

(ii) The nature and estimated cost of the utility's interconnection facilities and distribution upgrades necessary to accomplish the interconnection, including engineering, procurement, construction, and overhead; and

(iii) An estimate of the time required to complete the construction and installation of the facilities.

(c) Third Party Design or Construction of Interconnection Facilities.

(i) The applicant and Delmarva Power may agree to permit an applicant to separately arrange for a third party to design and construct the required interconnection facilities.

(ii) Delmarva Power may review and approve the design of the facilities under the interconnection facilities study agreement.

(iii) When the applicant and utility agree to separately arrange for design and construction, and consistent with security and confidentiality requirements, the utility shall make all relevant information and required specifications available to the applicant to permit the applicant to obtain an independent design and cost estimate for the interconnection facilities.

(iv) The interconnection facilities shall be built in accordance with the specifications.

(d) Upon completion of the interconnection facilities study, and with the agreement of the applicant to pay for the interconnection facilities and distribution upgrades identified in the interconnection facilities study, the utility shall provide the applicant with a standard small generator interconnection agreement within 5 business days.

(e) Delay in Electric Distribution System Upgrades.

(i) In the event that electric distribution system upgrades are identified in the impact study that will be required to be added only in the event that higher queue position customers not yet interconnected eventually will complete and interconnect their generation facilities, an applicant may elect to interconnect without paying for such upgrades at the time of the interconnection under the condition that the customer shall pay for such upgrades at the time the higher queue position customer is ready to interconnect.

(ii) If the applicant does not pay for the cost of the electric distribution system upgrades at that time, the utility shall require the customer to immediately disconnect its generating facility so that interconnection of the higher-queued customer can be accommodated.

F. Interconnection Agreement.

(1) When Delmarva Power determines, as a result of the interconnection studies conducted under a Level 4 review, that it is appropriate to interconnect the small generator facility, the utility shall provide the applicant with a standard small generator interconnection agreement.

(2) The applicant shall have either 30 calendar days, or another mutually agreeable timeframe after receipt of the standard small generator interconnection agreement, to sign and return the standard small generator interconnection agreement.

(3) If the applicant does not sign the standard small generator interconnection agreement within 30 calendar days, the request shall be deemed withdrawn unless the applicant and utility mutually agree to extend the time period for executing the standard small generator interconnection agreement prior to the

expiration of the 30 business day period. A request for extension may not be unreasonably denied by Delmarva Power.

(4) After the standard small generator interconnection agreement is signed by the applicant and utility, interconnection of the small generator facility shall proceed according to any milestones agreed to by the applicant and utility in the standard small generator interconnection agreement.

(5) The interconnection agreement will not be final until:

(a) Any milestones agreed to in the standard small generator interconnection agreement are satisfied;

(b) The small generator facility is approved by electric code officials with jurisdiction over the interconnection;

(c) The applicant provides a certificate of completion to Delmarva Power; and

(d) There is a successful completion of the witness test, if conducted by the utility.

G. Level 4 Review Failure. If the interconnection request is denied, Delmarva Power shall provide the applicant a letter explaining the reasons for denying the interconnection request.

Section 13 Dispute Resolution.

A. The applicant and Delmarva Power shall attempt to resolve all disputes regarding interconnection as provided in this section promptly, equitably, and in a good faith manner.

B. Dispute Resolution Before the Commission.

(1) When a dispute arises, the applicant or utility may seek immediate resolution through a dispute resolution process approved by the Commission, by providing written notice to the Commission and the other party stating the issues in dispute.

(2) Dispute resolution shall be conducted in an informal, expeditious manner to reach resolution with minimal costs and delay.

(3) When available, dispute resolution may be conducted by phone.

C. Dispute Resolution by Technical Master.

(1) When disputes relate to the technical matters regarding the interconnection process, upon the request of the applicant and utility and at their cost, the Commission may designate a technical master to resolve the dispute.

(2) The Commission may designate a Department of Energy National Laboratory, PJM Interconnection, LLC, or a college or university with electric distribution system engineering expertise as the technical master.

(3) Upon Commission designation, the applicant and utility shall use the technical master to resolve disputes related to interconnection.

(4) Responsibility for the costs for a dispute resolution conducted by the technical master shall be determined either prior to submission of the dispute to the technical master by the applicant and utility, or by the technical master after the resolution of the dispute.

- D. Pursuit of dispute resolution may not affect an applicant with regard to consideration of an interconnection request or an applicant's queue position.
- E. Any deadline imposed by the Delaware Interconnection Standard, which is directly affected by any issue in dispute, shall be suspended until resolution of the dispute.

Section 14 Record Retention and Reporting Requirements.

- A. Delmarva Power shall retain records of the following for a minimum of three years:
 - (1) The total number of and the nameplate capacity of the interconnection requests received, approved and denied under Level 1, Level 2, Level 3 and Level 4 reviews;
 - (2) The fuel type, total number and the nameplate capacity of small generator facilities approved in each of the following categories: net metering, emergency standby capable of operating in parallel, behind the meter load offset, combined heat and power, and other;
 - (3) The number of interconnection requests that were not processed within the deadlines established for Level 1, Level 2, Level 3 and Level 4 reviews;
 - (4) The number of scoping meetings held and the number of feasibility studies, impact studies, and facility studies performed and the fees charged for these studies;
 - (5) The justifications for the actions taken to deny interconnection requests; and
 - (6) Any special operating requirements required in interconnection agreements, which are permitted only for generating facilities with a capacity greater than 2 MW, that are not part of Delmarva Power's operating procedures applicable to small generator facilities.
- B. Delmarva Power shall retain records of interconnection studies it performs to determine the feasibility, system impacts, and facilities required by the interconnection of any small generator facility for a minimum of seven years.
- C. Delmarva Power shall file no later than April 1 of each year a report entitled "Annual Small Generator Interconnection Report" to the Commission containing the following information for the preceding calendar year:
 - (1) The total number of and the nameplate capacity of the interconnection requests received, approved and denied under Level 1, Level 2, Level 3 and Level 4 reviews;
 - (2) The fuel type, total number, and total nameplate capacity of small generator facilities approved in each of the following categories: net metering, emergency standby capable of operating in parallel, behind the meter load offset, combined heat and power, and other;
 - (3) The number of interconnection requests that were not processed within the deadlines established for Level 1, Level 2, Level 3 and Level 4 reviews; and
 - (4) The number of interconnection requests denied and the applicant, the address of the proposed small generator, and the reason for each denial.

- D. Delmarva Power shall file a notice with the Commission describing any interconnection equipment the utility has deemed field approved for its distribution system within 90 days after granting approval for the interconnection of a small generator facility using the field approved interconnection equipment.

End of document



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**DELAWARE LEVEL 1
INTERCONNECTION APPLICATION
&
AGREEMENT**

**With Terms and Conditions for Interconnection
(Lab Certified Inverter-Based Small Generator Facilities Less than or Equal to 10 kW)**

The Green Power Connection™ Team
Delmarva Power
A PHI Company
(866) 634-5571 - Phone
(856) 351-7523 - FAX
gpc-north@pepcoholdings.com

(Send applications via Email, FAX, or Mail to Delmarva Power, GPC Team)

Mailing Address: 5 Collins Drive, Mail Stop 84CP22, Carneys Point, NJ 08069



A PHI Company

PART 1

DELAWARE LEVEL 1 INTERCONNECTION APPLICATION & AGREEMENT

**With Terms and Conditions for Interconnection
(Lab Certified Inverter-Based Small Generator Facilities Less than or Equal to 10 kW)**

(Application & Conditional Agreement – to be completed prior to installation)

INTERCONNECTION CUSTOMER CONTACT INFORMATION

Customer Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Contact Person (if other than above): _____

Mailing Address (if other than above): _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address (Required): _____

Alternate Contact Information

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address: _____

FACILITY INFORMATION

Facility Address: _____

City: _____ State: DE Zip Code: _____

DPL Account # of Facility Site: _____

Energy Source: _____ Prime Mover: _____

Type of Application: Initial Addition/Upgrade ¹

DC Nameplate Rating: _____ (kW) _____ (kVA), AC Inverter Rating _____ (kW), AC System Design Capacity: _____ (kW) _____ (kVA)

¹ Initial if first time generator request. Addition/Upgrade if this is an add-on to a previously approved system.

Generator (or PV Panel) Manufacturer, Model #: _____

(A copy of Generator Nameplate and Manufacturer's Specification Sheet May Also be Submitted)

Inverter Manufacturer: _____ Model # & Rating: _____

Number of Inverters: _____

Ampere Rating: _____ Amps_{AC}, Number of Phases: 1 3, Voltage Rating: _____ V_{AC},

Nominal DC Voltage: _____ V_{DC}, Power Factor: _____ %, Frequency: _____ Hz,

DPL Accessible Disconnect or Lock Box: Yes No, If Yes, Location: _____

One-line Diagram Attached (Required): Yes No, Site Plan Attached (Required): Yes No

Do you plan to export power?² Yes No, If Yes, Estimated Maximum: _____ kW_{AC}

Estimated Gross Annual Energy Production: _____ kWh

Is the inverter IEEE/UL1741 lab certified? Yes No (If yes, attach manufacturer's cut sheet showing listing and label information from the appropriate listing authority, e.g. UL 1741 listing. If no, facility is not eligible for Level 1 Application.)

Estimated Commissioning Date: _____

EQUIPMENT INSTALLATION CONTRACTOR

Check if owner-installed

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address (Required): _____

ELECTRICAL CONTRACTOR

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address: _____

License number: _____

Active License? Yes No

Is small generator facility eligible for Net Metering? Yes No

² Yes, if your expected maximum output of the inverter (kW AC) is greater than the lowest load you anticipate at your facility during maximum PV output (kW). The difference would be the amount you may export.

INSURANCE DISCLOSURE

The attached terms and conditions contain provisions related to liability and indemnification, and should be carefully considered by the interconnection customer. The interconnection customer is not required to obtain general liability insurance coverage as a precondition for interconnection approval; however, the interconnection customer is advised to consider obtaining appropriate insurance coverage to cover the interconnection customer's potential liability under this agreement.

CUSTOMER SIGNATURE

I hereby certify that: 1) I have read and understand the terms and conditions which are attached hereto by reference and are a part of this Agreement; 2) I hereby agree to comply with the attached terms and conditions; and 3) to the best of my knowledge, all of the information provided in this application request form is complete and true. I consent to permit the PSC and interconnecting utility to exchange information regarding the generating system to which this application applies.

Interconnection Customer Signature: _____ Date: _____

Printed Name: _____ Title: _____

.....

Conditional Agreement to Interconnect Small Generator Facility (for EDC use only)

Receipt of the application fee is acknowledged and, by its signature below, the EDC has determined the interconnection request is complete. Interconnection of the small generator facility is conditionally approved contingent upon the attached terms and conditions of this Agreement the return of the attached Certificate of Completion duly executed, verification of electrical inspection and successful witness test or EDC waiver thereof.

EDC Signature: _____ Date: _____

Printed Name: _____ Title: _____

Level 1 Interconnection Agreement

Terms and Conditions for Delaware Interconnection

(Lab Certified Inverter-Based Small Generator Facilities Less than or Equal to 10 kW)

- 1) **Construction of the Small Generator Facility.** The Interconnection Customer may proceed to construct (including operational testing not to exceed 2 hours) the Small Generator Facility once the Conditional Agreement to Interconnect a Small Generator Facility on the preceding page has been signed by the EDC.
- 2) **Final Interconnection and Operation.** The Interconnection Customer may operate the Small Generator Facility and interconnect with the EDC's Electric Distribution System after all of the following have occurred:
 - a) **Electrical Inspection:** Upon completing construction, the Interconnection Customer will cause the Small Generator Facility to be inspected by the local electrical wiring inspector with jurisdiction who shall establish that the Small Generator Facility meets the requirements of the National Electrical Code.
 - b) **Certificate of Completion:** The Interconnection Customer shall provide the EDC with a completed copy of the Interconnection Agreement Certificate of Completion, including evidence of the electrical inspection performed by the local authority having jurisdiction. The evidence of completion of the electrical inspection may be provided on inspection forms used by local inspecting authorities. The Interconnection request shall not be finally approved until the EDC's representative signs the Interconnection Agreement Certificate of Completion.
 - c) EDC has either waived the right to a Witness Test in the Interconnection Request, or completed its Witness Test as per the following:
 - i) Within five (5) business days of the estimated commissioning date, the EDC may, upon reasonable notice and at a mutually convenient time, conduct a Witness Test of the Small Generator Facility to ensure that all equipment has been appropriately installed and that all electrical connections have been made in accordance with applicable codes;
 - ii) If the EDC does not perform the Witness Test within the 5-day period or such other time as is mutually agreed to by the parties, the Witness Test is deemed waived.
- 3) **IEEE 1547.** The Small Generator Facility is installed operated and tested in accordance with the requirements of IEEE standard 1547, "Standard for Interconnecting Distributed Resources with Electric Power Systems", as amended and supplemented, at the time the interconnection request is submitted.
- 4) **Access.** The EDC shall have direct, unabated access to the disconnect switch and metering equipment of the Small Generator Facility at all times. The EDC shall provide reasonable notice to the customer when possible prior to using its right of access.
- 5) **Metering.** Any required metering shall be installed pursuant to appropriate tariffs and tested by the EDC pursuant to the EDC's meter testing requirements pursuant to the Code of Delaware Regulations, Title 26 - Public Utilities – Chapter 10. Electric Utility Restructuring §1014.
- 6) **Disconnection.** The EDC may temporarily disconnect the Small Generator Facility upon the following conditions:
 - a) For scheduled outages upon reasonable notice;
 - b) For unscheduled outages or emergency conditions;

- c) If the Small Generator Facility does not operate in the manner consistent with this Agreement;
 - d) Improper installation or failure to pass the Witness Test;
 - e) If the Small Generator Facility is creating a safety, reliability or a power quality problem; or
 - f) The Interconnection Equipment used by the Small Generator Facility is de-listed by the Nationally Recognized Testing Laboratory that provided the listing at the time the interconnection was approved.
- 7) **Indemnification.** The parties shall at all times indemnify, defend, and save the other party harmless from any and all damages, losses, claims, including claims and actions relating to injury to or death of any person or damage to property, demand, suits, recoveries, costs and expenses, court costs, attorney fees, and all other obligations by or to third parties, arising out of or resulting from the other party's performance or failure to perform under this Agreement on behalf of the indemnifying party, except in cases of gross negligence or intentional wrongdoing by the indemnified party.
- 8) **Limitation of Liability.** Each party's liability to the other party for any loss, cost, claim, injury, liability, or expense, including reasonable attorney's fees, relating to or arising from any act or omission in its performance of this Agreement, shall be limited to the amount of direct damage actually incurred. In no event shall either party be liable to the other party for any indirect, incidental, special, consequential, or punitive damages of any kind whatsoever.
- 9) **Termination.** This Agreement may be terminated under the following conditions:
- a) By Interconnection Customer - The Interconnection Customer may terminate this application agreement by providing written notice to the EDC.
 - b) By the EDC - The EDC may terminate this Agreement if the Interconnection Customer fails to remedy a violation of terms of this Agreement within 30 calendar days after notice, or such other date as may be mutually agreed to prior to the expiration of the 30 calendar day remedy period. The termination date can be no less than 30 calendar days after the Interconnection Customer receives notice of its violation from the EDC.
- 10) **Modification of Small Generator Facility.** The Interconnection Customer must receive written authorization from the EDC before making any changes to the Small Generator Facility, other than minor changes that do not have a significant impact on safety or reliability of the Electric Distribution System as determined by the EDC. If the Interconnection Customer makes such modifications without the EDC's prior written authorization, the EDC shall have the right to temporarily disconnect the Small Generator Facility.
- 11) **Permanent Disconnection.** In the event the Agreement is terminated, the EDC shall have the right to disconnect its facilities or direct the customer to disconnect its Small Generator Facility.
- 12) **Disputes.** Each party agrees to attempt to resolve all disputes regarding the provisions of these interconnection procedures pursuant to the dispute resolution provisions of the Delaware Standard Small Generator Interconnection Rules, Title 26 - Public Utilities – Chapter 10. Electric Utility Restructuring §1014.
- 13) **Governing Law, Regulatory Authority, and Rules.** The validity, interpretation and enforcement of this Agreement and each of its provisions shall be governed by the laws of the State of Delaware. Nothing in this Agreement is intended to affect any other agreement between the EDC and the Interconnection Customer. However, in the event that the provisions of this agreement are in conflict with the provisions of the EDC's tariff, the EDC tariff shall control.

- 14) **Survival Rights.** This Agreement shall continue in effect after termination to the extent necessary to allow or require either party to fulfill rights or obligations that arose under the Agreement.
- 15) **Assignment/Transfer of Ownership of the Small Generator Facility.** This Agreement shall terminate upon the transfer of ownership of the Small Generator Facility to a new Eligible Customer Generator (owner or tenant), unless the new Eligible Customer Generator notifies the EDC of the change, their agreement to abide by the Terms and Conditions of the original Interconnection Agreement, and so notifies the EDC in writing prior to or coincident with the transfer of electric service to the new customer. Should an interconnection agreement terminate for failure of a new customer to provide appropriate written agreement within 30 days, the EDC shall notify the Public Service Commission the Interconnection Agreement has been terminated.
- 16) **Definitions.** Any capitalized term used herein and not defined shall have the same meaning as the defined terms used in the Delaware Standard Small Generator Interconnection Rule, Title 26 - Public Utilities – Chapter 10. Electric Utility Restructuring §1014.
- 17) **Notice.** Unless otherwise provided in this Agreement, any written notice, demand, or request required or authorized in connection with this Agreement (“Notice”) shall be deemed properly given if delivered in person, delivered by recognized national courier service, or sent by first class mail, postage prepaid, to the person specified below:

If to Interconnection Customer:

Use the contact information provided in the Agreement for the Interconnection Customer. The Interconnection Customer is responsible for notifying the EDC of any change in the contact party information, including change of ownership.

If to EDC:

Use the contact information provided on the EDC’s web page for small generator interconnection.

- 18) **Important Note.** Running grid-tied generation at a premise will generally raise voltage levels. A proper voltage drop/rise study must be done to insure that resulting voltages do not cause problems at the customer premise and/or to the operation of the inverter. If there are times when generator output will exceed the load of the premise, this will cause voltage rise across the line transformer and service line to the facility. Be sure this is taken into account when doing a voltage drop/rise analysis. If there are other customers that have grid-tied solar and their premise is fed by the same line transformer, be sure to take that into account when considering voltage rise across the line transformer. If the new generation system causes high voltage for other customers fed by the same transformer, it will be the responsibility of the newest generator installation to remediate the high voltage. The normal voltage at the meter without generation is 120 V +/- 4% (or other secondary voltages such as 208, 240, 480, etc.). Be sure to assume the highest voltage (+ 4%) at the meter when doing the voltage drop/rise analysis to insure acceptable voltage at the premise and at the inverter. **The utility is not responsible for elevated voltage caused by the operation of a generator.** The electrical grid has been designed to maintain 120 V +/- 4% (or other standard secondary voltages) during the course of the normal load cycle.



A PHI Company

PART 2

DELAWARE INTERCONNECTION APPLICATION & AGREEMENT

**With Terms and Conditions for Interconnection
(Lab Certified Inverter-Based Small Generator Facilities Less than or Equal to 10 kW)**

(Final Agreement – must be completed after installation and prior to interconnection)

Certificate of Completion

INTERCONNECTION CUSTOMER CONTACT INFORMATION

Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address: _____

FACILITY INFORMATION

Facility Address: _____
City: _____ State: DE Zip Code: _____

DPL Account # of Facility Site: _____

Energy Source: _____ Prime Mover: _____
DC Nameplate Rating: _____ (kW) _____ (kVA), AC Inverter Rating _____ (kW), AC System
Design Capacity: _____ (kW) _____ (kVA)

Inverter Manufacturer: _____ Model # & Rating: _____

Number of Inverters: _____

EQUIPMENT INSTALLATION CONTRACTOR Check if owner-installed

Name: _____
Mailing Address: _____
City: _____ State: _____ Zip Code: _____
Telephone (Daytime): _____ (Evening): _____
Facsimile Number: _____ E-Mail Address: _____

FINAL ELECTRIC INSPECTION AND INTERCONNECTION CUSTOMER SIGNATURE

The Small Generator Facility is complete and has been approved by the local electric inspector having jurisdiction. A signed copy of the electric inspector's form indicating final approval is attached. The Interconnection Customer acknowledges that it shall not operate the Small Generator Facility until receipt of the final acceptance and approval by the EDC as provided below.

Signed: _____ Date _____
(Signature of interconnection customer)

Printed Name: _____

Type of Application: New/Initial Growth/Increase System Capacity _____ KW (DC)
Check if copy of signed electric inspection form is attached

.....

ACCEPTANCE AND FINAL APPROVAL FOR INTERCONNECTION (for EDC use only)

The interconnection agreement is approved and the Small Generator Facility is approved for interconnected operation upon the signing and return of this Certificate of Completion by EDC:

Electric Distribution Company waives Witness Test? (Initial) Yes (_____) No (_____)
If not waived, date of successful Witness Test: _____ Passed: (Initial) (_____)

EDC Signature: _____ Date: _____

Printed Name: _____ Title: _____



A PHI Company

**DELAWARE LEVEL 2, 3, & 4
INTERCONNECTION APPLICATION
&
AGREEMENT**

**With Terms and Conditions for Interconnection
For a Level 2, 3, & 4 Review**

(Lab Certified Inverter-Based Generator Facilities Greater than 10 kW and Less than or Equal to 2 MW)

The Green Power Connection™ Team
Delmarva Power
A PHI Company
(866) 634-5571 - Phone
(856) 351-7523 - FAX
gpc-north@pepcoholdings.com

(Send applications via FAX, Email, or Mail to DPL, GPC Team)

Mailing Address: 5 Collins Drive, Mail Stop 84CP22, Carneys Point, NJ 08069



A PHL Company

DELAWARE STANDARD AGREEMENT FOR INTERCONNECTION OF SMALL GENERATOR FACILITIES WITH A CAPACITY GREATER THAN 10 KW AND LESS THAN OR EQUAL TO 2 MW¹

This agreement ("Agreement") is made and entered into this _____ day of _____ by and between _____, ("Interconnection Customer,") a _____ organized and existing under the laws of the State of _____, and _____, ("Electric Distribution Company", (EDC)) a _____ existing under the laws of the State of Delaware. Interconnection Customer and EDC each may be referred to as a "Party," or collectively as the "Parties."

Recitals:

Whereas, Interconnection Customer is proposing to, install or direct the installation of a Small Generator Facility, or is proposing a generating capacity addition to an existing Small Generator Facility, consistent with the Interconnection Request completed by Interconnection Customer on _____; and

Whereas, the Interconnection Customer will operate and maintain, or cause the operation and maintenance of the Small Generator Facility; and

Whereas, Interconnection Customer desires to interconnect the Small Generator Facility with EDC's Electric Distribution System.

Now, therefore, in consideration of the premises and mutual covenants set forth herein, and other good and valuable consideration, the receipt, sufficiency and adequacy of which are hereby acknowledged, the Parties covenant and agree as follows:

1. Scope and Limitations of Agreement

- 1.1. This Agreement shall be used for all approved Level 2, Level 3 and Level 4 Interconnection Requests according to the procedures set forth in the Delaware Standard Small Generator Interconnection Rule, Title 26 - Public Utilities – Chapter 10. Electric Utility Restructuring §1014.
- 1.2. This Agreement governs the terms and conditions under which the Small Generator Facility will interconnect to, and operate in Parallel with, the EDC's Electric Distribution System.
- 1.3. This Agreement does not constitute an agreement to purchase or deliver the Interconnection Customer's power.

¹ Up to 10 MW for interconnection requests to a radial distribution circuit pursuant to Title 26 – Chapter 10 -- §1014.

- 1.4. Nothing in this Agreement is intended to affect any other agreement between the EDC and the Interconnection Customer. However, in the event that the provisions of this Agreement are in conflict with the provisions of the EDC's tariff, the EDC tariff shall control.
- 1.5. Responsibilities of the Parties
- 1.5.1. The Parties shall perform all obligations of this Agreement in accordance with all Applicable Laws and Regulations.
- 1.5.2. The EDC shall construct, own, operate, and maintain its Interconnection Facilities in accordance with this Agreement, IEEE Standard 1547, the National Electrical Safety Code and applicable standards promulgated by the Delaware Public Service Commission.
- 1.5.3. The Interconnection Customer shall construct, own, operate, and maintain its Small Generator Facility in accordance with this Agreement, IEEE Standard 1547, the National Electrical Safety Code, the National Electrical Code and applicable standards promulgated by the Delaware Public Service Commission.
- 1.5.4. Each Party shall operate, maintain, repair, and inspect, and shall be fully responsible for the facilities that it now or subsequently may own unless otherwise specified in the attachments to this Agreement. Each Party shall be responsible for the safe installation, maintenance, repair and condition of their respective lines and appurtenances on their respective sides of the Point of Interconnection.
- 1.5.5. The Interconnection Customer agrees to design, install, maintain and operate its Small Generator Facility so as to minimize the likelihood of causing an Adverse System Impact on an electric system that is not owned or operated by the EDC.
- 1.6. Parallel Operation Obligations: Once the Small Generator Facility has been authorized to commence Parallel Operation, the Interconnection Customer shall abide by all written rules and procedures developed by the EDC which pertain to the Parallel Operation of the Small Generator Facility, which are clearly specified in Attachment 4 of this Agreement.
- 1.7. Metering: The Interconnection Customer shall be responsible for the cost of the purchase, installation, operation, maintenance, testing, repair, and replacement of metering and data acquisition equipment specified in Attachments 5 and 6 of this Agreement.
- 1.8. Reactive Power: The Interconnection Customer shall design its Small Generator Facility to maintain a composite power delivery at continuous rated power output at the Point of Interconnection at a power factor within the power factor range required by the EDC's applicable tariff for a comparable load customer. EDC may also require the Interconnection Customer to follow a voltage or VAR schedule if such schedules are applicable to similarly situated generators in the control area on a comparable basis and have been approved by the Commission. The specific requirements for meeting a voltage or VAR schedule shall be clearly specified in Attachment 4. Under no circumstance shall these additional requirements for reactive power or voltage support exceed the normal operating capabilities of the Small Generator Facility.
- 1.9. Capitalized Terms: Capitalized terms used herein shall have the meanings specified in the Definitions in Attachment 1 or the body of this Agreement.

2. Inspection, Testing, Authorization, and Right of Access

2.1. Equipment Testing and Inspection: The Interconnection Customer shall test and inspect its Small Generator Facility including the Interconnection Equipment prior to interconnection in accordance with IEEE Standard 1547 and IEEE Standard 1547.1. The Interconnection Customer shall not operate its Small Generator Facility in Parallel with EDC's Electric Distribution System without prior written authorization by the EDC as provided for in 2.1.1 – 2.1.4.

2.1.1. The EDC shall have the option of performing a Witness Test after construction of the small generator facility is completed. The Interconnection Customer shall provide the EDC at least 20 days notice of the planned Commissioning Test for the small generator facility. If the EDC elects to perform a Witness Test, it shall contact the Interconnection Customer to schedule the Witness Test at a mutually agreeable time within 5 business days of the scheduled commissioning test. If the EDC does not perform the Witness Test within 5 business days of the commissioning test, the Witness Test is deemed waived unless the parties mutually agree to extend the date for scheduling the Witness Test. If the Witness Test is not acceptable to the EDC, the Interconnection Customer will be granted a period of 30 calendar days to address and resolve any deficiencies. The time period for addressing and resolving any deficiencies may be extended upon the mutual agreement of the EDC and the Interconnection Customer. If the Interconnection Customer fails to address and resolve the deficiencies to the satisfaction of the EDC, the applicable cure provisions of 6.5 shall apply. If a Witness Test is not performed by the EDC or an entity approved by the EDC, the Interconnection Customer must still satisfy the interconnection test specifications and requirements set forth in IEEE Standard 1547 Section 5. The Interconnection Customer shall, if requested by the EDC, provide a copy of all documentation in its possession regarding testing conducted pursuant to IEEE Standard 1547.1.

2.1.2. To the extent that the Interconnection Customer decides to conduct interim testing of the Small Generator Facility prior to the Witness Test, it may request that the EDC observe these tests and that these tests be deleted from the final Witness Test. The EDC may, at its own expense, send qualified personnel to the Small Generator Facility to observe such interim testing. Nothing in this Section 2.1.2 shall require the EDC to observe such interim testing or preclude the EDC from performing these tests at the final Witness Test. Regardless of whether the EDC observes the interim testing, the Interconnection Customer shall obtain permission in advance of each occurrence of operating the Small Generator Facility in parallel with the EDC's system.

2.1.3. Upon successful completion of the Witness Test, the EDC shall affix an authorized signature to the Certificate of Completion and return it to the Interconnection Customer approving the interconnection and authorizing Parallel Operation. Such authorization shall not be unreasonably withheld, conditioned, or delayed.

2.2. Commercial Operation: The interconnection customer shall not operate the Small Generator Facility, except for interim testing as provided in 2.1, until such time as the Certificate of Completion is signed by all Parties.

2.3. Right of Access: The EDC shall have access to the disconnect switch and metering equipment of the Small Generator Facility at all times. The EDC shall provide reasonable notice to the customer when possible prior to using its right of access.

3. Effective Date, Term, Termination, and Disconnection

3.1. Effective Date: This Agreement shall become effective upon execution by the Parties.

3.2. Term of Agreement: This Agreement shall become effective on the Effective Date and shall remain in effect in perpetuity unless terminated earlier in accordance with Article 3.3 of this Agreement.

3.3. Termination: No termination shall become effective until the Parties have complied with all Applicable Laws and Regulations applicable to such termination.

3.3.1. The Interconnection Customer may terminate this Agreement at any time by giving the EDC 30 calendar days prior written notice.

3.3.2. Either Party may terminate this Agreement after default pursuant to Article 6.5.

3.3.3. The EDC may terminate upon 60 calendar days' prior written notice for failure of the Interconnection Customer to complete construction of the Small Generator Facility within 12 months of the in-service date as specified by the Parties in Attachment 2, which may be extended by mutual agreement of the Parties which shall not be unreasonably withheld.

3.3.4. The EDC may terminate this Agreement upon 60 calendar days' prior written notice if the Interconnection Customer fails to operate the Small Generator Facility in parallel with EDC's electric system for three consecutive years.

3.3.5. Upon termination of this Agreement, the Small Generator Facility will be disconnected from the EDC's Electric Distribution System. The termination of this Agreement shall not relieve either Party of its liabilities and obligations, owed or continuing at the time of the termination.

3.3.6. The provisions of this Article shall survive termination or expiration of this Agreement.

3.4. Temporary Disconnection: A Party may temporarily disconnect the Small Generator Facility from the Electric Distribution System in the event of an Emergency Condition for so long as the Party determines it is reasonably necessary in the event one or more of the following conditions or events occurs:

3.4.1. Emergency Conditions—shall mean any condition or situation: (1) that in the judgment of the Party making the claim is reasonably likely to endanger life or property; or (2) that, in the case of the EDC, is reasonably likely to cause an Adverse System Impact; or (3) that, in the case of the Interconnection Customer, is reasonably likely (as determined in a non-discriminatory manner) to cause a material adverse effect on the security of, or damage to, the Small Generator Facility or the Interconnection Equipment. Under Emergency Conditions, the EDC or the Interconnection Customer may immediately suspend interconnection service and temporarily disconnect the Small Generator Facility. The EDC shall notify the Interconnection Customer promptly when it becomes aware of an Emergency Condition that may reasonably be expected to affect the Interconnection Customer's operation of the Small Generator Facility. The Interconnection Customer shall notify the EDC promptly when it becomes aware of an Emergency Condition that may reasonably be expected to affect the EDC's Electric Distribution System. To the extent information is known, the notification shall describe the Emergency Condition, the extent of the damage or deficiency, the expected effect on the operation of both Parties' facilities and operations, its anticipated duration, and the necessary corrective action.

3.4.2. Scheduled Maintenance, Construction, or Repair – the EDC may interrupt

interconnection service or curtail the output of the Small Generator Facility and temporarily disconnect the Small Generator Facility from the EDC's Electric Distribution System when necessary for scheduled maintenance, construction, or repairs on EDC's Electric Distribution System. The EDC shall provide the Interconnection Customer with five business days notice prior to such interruption. The EDC shall use reasonable efforts to coordinate such reduction or temporary disconnection with the Interconnection Customer.

- 3.4.3. Forced Outages - During any forced outage, the EDC may suspend interconnection service to effect immediate repairs on the EDC's Electric Distribution System. The EDC shall use reasonable efforts to provide the Interconnection Customer with prior notice. If prior notice is not given, the EDC shall, upon written request, provide the Interconnection Customer written documentation after the fact explaining the circumstances of the disconnection.
- 3.4.4. Adverse Operating Effects – the EDC shall provide the Interconnection Customer with a written notice of its intention to disconnect the Small Generator Facility if, based on the operating procedures specified in Attachment 4, the EDC determines that operation of the Small Generator Facility will likely cause disruption or deterioration of service to other customers served from the same electric system, or if operating the Small Generator Facility could cause damage to the EDC's Electric Distribution System. Supporting documentation used to reach the decision to disconnect shall be provided to the Interconnection Customer upon written request. The EDC may disconnect the Small Generator Facility if, after receipt of the notice, the Interconnection Customer fails to remedy the adverse operating effect within a reasonable time unless Emergency Conditions exist in which case the provisions of 3.4.1 apply.
- 3.4.5. Modification of the Small Generator Facility - The Interconnection Customer must receive written authorization from the EDC prior to making any change to the Small Generator Facility, other than a Minor Equipment Modification, that could cause an Adverse System Impact. If the Interconnection Customer makes such modification without the EDC's prior written authorization, the EDC shall have the right to temporarily disconnect the Small Generator Facility until such time as the EDC reasonably concludes the modification poses no threat to the safety or reliability of its Electric Distribution System.
- 3.4.6. Reconnection - The Parties shall cooperate with each other to restore the Small Generator Facility, Interconnection Facilities, and EDC's Electric Distribution System to their normal operating state as soon as reasonably practicable following any disconnection pursuant to this section; provided, however, if such disconnection is done pursuant to Section 3.4.5 due to the Interconnection Customer's failure to obtain prior written authorization from the EDC for Minor Equipment Modifications, the EDC shall reconnect the Interconnection Customer only after determining the modifications do not impact the safety or reliability of its Electric Distribution System.

4. Cost Responsibility for Interconnection Facilities and Distribution Upgrades

4.1. Interconnection Facilities

- 4.1.1. The Interconnection Customer shall pay for the cost of the Interconnection Facilities itemized in Attachment 3 of this Agreement if required under the additional review procedures of Level a 2 review or under a Level 4 review. If a Facilities Study was performed, the EDC shall identify the Interconnection Facilities necessary to safely interconnect the Small Generator Facility with the EDC's Electric Distribution System, the cost of those facilities, and the time required to build and install those facilities.

4.1.2. The Interconnection Customer shall be responsible for its expenses, including overheads, associated with (1) owning, operating, maintaining, repairing, and replacing its Interconnection Equipment, and (2) its reasonable share of operating, maintaining, repairing, and replacing any Interconnection Facilities owned by the EDC as set forth in Attachment 3 and Attachment 4.

4.2. Distribution Upgrades: The EDC shall design, procure, construct, install, and own any Distribution Upgrades. The actual cost of the Distribution Upgrades, including overheads, shall be directly assigned to the interconnection Customer. The Interconnection Customer may be entitled to financial contribution from any other EDC customer who may in the future utilize the upgrades paid for by the Interconnection Customer. Such contributions shall be governed by the rules, regulations and decisions of the Delaware Public Service Commission.

5. **Billing, Payment, Milestones, and Financial Security**

5.1. Billing and Payment Procedures and Final Accounting (Applies to additional reviews conducted under a Level 2 review and Level 4 reviews)

5.1.1. The EDC shall bill the Interconnection Customer for the design, engineering, construction, and procurement costs of EDC provided Interconnection Facilities and Distribution Upgrades contemplated by this Agreement as set forth in Appendix 3, on a monthly basis, or as otherwise agreed by the Parties. The Interconnection Customer shall pay each bill within 30 calendar days of receipt, or as otherwise agreed to by the Parties.

5.1.2. Within ninety (90) calendar days of completing the construction and installation of the EDC's Interconnection Facilities and Distribution Upgrades described in the Attachments 2 and 3 to this Agreement, the EDC shall provide the Interconnection Customer with a final accounting report of any difference between (1) the actual cost incurred to complete the construction and installation and the budget estimate provided to the Interconnection Customer and a written explanation for any significant variation; and (2) the Interconnection Customer's previous deposit and aggregate payments to the EDC for such Interconnection Facilities and Distribution Upgrades. If the Interconnection Customer's cost responsibility exceeds its previous deposit and aggregate payments, the EDC shall invoice the Interconnection Customer for the amount due and the Interconnection Customer shall make payment to the EDC within thirty (30) calendar days. If the Interconnection Customer's previous deposit and aggregate payments exceed its cost responsibility under this Agreement, the EDC shall refund to the Interconnection Customer an amount equal to the difference within thirty (30) calendar days of the final accounting report.

5.1.3. If a Party in good faith disputes any portion of its payment obligation pursuant to this Article 5, such Party shall pay in a timely manner all non-disputed portions of its invoice, and such disputed amount shall be resolved pursuant to the dispute resolution provisions contained in Article 8. Provided such Party's dispute is in good faith, the disputing Party shall not be considered to be in default of its obligations pursuant to this Article.

5.2. Interconnection Customer Deposit: At least twenty (20) business days prior to the commencement of the design, procurement, installation, or construction of a discrete portion of the EDC's Interconnection Facilities and Distribution Upgrades, the Interconnection Customer shall provide the EDC with a deposit equal to 50% of the estimated costs prior to its beginning design of such facilities, provided the total cost is in excess of \$1,000.

6. Assignment, Limitation on Damages, Indemnity, Force Majeure, and Default

6.1. Assignment: This Agreement may be assigned by either Party upon fifteen (15) Business Days prior written notice, and with the opportunity to object by the other Party. Should the Interconnection Customer assign this agreement, the EDC has the right to request the assignee agree to the assignment and the terms of this Agreement in writing. When required, consent to assignment shall not be unreasonably withheld; provided that:

6.1.1. Either Party may assign this Agreement without the consent of the other Party to any affiliate (which shall include a merger of the Party with another entity), of the assigning Party with an equal or greater credit rating and with the legal authority and operational ability to satisfy the obligations of the assigning Party under this Agreement;

6.1.2. The Interconnection Customer shall have the right to assign this Agreement, without the consent of the EDC, for collateral security purposes to aid in providing financing for the Small Generator Facility. For Small Generator systems that are integrated into a building facility, the sale of the building or property will result in an automatic transfer of this agreement to the new owner who shall be responsible for complying with the terms and conditions of this Agreement.

6.1.3. Any attempted assignment that violates this Article is void and ineffective. Assignment shall not relieve a Party of its obligations, nor shall a Party's obligations be enlarged, in whole or in part, by reason thereof. An assignee is responsible for meeting the same obligations as the Interconnection Customer.

6.2. Limitation on Damages: Except for cases of gross negligence or willful misconduct, the liability of any Party to this Agreement shall be limited to direct actual damages, and all other damages at law are waived. Under no circumstances, except for cases of gross negligence or willful misconduct, shall any Party or its directors, officers, employees and agents, or any of them, be liable to another Party, whether in tort, contract or other basis in law or equity for any special, indirect, punitive, exemplary or consequential damages, including lost profits, lost revenues, replacement power, cost of capital or replacement equipment. This limitation on damages shall not affect any Party's rights to obtain equitable relief, including specific performance, as otherwise provided in this Agreement. The provisions of this Section 6.2 shall survive the termination or expiration of the Agreement.

6.3. Indemnity

6.3.1. This provision protects each Party from liability incurred to third parties as a result of carrying out the provisions of this Agreement. Liability under this provision is exempt from the general limitations on liability found in Article 6.2.

6.3.2. The Parties shall at all times indemnify, defend, and hold the other Party harmless from, any and all damages, losses, claims, including claims and actions relating to injury to or death of any person or damage to property, demand, suits, recoveries, costs and expenses, court costs, attorney fees, and all other obligations by or to third parties, arising out of or resulting from the other Party's action or failure to meet its obligations under this Agreement on behalf of the indemnifying Party, except in cases of gross negligence or intentional wrongdoing by the indemnified Party.

6.3.3. Promptly after receipt by an indemnified Party of any claim or notice of the commencement of any action or administrative or legal proceeding or investigation as to which the indemnity provided for in this Article may apply, the indemnified Party shall notify the indemnifying Party of such fact. Any failure of or delay in such

notification shall not affect a Party's indemnification obligation unless such failure or delay is materially prejudicial to the indemnifying Party.

- 6.3.4. If an indemnified Party is entitled to indemnification under this Article as a result of a claim by a third party, and the indemnifying Party fails, after notice and reasonable opportunity to proceed under this Article, to assume the defense of such claim, such indemnified Party may at the expense of the indemnifying Party contest, settle or consent to the entry of any judgment with respect to, or pay in full, such claim.
- 6.3.5. If an indemnifying Party is obligated to indemnify and hold any indemnified Party harmless under this Article, the amount owing to the indemnified person shall be the amount of such indemnified Party's actual loss, net of any insurance or other recovery.

6.4. Force Majeure

- 6.4.1. As used in this Article, a Force Majeure Event shall mean any act of God, labor disturbance, act of the public enemy, war, acts of terrorism, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment through no direct, indirect, or contributory act of a Party, any order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond a Party's control. A Force Majeure Event does not include an act of gross negligence or intentional wrongdoing.
- 6.4.2. If a Force Majeure Event prevents a Party from fulfilling any obligations under this Agreement, the Party affected by the Force Majeure Event (Affected Party) shall promptly notify the other Party of the existence of the Force Majeure Event. The notification must specify in reasonable detail the circumstances of the Force Majeure Event, its expected duration, and the steps that the Affected Party is taking and will take to mitigate the effects of the event on its performance, and if the initial notification was verbal, it should be promptly followed up with a written notification. The Affected Party shall keep the other Party informed on a continuing basis of developments relating to the Force Majeure Event until the event ends. The Affected Party shall be entitled to suspend or modify its performance of obligations under this Agreement (other than the obligation to make payments) only to the extent that the effect of the Force Majeure Event cannot be reasonably mitigated. The Affected Party shall use reasonable efforts to resume its performance as soon as possible.

6.5. Default

- 6.5.1. No default shall exist where such failure to discharge an obligation (other than the payment of money) is the result of a Force Majeure Event as defined in this Agreement, or the result of an act or omission of the other Party.
- 6.5.2. Upon a default of this Agreement, the non-defaulting Party shall give written notice of such default to the defaulting Party. Except as provided in Article 6.5.3 the defaulting Party shall have 60 calendar days from receipt of the default notice within which to cure such default; provided however, if such default is not capable of cure within 60 calendar days, the defaulting Party shall commence such cure within 20 calendar days after notice and continuously and diligently complete such cure within six months from receipt of the default notice; and, if cured within such time, the default specified in such notice shall cease to exist.
- 6.5.3. If a Party has made an assignment of this Agreement not specifically authorized by Article 6.1, fails to provide reasonable access pursuant to Article 2.3, is in default of its obligations pursuant to Article 7, or if a Party is in default of its payment obligations pursuant to Article 5 of this Agreement, the defaulting Party shall have 30 days from receipt of the default notice within which to cure such default.

6.5.4. If a default is not cured as provided for in this Article, or if a default is not capable of being cured within the period provided for herein, the non-defaulting Party shall have the right to terminate this Agreement by written notice at any time until cure occurs, and be relieved of any further obligation hereunder and, whether or not that Party terminates this Agreement, to recover from the defaulting Party all amounts due hereunder, plus all other damages and remedies to which it is entitled at law or in equity. The provisions of this Article will survive termination of this Agreement.

7. **Insurance:** For Small Generator Facilities with a Nameplate Capacity of 1 MW or above, the Interconnection Customer shall carry adequate insurance coverage that shall be acceptable to the EDC; provided, that the maximum comprehensive/general liability coverage that shall be continuously maintained by the Interconnection Customer during the term shall be not less than \$2,000,000 for each occurrence, and an aggregate, if any, of at least \$4,000,000. The EDC, its officers, employees and agents will be added as an additional insured on this policy.

8. **Dispute Resolution**

8.1. A party shall attempt to resolve all disputes regarding interconnection as provided in this section promptly, equitably, and in a good faith manner.

8.2. When a dispute arises, a party may seek immediate resolution through complaint procedures available through the Delaware Public Service Commission, or an alternative dispute resolution process approved by the Delaware Public Service Commission, by providing written notice to the Delaware Public Service Commission and the other party stating the issues in dispute. Dispute resolution will be conducted in an informal, expeditious manner to reach resolution with minimal costs and delay. When available, dispute resolution may be conducted by phone.

8.3. When disputes relate to the technical application of this section, the Delaware Public Service Commission may designate a technical master to resolve the dispute. The Delaware Public Service Commission may designate a Department of Energy National Laboratory, PJM Interconnection L.L.C., or a college or university with distribution system engineering expertise as the technical master. When the Federal Energy Regulatory Commission identifies a National technical dispute resolution team, the Delaware Public Service Commission may designate the team as its technical master. Upon designation by the Delaware Public Service Commission, the parties shall use the technical master to resolve disputes related to interconnection. Costs for a dispute resolution conducted by the technical master shall be established by the technical master, subject to review by the Delaware Public Service Commission.

8.4. Pursuit of dispute resolution may not affect an Interconnection Customer with regard to consideration of an Interconnection Request or an Interconnection Customer's queue position.

8.5. If the Parties fail to resolve their dispute under the dispute resolution provisions of this Article, nothing in this Article shall affect any Party's rights to obtain equitable relief, including specific performance, as otherwise provided in this Agreement.

9. **Miscellaneous**

9.1. Governing Law, Regulatory Authority, and Rules: The validity, interpretation and enforcement of this Agreement and each of its provisions shall be governed by the laws of the State of Delaware, without regard to its conflicts of law principles. This Agreement

is subject to all Applicable Laws and Regulations.

9.2. Amendment: Modification of this Agreement shall be only by a written instrument duly executed by both Parties.

9.3. No Third-Party Beneficiaries: This Agreement is not intended to and does not create rights, remedies, or benefits of any character whatsoever in favor of any persons, corporations, associations, or entities other than the Parties, and the obligations herein assumed are solely for the use and benefit of the Parties, their successors in interest and where permitted, their assigns.

9.4. Waiver

9.4.1. The failure of a Party to this Agreement to insist, on any occasion, upon strict performance of any provision of this Agreement shall not be considered a waiver of any obligation, right, or duty of, or imposed upon, such Party.

9.4.2. Any waiver at any time by either Party of its rights with respect to this Agreement shall not be deemed a continuing waiver or a waiver with respect to any other failure to comply with any other obligation, right, duty of this Agreement. Termination or default of this Agreement for any reason by Interconnection Customer shall not constitute a waiver of the Interconnection Customer's legal rights to obtain an interconnection from EDC. Any waiver of this Agreement shall, if requested, be provided in writing.

9.5. Entire Agreement: This Agreement, including all attachments, constitutes the entire Agreement between the Parties with reference to the subject matter hereof, and supersedes all prior and contemporaneous understandings or agreements, oral or written, between the Parties with respect to the subject matter of this Agreement. There are no other agreements, representations, warranties, or covenants that constitute any part of the consideration for, or any condition to, either Party's compliance with its obligations under this Agreement.

9.6. Multiple Counterparts: This Agreement may be executed in two or more counterparts, each of which is deemed an original but all constitute one and the same instrument.

9.7. No Partnership: This Agreement shall not be interpreted or construed to create an association, joint venture, agency relationship, or partnership between the Parties or to impose any partnership obligation or partnership liability upon either Party. Neither Party shall have any right, power or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Party.

9.8. Severability: If any provision or portion of this Agreement shall for any reason be held or adjudged to be invalid or illegal or unenforceable by any court of competent jurisdiction or other governmental authority, (1) such portion or provision shall be deemed separate and independent, (2) the Parties shall negotiate in good faith to restore insofar as practicable the benefits to each Party that were affected by such ruling, and (3) the remainder of this Agreement shall remain in full force and effect.

9.9. Environmental Releases: Each Party shall notify the other Party, first orally and then in writing, of the release any hazardous substances, any asbestos or lead abatement activities, or any type of remediation activities related to the Small Generator Facility or the Interconnection Facilities, each of which may reasonably be expected to affect the

other Party. The notifying Party shall (1) provide the notice as soon as practicable, provided such Party makes a good faith effort to provide the notice no later than 24 hours after such Party becomes aware of the occurrence, and (2) promptly furnish to the other Party copies of any publicly available reports filed with any governmental authorities addressing such events.

9.10. Subcontractors: Nothing in this Agreement shall prevent a Party from utilizing the services of any subcontractor as it deems appropriate to perform its obligations under this Agreement; provided, however, that each Party shall require its subcontractors to comply with all applicable terms and conditions of this Agreement in providing such services and each Party shall remain primarily liable to the other Party for the performance of such subcontractor.

9.10.1. The creation of any subcontract relationship shall not relieve the hiring Party of any of its obligations under this Agreement. The hiring Party shall be fully responsible to the other Party for the acts or omissions of any subcontractor the hiring Party hires as if no subcontract had been made. Any applicable obligation imposed by this agreement upon the hiring Party shall be equally binding upon, and shall be construed as having application to, any subcontractor of such a Party.

9.10.2. The obligations under this Article will not be limited in any way by any limitation of subcontractor's insurance.

9.11. Note about Voltage Rise: Running grid-tied generation at a premise will generally raise voltage levels. A proper voltage drop/rise study must be done to insure that resulting voltages do not cause problems at the customer premise and/or to the operation of the inverter. If there are times when generator output will exceed the load of the premise, this will cause voltage rise across the line transformer and service line to the facility. Be sure this is taken into account when doing a voltage drop/rise analysis. If there are other customers that have grid-tied solar and their premise is fed by the same line transformer. If the new generation system causes high voltage for other customers fed by the same transformer, it will be the responsibility of the newest generator installation to remediate the high voltage. The normal voltage at the meter without generation is 120 V +/- 4% (or other secondary voltages such as 208, 240, 480, etc.). Be sure to assume the highest voltage (+ 4%) at the meter when doing the voltage drop/rise analysis to insure acceptable voltage at the premise and at the inverter. **The utility is not responsible for elevated voltage caused by the operation of a generator.** The electrical grid has been designed to maintain 120 V +/- 4% (or other standard secondary voltages) during the course of the normal load cycle.

10. Notices

10.1. General: Unless otherwise provided in this Agreement, any written notice, demand, or request required or authorized in connection with this Agreement ("Notice") shall be deemed properly given if delivered in person, delivered by recognized national courier service, or sent by first class mail, postage prepaid, to the person specified below:

If to Interconnection Customer:

Interconnection Customer: _____

Attention: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____ E-mail _____

If to EDC:

EDC _____

Attention: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____ E-mail _____

10.2. Billing and Payment: Billings and payments shall be sent to the addresses set out below:

If to Interconnection Customer

Interconnection Customer: _____

Attention: _____

Address: _____

City: _____ State: _____ Zip: _____

If to EDC

EDC: _____

Attention: _____

Address: _____

City: _____ State: _____ Zip: _____

10.3. Designated Operating Representative: The Parties may also designate operating representatives to conduct the communications which may be necessary or convenient for the administration of this Agreement. This person will also serve as the point of contact with respect to operations and maintenance of the Party's facilities.

Interconnection Customer's Operating

Representative: _____
Attention: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Fax: _____ E-Mail _____

EDC's Operating Representative:

Attention: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Fax: _____

10.4. Changes to the Notice Information: Either Party may change this notice information by giving five business days written notice prior to the effective date of the change.

11. Signatures

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their respective duly authorized representatives.

For the Interconnection Customer:

Name: _____
Title: _____
Date: _____

For EDC:

Name: _____
Title: _____
Date: _____

Attachment 1

Definitions

Adverse System Impact - A negative effect, due to technical or operational limits on conductors or equipment being exceeded, that compromises the safety or reliability of the Electric Distribution System.

Applicable Laws and Regulations – All duly promulgated applicable federal, State and local laws, regulations, rules, ordinances, codes, decrees, judgments, directives, or judicial or administrative orders, permits and other duly authorized actions of any Governmental Authority.

Commissioning Test – Tests applied to a small generator facility by the applicant after construction is completed to verify that the facility does not create adverse system impacts. At a minimum, the scope of the commissioning tests performed shall include the commissioning test specified IEEE standard 1547 section 5.4 “Commissioning tests”.

Distribution Upgrades –A required addition or modification to the EDC's Electric Distribution System at or beyond the Point of Interconnection to accommodate the interconnection of a Small Generator Facility. Distribution upgrades do not include Interconnection Facilities.

Electric Distribution Company or EDC - Any electric utility entity subject to the jurisdiction of the Delaware Public Service Commission.

Electric Distribution System –The facilities and equipment used to transmit electricity to ultimate usage points such as homes and industries from interchanges with higher voltage transmission networks that transport bulk power over longer distances. The voltage levels at which Electric Distribution Systems operate differ among areas but generally carry less than 69 kilovolts of electricity. Electric Distribution System has the same meaning as the term Area EPS, as defined in 3.1.6.1 of IEEE Standard 1547.

Facilities Study – An engineering study conducted by the EDC to determine the required modifications to the EDC's Electric Distribution System, including the cost and the time required to build and install such modifications, as necessary to accommodate an Interconnection Request.

Governmental Authority – Any federal, State, local or other governmental regulatory or administrative agency, court, commission, department, board, or other governmental subdivision, legislature, rulemaking board, tribunal, or other governmental authority having jurisdiction over the Parties, their respective facilities, or the respective services they provide, and exercising or entitled to exercise any administrative, executive, police, or taxing authority or power; provided, however, that such term does not include the Interconnection Customer, EDC or any affiliate thereof.

IEEE Standard 1547 - The Institute of Electrical and Electronics Engineers, Inc. (IEEE) Standard 1547 (2003) "Standard for Interconnecting Distributed Resources with Electric Power Systems", as amended and supplemented, at the time the Interconnection Request is submitted.

IEEE Standard 1547.1 - The IEEE Standard 1547.1 (2005) "Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems", as amended and supplemented, at the time the Interconnection Request is submitted.

Interconnection Agreement or Agreement – This agreement between the Interconnection Customer and the EDC, which governs the connection of the Small Generator Facility to the

EDC's Electric Distribution System, as well as the ongoing operation of the Small Generator Facility after it is connected to the EDC's Electric Distribution System.

Interconnection Customer – The entity proposing to interconnect a Small Generator Facility to the EDC's Electric Distribution System.

Interconnection Equipment – A group of components or integrated system connecting an electric generator with a local electric power system or an Electric Distribution System that includes all interface equipment including switchgear, protective devices, inverters or other interface devices. Interconnection Equipment may be installed as part of an integrated equipment package that includes a generator or other electric source.

Interconnection Facilities – Facilities and equipment required by the EDC to accommodate the interconnection of a Small Generator Facility. Collectively, Interconnection Facilities include all facilities, and equipment between the Small Generator Facility and the Point of Interconnection, including modification, additions, or upgrades that are necessary to physically and electrically interconnect the Small Generator Facility to the Electric Distribution System. Interconnection Facilities are sole use facilities and do not include Distribution Upgrades.

Interconnection Request – An Interconnection Customer's request, in a form approved by the Delaware Public Service Commission, requesting the interconnection of a new Small Generator Facility, or to increase the capacity or operating characteristics of an existing Small Generator Facility that is interconnected with the EDC's Electric Distribution System.

Delaware Standard Small Generator Interconnection Rules – The most current version of the procedures for interconnecting Small Generator Facilities adopted by the Delaware Public Service Commission. Title 26 - Public Utilities – Chapter 10. Electric Utility Restructuring §1014.

Parallel Operation or Parallel - The state of operation which occurs when a Small Generator Facility is connected electrically to the Electric Distribution System and the potential exists for electricity to flow from the Small Generator Facility to the Electric Distribution System.

Point of Interconnection - The point where the Small Generator Facility is electrically connected to the Electric Distribution System. Point of Interconnection has the same meaning as the term point of common coupling defined in 3.1.13 of IEEE Standard 1547.

Small Generator Facility - The equipment used by an interconnection customer to generate, or store electricity that operates in parallel with the Electric Distribution System. A Small Generator Facility typically includes an electric generator, prime mover, and the Interconnection Equipment required to safely interconnect with the Electric Distribution System or a local electric power system.

Witness Test— For lab certified or field approved equipment, verification (either by an on-site observation or review of documents) by the EDC that the interconnection installation evaluation required by IEEE Standard 1547 Section 5.3 and the commissioning test required by IEEE Standard 1547 Section 5.4 have been adequately performed. For interconnection equipment that has not been lab certified or field approved, the witness test shall also include the verification by the EDC of the on-site design tests as required by IEEE Standard 1547 Section 5.1 and verification by the EDC of production tests required by IEEE Standard 1547 Section 5.2. All tests verified by the EDC are to be performed in accordance with the test procedures specified by IEEE Standard 1547.1.

Attachment 2

Construction Schedule, Proposed Equipment & Settings

This attachment shall include the following:

1.

The construction schedule for the Small Generator Facility

A one-line diagram indicating the Small Generator Facility, Interconnection Equipment, Interconnection Facilities, Metering Equipment, and Distribution Upgrades

Component specifications for equipment identified in the one-line diagram

Component settings

Proposed sequence of operations

Attachment 3

Description, Costs and Time Required to Build and Install EDC's Interconnection Facilities

EDC's Interconnection Facilities including any required metering shall be itemized and a best estimate of itemized costs, including overheads, shall be provided based on the Facilities Study.

Also, a best estimate for the time required to build and install EDC's Interconnection Facilities will be provided based on the Facilities Study.

Attachment 4

Operating Requirements for Small Generator Facilities Operating in Parallel

Applicable sections of EDC's operating manuals applying to the small generator interconnection shall be listed and Internet links shall be provided. Any special operating requirements not contained in EDC's existing operating manuals shall be clearly identified.

Attachment 5

Monitoring and Control Requirements

EDC monitoring and control requirements shall be clearly specified and a reference shall be provided to the EDC's written requirements documents from which these documents are derived along with an internet link to the requirements documents.

Attachment 6

Metering Requirements

Metering requirements for the Small Generator Facility shall be clearly indicated along with an identification of the appropriate tariffs that establish these requirements and an internet link to these tariffs.

Attachment 7

As Built Documents

After completion of the Small Generator Facility, the Interconnection Customer shall provide the EDC with documentation indicating the as built status of the following when it returns the Certificate of Completion to the EDC:

1.

A one-line diagram indicating the Small Generator Facility, Interconnection Equipment, Interconnection Facilities, Metering Equipment, and Distribution Upgrades

Component specifications for equipment identified in the one-line diagram

Component settings

Proposed sequence of operations



A PHI Company

PART 1

DELAWARE LEVEL 2, 3, & 4 INTERCONNECTION APPLICATION & AGREEMENT

With Terms and Conditions for Interconnection

(Lab Certified Inverter-Based Generator Facilities Greater than 10 kW and Less than or Equal to 2 MW)²

(Application & Conditional Agreement – to be completed prior to installation)

INTERCONNECTION CUSTOMER CONTACT INFORMATION

Customer Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Contact Person (If other than above): _____

Mailing Address (If other than above): _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address (Required): _____

Alternate Contact Information

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address: _____

FACILITY INFORMATION

Facility Address: _____

City: _____ State: DE Zip Code: _____

DPL Account # of Facility site: _____

Energy Source: _____ Prime Mover: _____

TYPE OF APPLICATION: Initial Addition/Upgrade ³

DC Nameplate Rating: _____ (kW) _____ (kVA), AC Inverter Rating _____ (kW), AC System Design Capacity: _____ (kW) _____ (kVA)

² Up to 10 MW for interconnection requests to a radial distribution circuit pursuant to Title 26 – Chapter 10 -- §1014.
³ Initial if first time generator request. Addition/Upgrade if this is an add-on to a previously approved system.

Generator (or PV Panel) Manufacturer, Model # Rating: _____
(A copy of Generator Nameplate and Manufacturer's Specification Sheet May Also be Submitted)

Number of Generators (or PV Panels): _____

Inverter Manufacturer: _____ Model # & Rating: _____

Number of Inverters: _____

Ampere Rating: _____ Amps_{AC}, Number of Phases: 1 3, Voltage Rating: _____ V_{AC},

Nominal DC Voltage: _____ V_{DC}, Power Factor: _____ %, Frequency: _____ Hz,

DPL Accessible Disconnect or Lock Box: Yes No, If Yes, Location: _____

One-line Diagram Attached (Required): Yes No

Site Plan Attached (Required): Yes No

Do you plan to export power?⁴ Yes No, If Yes, Estimated Maximum: _____ kW_{AC}

Estimated Gross Annual Energy Production: _____ kWh

Is the inverter IEEE/UL1741 lab certified? Yes No (If yes, attach manufacturer's cut sheet showing listing and label information from the appropriate listing authority, e.g. UL 1741 listing. If no, facility is not eligible for Level 1 Application.)

Estimated Commissioning Date: _____

Electric Service Information for Customer Facility Where Generator Will Be Interconnected
(If primary service is from DPL but customer owns their own transformer)

Capacity: _____ (Amps) Voltage: _____ (Volts)

Type of Service: Single Phase Three Phase

If 3 Phase Transformer, Indicate Type

Primary Winding Wye Delta

Secondary Winding Wye Delta

Transformer Size: _____ Impedance: _____

Intent of Generation:

Offset Partial Load (Unit will operate in parallel, but will not export power at any time to EDC)

Net Meter (Unit will operate in parallel and will export power pursuant to Delaware Net Metering or other filed tariff(s))

Wholesale Market Transaction (Unit will operate in parallel and participate in PJM market(s) pursuant to a PJM Wholesale Market Participation Agreement)

Back-up Generation (Units that temporarily parallel for more than 100 milliseconds) Note: Backup units that do not operate in parallel for more than 100 milliseconds do not need an interconnection agreement.

⁴ Yes, if your expected maximum output of the inverter (kW AC) is greater than the lowest load you anticipate at your facility during maximum PV output (kW). The difference would be the amount you may export.

Generator & Prime Mover Data:

Energy Source: _____

Energy Converter Type: _____

Generator Size (kW or kVA): _____ Number of Generator Units: _____

Total Electrical Generation Capacity (kW or kVA): _____

Generator Type: Induction Inverter Synchronous Other: _____

Requested Procedure Under Which to Evaluate Interconnection Request:^{*}

Please indicate below which review procedure applies to the interconnection request.

- Level 2** - Certified interconnection equipment with an aggregate electric nameplate capacity less than or equal to 2 MW. Indicate type of certification below. (Application fee amount is \$50 plus \$1 per KW).
- Lab certified - tested to IEEE 1547.1 and other specified standards by a nationally recognized testing laboratory and is appropriately labeled.
 - Field approved – identical interconnection has been approved by an EDC under a Level 4 study review process within the prior 36 months of the date of this interconnection request.
- Level 3** – Small generator facility does not export power. Nameplate capacity rating is equal to less than 50KW if connecting to area network or equal to or less than 10 MW if connecting to a radial distribution feeder. (Application fee amount is \$100 plus \$2 per KW).
- Level 4** – Nameplate capacity rating is less than or equal to 10 MW and the small generator facility does not qualify for a Level 1, Level 2 or Level 3 review or, the small generator facility has been reviewed but not approved under a Level 1, Level 2 or Level 3 review. (Application fee amount is \$100 plus \$2 per KW, to be applied toward any subsequent studies related to this application).

^{*} **Note:** Descriptions for interconnection review categories do not list all criteria that must be satisfied. For a complete list of criteria, please refer to the Delaware Standard Small Generator Interconnection Procedures, Title 26 - Public Utilities – Chapter 10. Electric Utility Restructuring §1014.

Field Approved Equipment:

If the field approved equipment box is checked above, please provide the estimated completion date in the section that follows, then sign the application and return it with the following information that is required for review of Level 2 field approved small generator facilities:

- A copy of the certificate of completion for the previously approved small generator facility,
- A written statement indicating that the interconnection equipment being proposed is identical, except for minor equipment modification, to the one previously approved.

You do not have to complete the rest of the application if field approved equipment is being proposed.

Small Generator Facility Information:

List interconnection components/system(s) to be used in the Small Generation Facility that are lab certified (required for Level 2 Interconnection requests only).

Component/System	NRTL Providing Label & Listing
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

Please provide copies of manufacturer brochures or technical specifications

Energy Production Equipment/Inverter Information:

Synchronous Induction Inverter Other _____

Rating: _____ kW Rating: _____ kVA

Rated Voltage: _____ Volts

Rated Current: _____ Amps

System Type Tested (Total System): Yes No; attach product literature

For Synchronous Machines:

Note: Contact EDC to determine if all the information requested in this section is required for the proposed small generator facility.

Manufacturer: _____

Model No. _____ Version No. _____

Submit copies of the Saturation Curve and the Vee Curve

Salient Non-Salient

Torque: _____ lb-ft Rated RPM: _____ Field Amperes: _____ at rated generator voltage and current and _____ % PF over-excited

Type of Exciter: _____

Output Power of Exciter: _____

Type of Voltage Regulator: _____

Locked Rotor Current: _____ Amps Synchronous Speed: _____ RPM

Winding Connection: _____ Min. Operating Freq./Time: _____

Generator Connection: Delta Wye Wye Grounded

Direct-axis Synchronous Reactance: (Xd) _____ ohms

Direct-axis Transient Reactance: (X'd) _____ ohms

Direct-axis Sub-transient Reactance: (X''d) _____ ohms

Negative Sequence Reactance: _____ ohms

Zero Sequence Reactance: _____ ohms

Neutral Impedance or Grounding Resister (if any): _____ ohms

For Induction Machines:

Note: Contact EDC to determine if all the information requested in this section is required for the proposed small generator facility.

Manufacturer: _____
Model No. _____ Version No. _____
Locked Rotor Current: _____ Amps
Rotor Resistance (Rr) _____ ohms Exciting Current _____ Amps
Rotor Reactance (Xr) _____ ohms Reactive Power Required: _____
Magnetizing Reactance (Xm) _____ ohms _____ VARs (No Load)
Stator Resistance (Rs) _____ ohms _____ VARs (Full Load)
Stator Reactance (Xs) _____ ohms
Short Circuit Reactance (X"d) _____ ohms
Phases: Single Three-Phase
Frame Size: _____ Design Letter: _____ Temp. Rise: _____ °C.

Reverse Power Relay Information (Level 3 Review Only):

Manufacturer: _____
Relay Type: _____ Model Number: _____
Reverse Power Setting: _____
Reverse Power Time Delay (if any): _____

Additional Information for Inverter Based Facilities

Inverter Information:

Manufacturer: _____ Model: _____
Type: Forced Commutated Line Commutated
Rated Output _____ Watts _____ Volts
Efficiency _____ % Power Factor _____ %
Inverter UL1547 Listed: Yes No

DC Source / Prime Mover:

Rating: _____ kW Rating: _____ kVA
Rated Voltage: _____ Volts
Open Circuit Voltage (If applicable): _____ Volts
Rated Current: _____ Amps
Short Circuit Current (If applicable): _____ Amps

EQUIPMENT INSTALLATION CONTRACTORCheck if owner-installed

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address (Required): _____

ELECTRICAL CONTRACTOR

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address: _____

License number: _____

INSURANCE DISCLOSURE

The attached terms and conditions contain provisions related to liability and indemnification, and should be carefully considered by the interconnection customer. The interconnection customer is not required to obtain general liability insurance coverage as a precondition for interconnection approval; however, the interconnection customer is advised to consider obtaining appropriate insurance coverage to cover the interconnection customer's potential liability under this agreement.

CUSTOMER SIGNATURE

I hereby certify that: 1) I have read and understand the terms and conditions which are attached hereto by reference and are a part of this Agreement; 2) I hereby agree to comply with the attached terms and conditions; and 3) to the best of my knowledge, all of the information provided in this application request form is complete and true. I consent to permit the PSC and interconnecting utility to exchange information regarding the generating system to which this application applies.

Interconnection Customer Signature: _____ Date: _____

Printed Name: _____ Title: _____

Application Fee:

Refer to fees on page 25. DPL will mail an invoice for your application fee.

.....

EDC ACKNOWLEDGEMENT (FOR USE BY EDC ONLY)

Receipt of the application fee is acknowledged and the interconnection request is complete.

EDC Signature: _____

Date: _____

Printed Name: _____

Title: _____



A PHI Company

PART 2

DELAWARE LEVEL 2, 3, & 4 INTERCONNECTION APPLICATION & AGREEMENT

With Terms and Conditions for Interconnection

(Lab Certified Inverter-Based Generator Facilities Greater than 10 kW and Less than or Equal to 2 MW)

(Final Agreement –must be completed after installation and prior to interconnection)

Certificate of Completion

INTERCONNECTION CUSTOMER CONTACT INFORMATION

Customer Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address: _____

FACILITY INFORMATION

Facility Address: _____

City: _____ State: DE Zip Code: _____

DPL Account # of Facility site: _____

Energy Source: _____ Prime Mover: _____

DC Nameplate Rating: _____ (kW) _____ (kVA), AC Inverter Rating _____ (AC kW), AC System Design Capacity: _____ (kW) _____ (kVA)

Generator (or PV Panel) Manufacturer, Model #: _____

Inverter Manufacturer: _____ Model # & Rating: _____

Number of Inverters: _____

EQUIPMENT INSTALLATION CONTRACTOR

Check if owner-installed

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone (Daytime): _____ (Evening): _____

Facsimile Number: _____ E-Mail Address: _____

FINAL ELECTRIC INSPECTION AND INTERCONNECTION CUSTOMER SIGNATURE

The Small Generator Facility is complete and has been approved by the local electric inspector having jurisdiction. A signed copy of the electric inspector's form indicating final approval is attached. The Interconnection Customer acknowledges that it shall not operate the Small Generator Facility until receipt of the final acceptance and approval by the EDC as provided below.

Signed: _____ Date _____
(Signature of interconnection customer)

Printed Name: _____

Type of Application: New/Initial Growth/Increase System Capacity _____ KW (DC)
Check if copy of signed electric inspection form is attached (required)
Check if copy of as built documents is attached (projects larger than 10 kW only)

.....

ACCEPTANCE AND FINAL APPROVAL FOR INTERCONNECTION (for EDC use only)

The interconnection agreement is approved and the Small Generator Facility is approved for interconnected operation upon the signing and return of this Certificate of Completion by EDC:

Electric Distribution Company waives Witness Test? *(Initial)* Yes (_____) No (_____)
If not waived, date of successful Witness Test: _____ Passed: *(Initial)* (_____)

EDC Signature: _____ Date: _____

Printed Name: _____ Title: _____

Delmarva Power

Technical Considerations Covering Parallel Operations of Customer Owned Generation Of Less than One (1) Megawatt And Interconnected with the DPL Power System

October 9, 2009

Technical Considerations Covering Parallel Operations of Customer Owned Generation of Less than One (1) Megawatt and Interconnected with the Delmarva Power System

Perquisite - The customer must be first in compliance with the tariff rules and regulations and the applicable tariff classification and rates. The terms and conditions contained herein are in addition to, but do not modify nor negate, the terms of the tariff.

I Purpose - The purpose of this document (relating to interconnection of on-site distributed generation and parallel generation requirements) is to clearly state the terms and conditions that govern the interconnection and parallel operation of on-site distributed generation, in order to:

- A. establish technical requirements which will promote the safe and reliable parallel operation of distributed generation resources;
- B. enhance the reliability of electric service;
- C. facilitate the implementation and use of distributed resource technologies;
- D. enhance economic efficiency in the production and consumption of electricity and other energy; and
- E. promote the use of distributed resources in order to provide electric system benefits during periods of capacity constraint.

II Applicability. Unless otherwise provided, these guidelines apply to all customer generation operating below 1 Megawatt which is interconnected at 34.5kV or below and operated in parallel with the Company's power delivery System. The technical requirements of Section XIV and subsequent sections of this document do not apply to NEM Rider Tariff generators 30kW or less using inverter technology as requirements for these installations are already covered in the applicable codes, IEEE Standard 929, *Recommended Practice for Utility Interface of Photovoltaic (PV) Systems*, and UL 1741-2005, Underwriters Laboratories Standard entitled, *Inverters, Converters, Controllers and Interconnection Equipment for Use with Distributed Energy Resources*. All sections of this document apply to NEM Rider Tariff generators greater than 30kW and to all non-inverter based generators.

III Definitions

A. Account - An account is one metered or un-metered rate or service classification which normally has one electric delivery point of service. Each account shall have only one electric service supplier providing full electric supply requirements for that account. A premises may have more than one account.

B. Company – Delmarva Power & Light Company (DPL).

C. Customer – Any adult person, partnership, association, corporation, or other entity: (i) in whose name a service account is listed, (ii) who occupies or is the ratepayer for a premises, building, structure, etc., and (iii) who is primarily responsible for payment of bills. A Customer includes anyone taking Delivery Service or combined Electric Supply & Delivery Service from the Company under one service classification for one account, premises or site. Multiple premises or sites under the same name are considered multiple Customers.

D. Distributed Generation or On-Site Distributed Generation – an electrical generating unit of less than 1 MW, which may be connected in parallel operation to the Company's system.

E. Generator Owner – the owner of the generation system that is interconnected to the Company.

F. Grid – The interconnected arrangement of lines and transformers that make up the Company's electric power system.

G. IEEE Standard 929 - IEEE Standard entitled *Recommended Practice for Utility Interface of Photovoltaic (PV) Systems, 2000*, or subsequent approved revision thereof.

H. IEEE Standard 1547 – IEEE Standard entitled *IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems, 2003*

I. Interconnection – the physical connection of distributed generation to the Company's system in accordance with these guidelines so that parallel operation can occur.

J. Interconnection Application – the standard form of application which must be submitted by the Generation Owner to the Company for permission to interconnect with the Company system. The approved Interconnection Application sets forth the contractual conditions under which the Company and Generator Owner agree that one or more generating units whose aggregate generation at the Point of Common Coupling is less than 1 MW may be interconnected at 34.5 kV or less with the Company's system.

K. Inverter – A static power converter with control, protection and filtering functions that converts Direct Current input to Alternating Current output. Inverters must be of the non-islanding type.

L. Island – A portion of the utility system which contains both load and distributed generation and is isolated from the remainder of the utility system.

M. Parallel Operation – any electrical connection between the Company's system and the Generator Owner's generation source.

N. Point of Common Coupling – the point where the electrical conductors of the Company system are connected to the Customer’s conductors and where any transfer of electric power between the Generator Owner and the Company System takes place (such as switchgear near the meter.)

O. Pre-Approved Equipment - specific generating and protective equipment system or systems that have been approved by the Company as meeting the applicable parts of this document.

P. Pre-Interconnection Study – a study or studies which may be undertaken by the Company in response to its receipt of a completed application for parallel operation with the Company’s system submitted on the Interconnection Application form prescribed by these guidelines. Pre-Interconnection Studies may include, but are not limited to, service studies, coordination studies and facilities impact studies.

Q. Qualifying Facility (QF) – an electric generation facility which is a qualifying facility under Subpart B, Section 201 of the Federal Energy Regulatory Commission’s regulations per the Public Utility Regulatory Policies Act of 1978.

R. Stabilized – the Company’s system following a disturbance which returns to the normal range of voltage and frequency for at least 5 minutes or longer as coordinated with the Company. The Company may require a longer period upon a reasonable showing that reconnection after 5 minutes will adversely affect the safety and reliability of the electric system.

S. UL 1741 – Underwriters Laboratories Inc. document UL 1741 – 2005 entitled *Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*.

T. Unit – a distributed generation facility.

U. Utility System or Electric Distribution Facilities – Company’s distribution system operating at 34.5 kilovolts or below to which the generation equipment is interconnected.

IV Interconnection Application - A proposed Generator Owner will make a formal application to the Company for the interconnection of a generator to the Company system. The application will be made on an Application Form provided by the Company. Two Application Forms are available. Generators 25kW or less will use the shorter Application Form as less technical data is needed for units within this size range.

V Designation of Company Contact Persons for Matters Relating to Distributed Generation Interconnection – The Company’s Power Delivery Marketing Department will be the designated point of contact for all matters related to interconnected generation. The Company will maintain records concerning applications received for interconnection and parallel operation of distributed generation. Such records will include the date of receipt of each such application, documents generated in the course of processing such

applications, correspondence regarding such applications and the final disposition of such applications.

VI Pre-Interconnection Studies - In many instances the Company will wish to conduct a service study, coordination study, or facilities impact study prior to interconnection of a distributed generation unit. In instances where such studies are deemed necessary the scope of such studies shall be based on the characteristics of the particular distributed generation unit to be interconnected and the proposed Point of Common Coupling. All generators less than 25 kW are exempt from the pre-interconnection study requirement.

- A) Completion of Pre-interconnection Study** - Upon completion of the pre-interconnection study, the Company will notify the Generator Owner that his application has been approved or indicate in sufficient detail why the application cannot be approved. The conducting of such pre-interconnection studies shall not unduly delay the interconnection of the distributed generation. In no event shall such studies take longer to complete than 4 weeks after receipt of signed customer application and customer submittal of all required data.
- B) Per-interconnection Study Fee** - The Company will do a pre-interconnection study without charge up to the typical and customary cost that the Company would expend for study work of a similar type of customer interconnection. If the cost to the Company is expected to exceed this typical and customary amount, or if multiple submittals by the Generator Owner are necessary, the Company will advise the Generator Owner of the expected cost of such study work by the Company before such work begins. The Generator Owner will be responsible for payment of all costs above the typical and customary amount.

VII Network Interconnection of Distributed Generation – Where generation is to be connected to a network system and capable of exporting power onto the Grid, the interconnection study may result in more stringent interconnection requirements.

VIII Pre-approval of Generation Units, Devices and Systems - Upon approval by the Company that certain generating unit's protective devices and/or system(s) meet the standards set out in these guidelines, such approval shall be made available to the appropriate manufacturer upon written request. For subsequent applications using some or all of the identical generating units' protective devices and/or systems, the manufacturer may submit a copy of the approval with the application as proof that its equipment has already been approved for use on the Company's system. Use of pre-approved equipment will not eliminate any applicable requirement for a pre-interconnection study to determine the suitability of the equipment for each application,

given the unique arrangements and characteristics of both the Generator Owner and Company systems at the Point of Common Coupling.

IX Connection Approval - The Generator Owner can connect their generation to the Company system only after the Interconnection Application has been approved and the Generation Owner has received approval notification. The Company will provide notification within four weeks after receipt of the Interconnection Application and all required data.

X Interconnected Generation Site Warning Label - The Generator Owner will install a warning label in a conspicuous place on their electric meter or meter box to notify Company personnel that there is a generator source installed on the load side of the meter. The warning label shall not be placed in a location that would interfere with the ability of Company personnel to read the electric meter. The Company will provide the warning label to the Generator Owner. The warning label must be in place before the generation can be interconnected.

XI Disconnection and Reconnection.

The Company may disconnect a distributed generation unit under the following conditions:

- 1) **Application Termination** - Upon termination of the approved Interconnection Application.
- 2) **Non Compliance** - For non-compliance with the technical guidelines specified in this document or other requirements contained in the applicable Customer Tariff, provided that the Company has given notice to the Generator Owner and provided the Generator Owner reasonable time (consistent with the condition) to correct such non-compliance. The Company will reconnect the unit only upon receipt of certification from the Generator Owner and verification by the Company that the unit is in compliance. The Company will provide verification within a reasonable time period.
- 3) **In case of a system emergency or outage of the Company's primary Electrical Source** - The Generator Owner's generation equipment must be installed and configured so that parallel operation must cease immediately and automatically during outages or loss of the Company's electric source in accordance with these guidelines. The Generator Owner must also cease parallel operation upon notification by the Company of a system emergency, abnormal condition or in cases where such operation is determined to be unsafe, interferes with the supply of service to other customers or interferes with the Company's system maintenance or operation. In addition, the Company may disconnect the generator from the system for system emergencies without notice. However, the Company will use reasonable efforts to notify the Generator Owner prior to disconnecting.

- 4) For Routine Maintenance and Repairs** - The Company may disconnect a Customer/Generator Owner for routine maintenance and repairs on the Company's system consistent with applicable tariffs and agreements. The Company will make reasonable efforts to provide advance notice to the Customer/Generator Owner of service interruptions resulting from routine maintenance.

The Company will reconnect the Customer/Generator Owner as quickly as possible following any such service interruption.

XII Termination – The Generator Owner may terminate the approved Interconnection Application at any time upon thirty (30) days of providing written notice to the Company. The Company may terminate the Interconnection Application for cause after 60 days written notice to the Generator Owner of a material violation of the terms of the approved Interconnection Application and after the Generator Owner has had a reasonable opportunity to remedy the violation. The Generator Owner must give the Company notice that it intends to permanently shut down his generation.

XIII Privileged Communications Concerning Proposed Distributed Generation Projects - In the course of processing applications for parallel operation and in the conduct of pre-interconnection studies, the Generator Owner shall provide the Company with detailed information concerning the proposed distributed generation project. The Company shall not use such knowledge of proposed distributed generation projects submitted to it for review to prepare competing proposals to the Generator Owner whereby the Company, or its affiliate, offers either discounted rates in return for not installing the distributed generation, or offers competing distributed generation projects.

XIV Technical Guidelines for Parallel Operation of On-site Distributed Generation Units - This subsection describes minimum requirements and procedures for safe and effective connection and operation of distributed generation. A Generator Owner may operate 60 Hertz, three phase or single phase generating equipment, whether a QF or non-QF, in parallel with the Company's system pursuant to an approved Interconnection Application provided that the equipment and Generator Owner meet or exceed the requirements of these guidelines or the NEM Rider Tariff requirements and that the Company has approved the Generator Owner's application to interconnect. This subsection describes typical interconnection requirements. Certain specific interconnection locations and conditions may require the installation of additional protective settings or hardware, especially when exporting power to the system. If the Company concludes that an application for parallel operation requires additional protective settings or hardware, the Company shall make those requirements known to the Generator Owner within 14 days after all pertinent studies are completed.

Approval to connect to the Company system indicates only that the minimum requirements for a safe proper interconnection have been satisfied. Such approval does

not imply that the Generator Owner's facility meets all federal, state and local standards or regulations.

A) General Interconnection and Protection Requirements.

- 1) The Generator Owner's generation and interconnection installation must meet all applicable national, state, and local construction and safety codes.
- 2) The Generator Owner's generator shall be equipped with protective hardware and software designed to prevent the generator from energizing one of the Company's de-energized circuits. The Generator Owner's generator must automatically disconnect from the Company's system if the Grid source is lost, irrespective of connected loads or other generators.
- 3) The generator shall be equipped with the necessary protective hardware and software designed to prevent sustained parallel operation of the generating equipment with the Company's system unless the system service voltage and frequency are within acceptable magnitudes as defined in Section XIV.B.
- 4) Pre-approved equipment shall be accepted as part of an interconnection proposal without the need to re-review the equipment itself. However, the application, design and setting of pre-approved units and/or equipment must be reviewed and coordinated according to the unique needs of the specific location of the proposed installation. Where a complete unit or system has been pre-approved, only location-specific issues will typically need to be reviewed.
- 5) The Generator Owner will be responsible for protecting its own generating and interconnection equipment in such a manner so that Company system outages, short circuits, single phasing conditions or other disturbances including zero sequence currents and ferroresonant over-voltages do not damage the Generator Owner's generating equipment. The protective equipment shall also prevent excessive or unnecessary tripping that would adversely affect the Company's service reliability to other Generator Owners and Customers.
- 6) The Generator and interface protection schemes shall be continuously monitored and functioning and the generator shall immediately disconnect from the Company's system for any condition that would make the protection scheme inoperable.
- 7) The operating power required for the protection and control schemes for the generator and the control power used to disconnect the generator from the Company must not be dependent on local Company grid power.
- 8) Where multiple generators are connected to the system through a single Point of Common Coupling, the sum of the ratings of the generators will be used to determine the applicability of these guidelines. Protection scheme performance with one or more units off line will have to be considered.

- 9) Applicable circuit breakers or other interrupting devices at the Generator Owner's facility must be capable of interrupting the maximum available fault current at the site, including any contribution from the Owner's generator(s).
- 10) The Generator Owner will furnish and install a manual disconnect device which, when opened, will have the affect of isolating the generator from the Company's system. This disconnect device shall have a visual break (a disconnect switch, a draw-out breaker, fuse block, etc. as appropriate to the voltage level), will, at all times, be accessible to Company's personnel, and shall be capable of being locked in the open position via a Company padlock. The Company shall use reasonable efforts to utilize padlocks of a size consistent with typical manufacturer's specifications. The Generator Owner shall follow the Company's switching, clearance and tagging procedures which the Company shall provide and attached the Warning Label noted in Section X.

On generation installations of 25kW or less, the Generator Owner may elect not to install a manual disconnect switch provided that the meter can be safely "pulled" by DPL to isolate the generation equipment from the Company. **If the Generator Owner elects not to install a manual disconnect device, the Generator Owner assumes all risks and consequences when a meter must be "pulled" to disconnect the generator thereby also interrupting electric service to the Customer.**

- 11) The design, procurement, installation, and maintenance of the equipment at the Generator Owner's site is the responsibility of the Generator Owner and at the Generator Owner's expense.
- 12) Any necessary enhancements or improvements needed within the Company's system and/or at other Customer sites to accommodate the parallel interconnection of the Generator Owner's generation will be at the Generator Owner's expense.
- 13) The Generator Owner has full responsibility and liability for the safe and proper operation and control of their equipment and the power originating from their generator. The Generator Owner is also responsible for synchronizing their generator(s) with the Company's system and maintaining a synchronous condition.
- 14) The Generator Owner must immediately cease parallel operation upon notification by the Company if such operation is determined to be unsafe, interferes with the supply of service to other customers, or interferes with the Company's system maintenance or operation.
- 15) The Company reserves the right to specify the type of transformer connection (e.g. delta-delta, wye-delta, wye-wye) that will be employed for all multiphase interface transformers consistent, where reasonable, with the Generator Owner's power system.

B) Prevention of Generator Owner Generation Interference with Company System. To eliminate undesirable interference caused by operation of the Generator Owner's generating equipment, the Generator Owner's generator shall meet the following criteria:

1) Voltage - The generating equipment will be operated in such a manner that the voltage levels on the Company's system are in the same range as if the generating equipment were not connected to the Company's system. The Generator Owner shall provide an automatic method of initiating a disconnect sequence of his generating equipment from the Company system with set points noted in the table below.

Generating Systems with Inverters Up to 30kW	Generating Systems with Inverters Greater than 30kW	Non-Inverter or Rotating Machine Generating Systems
<ul style="list-style-type: none"> • Trip in 0.16 Second for $V < 50\%$ • Trip In 2 Seconds for $50\% \leq V < 88\%$ • Trip In 1 Seconds for $110\% < V < 120\%$ • Trip in 0.16 Second for $120\% \leq V$ <p>IEEE 1547 – 2003 UL 1741 - 2005</p>	<ul style="list-style-type: none"> • Trip in 0.16 Second for $V < 50\%$ • Trip within 0.1 to 30 Seconds (<i>Default 2.0 Seconds</i>) for $50\% \leq V < 88\%$ • Trip within 0.1 to 30 Seconds (<i>Default 1.0 Second</i>) for $110\% < V < 120\%$ • Trip in 0.16 Second for $120\% \leq V$ <p>(Specific voltage and time delay set points will be determined for each installation. Otherwise inverter default setting will remain.) IEEE 1547 – 2003 UL 1741 - 2005</p>	<ul style="list-style-type: none"> • Trip in 0.16 Second for $V < 50\%$ • Trip in 2.0 Seconds for $50\% \leq V < 88\%$ • Trip in 1.0 Second for $110\% < V < 120\%$ • Trip in 0.16 Second for $120\% \leq V$ <p>(Specific voltage and time delay set points may vary for each installation. Otherwise, the above set points will remain.) IEEE 1547 - 2003</p>

Notes: Trip time refers to the time between when the abnormal voltage condition occurs and the generator being disconnected from the utility Company.

On three phase generator installations, full three phase voltage sensing should be employed. Voltages must be sensed on the high side of any interface transformer if the transformer high voltage winding is ungrounded.

The Generator Owner may reconnect to the grid when the system voltage returns to normal range and is Stabilized as defined in Section III, Definitions.

2) **Flicker** - The Generator Owner generator shall not cause excessive voltage flicker on the Company's system. This flicker shall not exceed the "Borderline of Irritation" curve, Fig. 10.3, as defined in IEEE Std 519-1992, *Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*. Lower levels of flicker may be required in areas where equipment such as computers and instrumentation are impacted.

3) **Frequency** - The operating frequency of the generating equipment shall not deviate more than the values noted in the table below.

Generating Systems with Inverters Up to 30kW	Generating Systems with Inverters Greater than 30kW	Non-Inverter or Rotating Machine Generating Systems
<ul style="list-style-type: none"> • Trip in 0.16 Second for $F < 59.3$ Hz • Trip in 0.16 Second for $F > 60.5$ Hz. <p>IEEE 1547 – 2003 UL 1741 - 2005</p>	<ul style="list-style-type: none"> • Trip in 0.16 Second for $F < 57.0$ Hz. • Trip in 0.16 – 300 Seconds for $57.0 \leq F < 59.8$ Hz • Trip in 0.16 Second for $F > 60.5$ Hz. <p>Frequency and time delay set points for 57.0 – 59.8 Hz. will be determined for each specific installation. IEEE 1547 – 2003 UL 1741 - 2005</p>	<ul style="list-style-type: none"> • Trip in 0.16 Second for $F < 57.0$ Hz. • Trip in 0.16 – 300 Seconds for $57.0 \leq F < 59.8$ Hz. • Trip in 0.16 Second for $F > 60.5$ Hz. <p>Frequency and time delay set points for 57.0 – 59.8 Hz. will be determined for each specific installation. IEEE 1547 - 2003</p>

Notes:

Trip time refers to the time between when the abnormal frequency condition occurs and the generator being disconnected from the utility Company.

The Generator Owner may reconnect when the system frequency returns to normal range and is Stabilized as defined in Section III, Definitions.

4) **Harmonics** – Non-linear circuit elements such as inverters can produce harmonics. Per IEEE Std 519, *Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*, Table 11.1, the total harmonic distortion (THD) voltage shall not exceed 5% of the fundamental 60 Hz frequency nor 3% of the fundamental for any individual harmonic as measured at the location where the customer interfaces with the Company's system. (Point of Common Coupling). In addition, the level of harmonic current that the customer is allowed to inject into the Company's system shall not exceed that specified in Table 10.3 in IEEE Std. 519. Furthermore, any commutation notch should be limited as defined by Table 10.2 in IEEE Std. 519. The preceding requirements apply to all types of generation systems.

The Generation Owner is responsible for the installation of any necessary controls or hardware to limit the voltage and current harmonics generated by his equipment to defined levels.

5) Power Factor – The generator must not adversely impact the power factor of the Generator Owner site. Most inverters are designed to operate close to unity power factor. The operating power factor of the generator shall be contained within the limits defined in the table below.

Generating Systems with Inverters Up to 25kW	Generating Systems with Inverters Greater than 25kW	Non-Inverter or Rotating Machine Generating Systems
0.85 Lagging or Leading when output exceeds 10% of inverter rating. (From IEEE 929-2000)	0.85 Lagging or Leading when output exceeds 10% of inverter rating.	0.85 Lagging or Leading

However, to the extent that a Generator Owner’s power factor at the Point of Common Coupling falls below 0.9 lagging as a direct result of the installation of the generating unit(s), the Generator Owner must obtain, install and maintain, at his expense, corrective apparatus that compensates for the drop in power factor caused by the installation of the generator.

6) Current – In some cases, directional over-current protection may be required to limit fault current flowing onto the Grid in the event of a line fault. DC inverters that are incapable of producing fault current do not require directional over-current protection.

Inverter systems should not inject DC current greater than 0.5% of rated inverter output in the AC interface point under either normal or abnormal conditions.

7) Fault and Line Clearing – The Generator Owner shall automatically disconnect from the Company’s system during electrical faults on the Company’s electrical system and upon loss of the Company’s electric source. The Generator Owner may reconnect when the system voltage and frequency return to normal range and is Stabilized as defined in Section III, Definitions. Detection of the loss of the Company’s primary electric system, where the Generator Owner is operating in an island with other customer load, becomes increasingly difficult as the level of dispersed generation on a feeder approaches the connected load. For generating units 30kW and below, the over/under voltage and over/under frequency settings described previously, along with the anti-islandizing provisions of IEEE 929 / UL 1741 inverters, should be sufficient to satisfy this provision. For units greater than 30kW the

voltage and frequency set-points are to be adjustable, with the actual setting determined by the Company based on the electrical characteristics of the generator and the Company's electrical system. In addition, additional protection such as power directional or directional over current functions may be required. For units 500kW or larger, a direct tripping scheme to trip the generator upon loss of the Company's feeder may be required by the Company. This decision will be based on the saturation of distributed generation on a particular feeder circuit and in those cases where under voltage or under frequency sensing may not adequately detect loss of the Company source.

8) Automatic Reclosing – The Generator Owner is responsible for protecting his equipment from the effects of switching or automatic reclosing of the Company's feeder circuit. The Generator Owner may request the Company to delay high speed reclosing on the Company's feeder to allow the interconnected generator sufficient time to remove itself from an islandized or de-energized feeder prior to automatic reclose. Since delaying the automatic reclose time degrades the level of service provided to other customers on the circuit, the Company will limit the automatic reclose time delays to a few seconds or less. The Generator Owner may also request that a direct transfer trip scheme be added to remove the interconnected Generator from service prior to automatic reclosing by using communications equipment between the generator site and the Company. Similarly the Generation Owner may request that a synchronizing check, or reclose blocking scheme be installed on the Company's feeder to prevent out of phase reclosing. The Generation Owner is responsible for all costs associated with the installation and maintenance of these requested modifications.

C) Control, Protection and Safety Equipment Requirements Specific to Generators of 25 kW or less.

All Generator Owner generators 10 kW or less can be single phase. Customer owned generators greater than 10 kW must be evaluated by the Company to determine if it can be single phase. The following table describes necessary control, protection and safety equipment specific to generators of 25 kW or less connected to Secondary or Primary Voltage Systems:

**Control, Protection and Safety Equipment for Generators 25 kW¹
or Less Connected to
Secondary or Primary System**

Generator Size 25 kW or less

<u>Generator Disconnect Device²</u>	X
<u>Over-Current Trip</u>	X
<u>Over-Voltage Trip</u>	X
<u>Under-Voltage Trip</u>	X
<u>Over/Under Frequency Trip</u>	X
<u>Synchronizing Check³</u>	Manual or Automatic

Notes:

1. Exporting to the Company system may require additional operational/protection devices.
2. Generator Owner may elect to have the meter act as the disconnect device. (See XIV.A.10)
3. For synchronous and other type of generators with stand-alone capability

D) Control, Protection and Safety Equipment Requirements Specific to Three Phase Synchronous Generators, Induction Generators, and Inverter Systems.

Generators greater than 25 kW must be three phase machines connected to three phase circuits.

- 1) **Three Phase Synchronous Generators.** Generator circuit breakers shall be three-phase devices with electronic or electromechanical control. The Generator Owner is solely responsible for properly synchronizing his generator with the Company's system. For a synchronous generator, the excitation system response ratio shall not be less than 0.5 (five-tenths). The generator's excitation system(s) shall conform, as near as reasonably achievable, to the field voltage vs. time criteria specified in American National Standards Institute Standard C50.13-1989 in order to permit adequate field forcing during transient conditions.

- 2) **Three Phase Induction Generators and Inverter Systems.** Induction generation may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured on the Company's side at the Point of Common Coupling is within the visible flicker limits stated in Section XIV.B.2. Otherwise, the Generator Owner may be required to install hardware or other techniques to bring voltage fluctuations to acceptable levels. Line-commutated inverters do not require synchronizing equipment. Self-commutated inverters whether of the utility-interactive type or stand-alone type shall be used in parallel with the Company system only with synchronizing equipment.

Control, Protection and Safety Equipment¹

Less than 1 MW Three Phase Connected to Primary System

<u>Generator Disconnect Device</u>²	X
<u>Over-Voltage Trip</u>	X
<u>Under-Voltage Trip</u>	X
<u>Over-Current Trip</u>	X
<u>Over/Under Frequency Trip</u>	X
<u>Ground Over-Voltage Trip</u>³	X
Or	X
<u>Ground Over-Current Trip</u>³	X
<u>Synchronizing Check</u>⁴	Automatic
<u>Power Direction</u>⁵	X
<u>Transfer Trip/Reclose Blocking</u>⁶	X

Notes:

1. Exporting to the Company's system may require additional operating/protection devices and will require coordination of operations with the Company.
2. For installations of 25 kW or less, the Generator Owner may elect to have the meter act as the disconnect device. (See XIV.A.10)
3. Selection depends on grounding system, if required, by the Company.
4. For synchronous and other types of generators with stand-alone capability.
5. Required only if generator size is greater than Generator Owner's minimum load and thus capable of exporting. The relay will operate if the power flow from the generator into the Grid exceeds a predetermined level. A time delay will have to be incorporated into this relay to prevent it from operating during synchronous swings.
6. May be required as part of any necessary transfer tripping/reclose blocking protection scheme.

**E) Requirements Specific to Generators paralleling for 0.1 second or less
(Closed Transition Switching)**

The table below shows the protective functions required by this requirement for generators less than 1 MW which parallel with the Company's system for 0.1 second or less such as during source or load transfers.

Control, Protection and Safety Equipment
Generators Connected to Secondary or Primary System Voltage

**For 0.1 Second or less
(Closed Transition Switching)**

<u>Generator Size</u>	
Up to 1 MW	
<u>Over-Voltage Trip</u>	X
<u>Under-Voltage Trip</u>	X
<u>Synchronizing Check</u>¹	Manual or Automatic
<u>Excessive Closed Time Trip</u>²	X

Notes:

1. For synchronous and other types of generators with stand-alone capability.
2. Scheme will trip generator if closed transition parallel mode remains in effect longer than 0.1 second.

F) Inverter Type – DC Generation installations using inverters for interconnection with the Company must use non-islanding type inverters as defined in IEEE 929, *IEEE Recommended Practices for Utility Interface of Photovoltaic (PV) Systems* (including Annex B, D, E & G) and UL Subject 1741, Nov. 2005, *Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*.

G) Inspection and Start-Up Testing - The Generator Owner shall provide the Company with reasonable prior notice at least 2 weeks before the initial energizing and start-up testing of the Generator Owner's generating equipment and the Company, at its discretion, shall witness the testing of any equipment and protective systems associated with the interconnection. The Generator Owner shall revise and re-submit the application information for any proposed modification that may affect the safe and reliable operation of the Company's system. The generator may be reconnected to the Company system only after the modified application has been reviewed, testing has been confirmed and the Company has given approval to reconnect.

H) Site Testing and Commissioning - Testing of protection systems shall include procedures to functionally test all protective elements of the installation up to and including tripping of the generator and interconnection point. Testing and testing intervals should be in accordance with manufacturers' and industry recommendations. Testing will verify all protective set points and relay/breaker trip timing. The Company may witness the testing of installed switchgear, protection systems, and generator. The Generator Owner is responsible for all maintenance of the generator, control and protective equipment. The Generator Owner will maintain records of such maintenance activities which the Company may review at reasonable times. For generation systems greater than 500 kW, a log of generator operations may be required in order to determine its output and run times for system planning purposes.

I) Metering - Metering requirements will be reviewed on each specific installation.

J) Dedicated Transformer A dedicated transformer will be required where the generating Generator Owner is served from the same transformer secondary as another Company customer and inverter-based technology not meeting IEEE 929-1999 and IEEE 519-1992 specifications is used. In addition, a dedicated transformer or other current-limiting device is needed for any type of generator installation where the increase in available short circuit current could adversely impact other Company customers on the same secondary circuit.

K) Suggested References

The following references can supply technical support and insight into the safe, reliable interconnection of distributed generation with the Company's systems. These references should be reviewed by those individuals or firms contemplating parallel operation of generation with the Company.

IEEE C37.95-1989	<i>IEEE Guide for Protective Relaying of Utility-Consumer Interconnections</i>
IEEE Std 1001 (1988)	<i>IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems</i>
IEEE Std 929 – 2000	<i>IEEE Recommended Practices for Utility Interface of Photovoltaic (PV) Systems</i>
IEEE Std 1021 (1988)	<i>IEEE Recommended Practices for Utility Interconnection of Small Wind Energy Conversion Systems</i>
IEEE Std 519-1992	<i>IEEE Recommended Practices and Requirements for Harmonic Control In Electrical Power Systems</i>
IEEE Std. 1547-2003	<i>IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.</i>
IEEE Std. 1547.1 – 2005	<i>IEEE Standards Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.</i>
UL 1741-2005	<i>Underwriters Laboratories, Inc. Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources.</i>

Pepco Holdings, Inc (PHI) Power Delivery

Technical Considerations Covering Parallel Operations of Customer Owned Generation Of One (1) Megawatt or Greater And Interconnected with the PHI Power Delivery System*

*** The PHI Power Delivery System is Atlantic City Electric, or Delmarva Power & Light or Potomac Electric Power Company depending on the utility service territory in which the Customer Owned Generation is interconnected.**

January 25, 2011

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I. Disclaimer

This document and all the material contained herein is designed for informational and illustrative purposes and to insure at least minimum interconnection requirements are satisfied. It is produced as an aid to those Customers contemplating the purchase of generation equipment and interconnecting this generation equipment with the PHI Power Delivery System. The information is intended to guide the customer in making a decision on whether to proceed with a more detailed engineering study.

All the information in this document is intended to be typical and of a general nature for information purposes. It is not intended to be site or facility specific. Requirements and practices are also subject to change and it must be recognized that any given item may become obsolete or be modified in the future.

PHI Power Delivery companies which comprises Atlantic City Electric Company (ACE), Delmarva Power & Light Company (DPL) and Potomac Electric Power Company (PEPCO) make no warranty of any nature whatsoever concerning the information contained in this document.

II. Prerequisites

To interconnect with the PHI Power Delivery System, the Customer must first be in compliance with the tariff rules and regulations and the applicable tariff classifications and rates. The terms and conditions contained within this document are in addition to, but do not modify nor negate, the terms of the tariff.

The Generator Owner must also negotiate an Interconnection Agreement Contract with the particular PHI subsidiary Company covering the interconnection and the use of PHI's facilities to enable the transfer of power from or to the Facility. The details of the Interconnection Agreement Contract are outside the scope of this document. However, this Technical Considerations Document may be included in and become part of the overall Interconnection Agreement Contract.

In addition to submitting an Interconnection Application to the Company, a Generator Owner may also be required to submit an Interconnection Request to PJM. PJM will initiate a process to study the feasibility of the generation, its impact within the PJM Grid and the cost to make any necessary Grid improvements. These Grid improvements may be outside the service territory of the local utility. The extent of the studies is dependent on the size of the generation and the proposed Point of Common Coupling. Again, the details of this process are outside the scope of this document.

A Generator Owner must also complete an Interconnection Service Agreement with PJM if system upgrades are deemed necessary.

III. Applicability

Unless otherwise provided, these technical considerations apply to all Customer owned generation operating at 1 MW or greater interconnected with and operating in parallel with the PHI Power Delivery System at voltages up to and including 500kV. Where multiple generators are connected to the Grid through a single Point of Common Coupling, the sum of the generator ratings will be used to determine the applicability of these Technical Considerations.

These technical considerations also apply to NEM (Net Energy Metering) generator interconnections where State jurisdictions permit NEM generation of 1 MW or greater.

IV. Definitions

Various terms as utilized in this document are defined below. Whenever used in the document with initial capitalization, the following terms have the meanings specified in this Section.

- A. **Account** – An account is one metered or un-metered rate or service classification which normally has one electric delivery point of service. Each account shall have only one electric service supplier providing full electric supply requirements for that account. A premise may have more than one account.
- B. **Company** - PHI doing business as Atlantic City Electric, Delmarva Power & Light and Potomac Electric Power Company.
- C. **Customer** - Any adult person, partnership, association, corporation, or other entity: (i) in whose name a service account is listed, (ii) who occupies or is the ratepayer for a premises, building, structure, etc., and (iii) who is primarily responsible for payment of bills. A Customer includes anyone taking Delivery Service or combined Electric Supply & Delivery Service from the Company under one service classification for one account, premises or site. Multiple premises or sites under the same name are considered multiple Customers.
- D. **Control Center** – The Company office that monitors and has direct control over the operation of the PHI Power Delivery System.
- E. **Facility (or Facilities)** – The Customer owned generating equipment and all associated or ancillary equipment, including Interconnection Equipment, on the Customer's side of the Point of Common Coupling (Point of Interconnection).
- F. **Generator Owner** – The owner of the generation Facility that is interconnected to the Company.
- G. **Grid** – The interconnected arrangement of lines, transformers and generators that make up the Company's electric power system.
- H. **Interconnection** – The physical connection of Customer owned generation to the PHI Power Delivery System in accordance with these technical considerations so that parallel operation can safely occur.
- I. **Interconnection Application** – The standard form of application which must be submitted by the Generation Owner to the Company as a request to interconnect a generating unit to the PHI Power Delivery System or to increase the capacity of a generating unit already connected to the PHI Power Delivery System.
- J. **Interconnection Equipment** - That equipment necessary to safely interconnect the Facility to the PHI Power Delivery System, including any and all relaying, interrupting devices, metering or communication equipment needed to protect the Facility and the PHI Power Delivery System and to control and safely operate the Facility in parallel with the PHI Power Delivery System.
- K. **Interface (Isolation) Transformer** - A transformer which interconnects a privately owned generation source voltage with the PHI Power Delivery System voltage.
- L. **Inverter** – A static power converter with control, protection and filtering functions that converts Direct Current (DC) input to Alternating Current (AC) output. Inverters connected to the PHI Power Delivery System must be of the non-islanding type.
- M. **Island** – A portion of the PHI Power Delivery System containing both load and generation that is electrically isolated from the remainder of the PHI Power Delivery System.

- N. **NEM – Net Energy Metering** - Generation installed to offset a Customer’s energy usage and may occasionally export power to the Grid. Maximum generation size and acceptable fuel source are dictated by the various State jurisdictions.
- O. **NERC - North American Electric Reliability Council**. The purpose of NERC is to ensure the adequacy, reliability and security of the bulk electric supply systems through coordinated operations and planning of generation and transmission facilities.
- P. **One Way Power Flow** - An interconnected Facility is classified as a “One Way Power Flow” installation if the Facility is configured such that its load is always greater than the generation capacity or the Facility does NOT propose to export excess generated power through the PHI Power Delivery transmission and distribution system. This type of installation will receive power through the PHI interconnection but will never export power back into the PHI Power Delivery transmission and distribution system.
- P. **Parallel Operation** – Any electrical connection between the PHI Power Delivery System and the Generator Owner’s generation source.
- Q. **PHI Power Delivery System** – The electric system of the appropriate affiliate of PHI, i.e. either Atlantic City Electric, Delmarva Power & Light or Potomac Electric Power Company in whose geographic service area the Customer’s Facility is electrically connected. This should include all that affiliate’s electric facilities and systems located on that affiliate’s side of the Point of Common Coupling including that affiliate’s transmission and distribution systems.
- R. **PJM - PJM Interconnection, L.L.C.** PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 States and the District of Columbia. Members include electric utilities and independently owned generating resources. The organization is responsible for dispatching generation, operating the bulk transmission system within its service area and operating a buy/sell market for member’s generation.
- S. **Point of Common Coupling (or PCC)** – The point where the electrical conductors of the PHI Power Delivery System are connected to the Generator Owner’s conductors and where any transfer of electric power between the Generator Owner and the Company takes place.
- T. **Pre-Interconnection Study** – A technical study or studies which may be undertaken by either the Company and/or PJM in response to its receipt of a completed Interconnection Application for Parallel Operation with the PHI Power Delivery System submitted on the Interconnection Application form prescribed by these technical considerations or by PJM. Pre-Interconnection Studies may include, but are not limited to, service studies, coordination studies and facilities impact studies.
- U. **RFC – Reliability First Corporation** One of eight Regional Reliability Councils which together form the North American Electric Reliability Council (NERC). RFC is responsible for thirteen States and the District of Columbia including all the PHI service territories in Delaware, Maryland, New Jersey, Virginia and Washington, DC.
- V. **RTU (Remote Terminal Unit)** - The remote unit of a supervisory control system used to telemeter operating data, provide device status/alarms and to provide remote control of equipment at a substation or generator site. The unit communicates with a master unit at the PHI Control Center.
- W. **Stabilized** – The state of the Company’s system when the voltage and frequency have returned to their normal range for at least 5 minutes or longer following a disturbance after which tripped Customer owned generation may reconnect to the PHI Power Delivery System. The Company

may require a longer time period upon a reasonable showing that reconnection after only 5 minutes will adversely impact the safety and reliability of the PHI Power Delivery System.

- X. **Stiffness Ratio** - A measure of how strong a generator's fault current contribution is in comparison to the total fault current available at the Point of Common Coupling.

$$\text{Stiffness Ratio} = \text{Total Fault Current Available at PCC} / \text{Generator Fault Contribution}$$

- Y. **System Emergency** – An imminent or occurring condition on the PHI Power Delivery System, the PJM System, the system of a neighboring utility, or in the Facility that is likely to impair system reliability, quality of service, or result in significant disruption of service, or damage, to any of the foregoing, or is likely to endanger life, property or the environment.
- Z. **Two Way Power Flow** - An interconnected Facility is classified as a "Two Way Power Flow" installation if the Facility is configured such that the PHI Power Delivery transmission and distribution system can deliver power to the Generator Owner and the Generator Owner can also export power into the PHI Power Delivery transmission or distribution system. In this type of facility, the Generator Owner's load is either variable or smaller than the generating capacity and the Generator Owner proposes to export any excess power.

V. Introduction and Purpose

Prior to the de-regulation of the electric power industry, the complete electric Grid including generation was owned and operated by the electric utility. The electric utility had full knowledge and complete control of all generation equipment connected to the Grid. Therefore, any new utility generation was designed by the utility to fully integrate into the overall electric system.

The restructuring of the electric power industry, the development of an open market for electric power generation and the advent of technical advances in generator technologies have resulted in privately owned generators being connected to the utility electric Grid. The intent of this document is to outline the basic requirements to those Customers who are contemplating the installation of privately owned generation connected to, and operated in parallel with, the PHI Power Delivery System. The information contained in this document is to provide the proposed Generation Owner with a summary of Company and Generator Owner obligations, technical and safety requirements and the need for adequate protective equipment to be designed and installed by the Generator Owner in order to operate one or more generator units in Parallel Operation with the PHI Power Delivery System, without adversely impacting the reliability or power quality of electric service to other Customers or the safety of the general public and Company employees. The information contained in this document should be useful in understanding the need for a proper design and the details needed to complete a comprehensive interconnection feasibility study.

No one document can provide all the details needed to cover every conceivable generator installation. Consequently, this document is provided only as a starting point and a source of preliminary information. Any Customer considering the installation of interconnected generation will have to consult all available resources, design standards and professionals necessary to develop a feasible design and installation.

VI. Generator Owner Obligations

In the course of owning, interconnecting and operating a generator in parallel with the PHI Power Delivery System, the Generator Owner is responsible for the following obligations:

- A. The Generator Owner must design and construct their Facility to meet all applicable national, state and local construction and safety codes.
- B. The Generator Owner must design their Facility with protective hardware and software to prevent the generator from energizing any Company de-energized circuit.
- C. The Generator Owner must design their Facility with protective hardware and software to automatically disconnect from the Company Grid if the source from the PHI Power Delivery System is lost, irrespective of connected loads or other generators on the circuit. Operating an intentional island of Customer owned generation with other Customers will be permitted only if specific contractual arrangements have been made and necessary equipment has been installed and confirmed by the Generator Owner that the equipment will satisfactorily control and stabilize voltage and frequency within the island.
- D. The Generator Owner must equip his Facility with the necessary protective hardware and software designed to prevent sustained Parallel Operation of the generator with the PHI Power Delivery System unless the system service voltage and frequency are within acceptable magnitudes as defined in Sections IX - B and C.
- E. The Generator Owner is responsible for protecting his own Facility in such a manner that Company Grid outages, short circuits, single phasing conditions or other disturbances including zero sequence currents and ferroresonant over voltages do not damage the Generator Owner's equipment.
- F. The Generator Owner is responsible for protecting his generator and equipment from the effects of switching or automatic reclosing on the PHI Power Delivery System circuit(s) supplying the Generator Owner's Facility.
- G. The Generator Owner shall insure that his designs utilize equipment properly sized to meet the operating voltage, current rating, fault duty, etc. necessary for the site.
- H. The Generator Owner is responsible for protecting its own generator and all interconnection / ancillary equipment. The Generator Owner must supply the required protection schemes along with the necessary metering and monitor/control requirements specified either by PHI Power Delivery or by PJM.
- I. The design, procurement, installation and maintenance of all equipment at the Generator Owner's Facility are the responsibility of the Generator Owner. The Generator Owner is responsible for all costs.
- J. The Generator Owner will supply the Company with the necessary technical information, one-lines, equipment data, specifications, etc. so that so that the Company can conduct a complete review of the proposed Facility and conduct any necessary studies. (See Appendix B)
- K. The Generator Owner will cover the expense of any Company service study, coordination study or facility impact study necessary to assess the impact of the interconnected generation. The scope of such Pre-Interconnection Studies will be based on the generator characteristics and the location of the proposed Point of Common Coupling. (The expense shall be directly reimbursed to the Company or through PJM.)

- L. Any necessary enhancements or improvements needed within the PHI Power Delivery System, neighboring utility system and/or at other Customer sites to accommodate the Parallel Operation of the Generator Owner's generator will be at the Generation Owner's cost, unless otherwise allocated in accordance with PJM Transmission Tariff, the PJM Operating Agreement or State regulation.
- M. The Generator Owner has full responsibility and liability for the safe and proper operation and control of their equipment and for the power originating from their generator.
- N. The Generator Owner is responsible for synchronizing their generator to the PHI Power Delivery System and maintaining a synchronous condition.
- O. The Generator Owner shall maintain their Facility in good working order, consistent with industry standards, manufacturer recommendations, and in compliance with all applicable rules, codes and regulations. The Generation Owner shall have a maintenance and testing program that ensures all protective schemes and equipment are periodically calibrated and functionally tested. *PJM Relay Testing and Maintenance Practices* shall be followed for all facilities participating in the PJM marketplace, or interconnected at 138kV and above. The Company may periodically request supporting documentation that confirms the Generator Owner's maintenance and testing program.
- P. The Generator Owner must immediately cease parallel operation upon notification by the Company that their operation is unsafe, interferes with the quality of supply to other Customers or interferes with the Company's system maintenance or operation.
- Q. The Generator Owner will connect and disconnect their generator to/from the PHI Power Delivery System only under the direction and approval of the Company's Control Center. (NEM generators and other generators 2 MW or less are generally exempt from this requirement.)
- R. The Generator Owner will obtain and cover the cost of any required communication circuits to their site for protective relaying, generator monitoring/control, metering and equipment remote access.
- S. The generator must not be connected in parallel with the PHI Power Delivery System until the Company has granted approval to interconnect and the Generator Owner has received such notification.
- T. The Generator Owner will apply a Warning Label provided by the Company in a conspicuous place on or near their meter, meter box, breaker or Point of Common Coupling to notify Company personnel that there is a generator source at the site.
- U. The Generator Owner must notify the Company in writing if it intends to add or modify any equipment at its Facility that impacts the protection associated with the Point of Common Coupling. The Generator Owner must also give the Company reasonable advance notice if it intends to permanently shut down their generation.
- V. The Generator Owner shall maintain an operating log at their Facility which details all changes in operating status, trip occurrences, maintenance outages or other unusual conditions found upon inspection. The Company may require other information to be logged. The Generator Owner and the Company will generally negotiate the specific information that must be logged at each site. The operating log shall be available to the Company upon request and shall be maintained by the Generator Owner at their Facility.
- W. The Generator Owner must accept the fact that all Customers including Generator Owners may be switched temporarily or permanently from one PHI Power Delivery System circuit to another in response to such causes as load growth, equipment failure, maintenance outages, etc. The

Generator Owner is responsible for any redesign or setting adjustments in their Facility that are necessary to accommodate a permanent transfer to another Company circuit.

- X. The Generator Owner will most likely not be allowed to operate when temporarily transferred to another Company circuit or for other abnormal circuit conditions. This is particularly true if the protection of the normal source circuit has been modified to specifically accommodate the generator interconnection. When requested by the Company, the Generator Owner must cease parallel operation of their generation and reconnect their generation only when permission has been received from the Company.

VII. PHI Power Delivery Obligations

In negotiation, in reviewing an Interconnection Application and in ongoing operation with a Generator Owner, the Company is responsible for the following obligations:

- A. The Company will provide the Generator Owner with the PHI Power Delivery System available fault current, system impedance and protection system details at the proposed Point of Common Coupling. This data will be updated, as required, when significant system changes occur.
- B. The Company will review the proposed Facility design and make all the necessary Pre-Interconnection Studies to evaluate the impact of the generator on the PHI Power Delivery System and to identify any enhancements necessary. The Company should complete this review in a timely manner and within the timeframe that may be required by State regulation.
- C. The Company will review and provide feedback to the Generator Owner on the proposed design and protection schemes associated with the Point of Common Coupling. The Company may also review and provide comment on the generator protection and protective relay settings. However, any review by the Company does not relieve the Generation Owner of full responsibility for the protection of their generator and equipment.
- D. The Company will provide the Generation Owner with the technical details and requirements necessary to satisfy the generator metering and RTU monitoring/control needs for each specific generator installation site.
- E. The Company will provide written approval or enter into an appropriate agreement for the interconnection of the Generator Owner's Facility as soon as all requirements are satisfied. Such approval does not, however, supersede the Generator Owner's obligations or imply that the Facility meets all federal, state and local standards. If not approved, the Company will provide details on the reason or reasons for denying the parallel interconnection.
- F. The Company, in the course of reviewing applications for interconnected parallel generators and making any necessary Pre-Interconnection Studies, has the need for detailed information on the proposed Generator Owner's Facility. The Company or any of its affiliates shall not use such knowledge and information submitted by the proposed Generator Owner to offer competing services or special rate considerations. In addition, the Company will not divulge this information to a third party without the Generator Owner's consent.
- G. The Company may disconnect and isolate the Generator Owner's Facility from the PHI Power Delivery System for routine maintenance and repairs on the Company's Grid consistent with applicable tariffs and agreements. The Company will make reasonable efforts to provide advance notice to the Generator Owner of service interruptions resulting from routine maintenance. The Company will reconnect the Generator Owner's Facility as quickly as possible following any such service interruption.
- H. The Company reserves the right to disconnect and isolate the Generator Owner's Facility from the PHI Power Delivery System for System Emergencies or unsafe conditions without notice. The Company will use reasonable efforts to notify the Generator Owner prior to disconnecting.
- I. The Company will advise the Generator Owner with as much lead time as possible when the Generator Owner's Facility must be transferred from one PHI Power Delivery System circuit to another circuit. The Company will also advise the Generator Owner of data on the new PHI Power Delivery System circuit needed by the Generator Owner to re-design or reset equipment at their Facility.

VIII. Technical Design Considerations

A. General

- 1) This Technical Considerations Document describes the minimum design requirements and operating procedures necessary for the safe and effective interconnection of parallel Customer owned generation. The Generator Owner's design must meet or exceed the requirements outlined in these Technical Considerations and also meet any applicable Tariff requirements. Some aspects of the Generator Owner's design and operation must meet PJM, RFC and NERC requirements. It is the Generator Owner's responsibility to know and understand all applicable requirements.
- 2) The Generator Owner's Facility must meet all applicable national, state and local municipal construction, safety and electrical codes. Company approval to interconnect indicates only that the minimum requirements for parallel operation outlined in this document have been satisfied. Such approval does not imply that the Generator Owner's Facility meets all federal, state and local standards and regulations.
- 3) All equipment, circuit breakers and other current interrupting devices at the Generator Owner's Facility must be capable of interrupting the maximum available fault current at the site including any contribution from the Facility's generator.
- 4) The Generator Owner must furnish and install a manual disconnect device which, when opened, will have the affect of isolating the generator from the PHI Power Delivery System. This disconnect device shall have a visual break such as a disconnect switch, a draw-out breaker, fuse block, etc. as appropriate to the voltage level. The disconnect device will, at all times, be accessible to Company personnel and be capable of being locked in the open position via a Company padlock. (The Company will use reasonable efforts to utilize padlocks of a size consistent with typical manufacturer's specifications.)

Note: Some State regulations may exempt the requirement for a manual disconnect device on NEM generators. However, a disconnect device is still highly recommended.

B. Background Information and Need for Protection

- 1) The PHI Power Delivery System is subject to a variety of natural and man-made hazards. Among these are lightning, wind, snow, animals, vehicular-pole accidents, vandalism and human error. These same hazards are present in residential and commercial electric systems but to a lesser degree due to the smaller size and protected environment of these systems.
- 2) The electric problems that can result from the preceding hazards are principally short circuits, grounded conductors and broken or open conductors. All of these problems require that the affected equipment be de-energized as quickly as possible to minimize equipment damage, to protect Grid security, to lessen the adverse impact on Customers and to remove any hazard to the public and Company personnel.
- 3) Before de-regulation, the Company owned and controlled all generation connected to the Grid. The Company had the full responsibility to install protective equipment to detect electrical problems and isolate the affected equipment. The interconnection of Customer owned generators in parallel with the Grid now expands this protection responsibility to include the Generator Owner. The Generator Owner has the responsibility to protect both his own Facility and the Grid from the impact of his Facility.

C. Basic Protection Goals

The protection system at the Point of Common Coupling should be designed and operated with the following desired goals in mind:

- 1) Protect the PHI Power Delivery System from the adverse impacts of the parallel generator and from faults within the Customer's Facility.
- 2) Protect the parallel generator from faults or other disturbances in the PHI Power Delivery System.
- 3) Disconnect the parallel generator from the PHI Power Delivery System for abnormal operating conditions.
- 4) Permit the desired range of power transfer without false operation.

D. Protection General Requirements

- 1) The generator and Point of Common Coupling protection schemes shall be continuously monitored and in a functional state. The generator shall immediately be disconnected from the Company Grid for any condition that would make the protection scheme inoperable.
- 2) The operating power for the generator and Point of Common Coupling protection schemes and the control power used to disconnect the generator from the Company Grid must not be dependent on Company Grid power.
- 3) The generator protection shall be designed to automatically and immediately disconnect the generator from the PHI Power Delivery System if the source circuit from the Company is lost, irrespective of connected loads or other generators on the circuit.
- 4) The generator shall be equipped with protective equipment (hardware or software) to prevent the generator from energizing a de-energized PHI Power Delivery System circuit.
- 5) Parallel operation must cease immediately and automatically for abnormal operating voltage, frequency, harmonic content or power flow. Parallel operation must also cease for loss of a phase or improper phase sequence. Voltage sensing shall be performed on all three phases.
- 6) Protection at the Point of Common Coupling must detect and isolate the Facility from the PHI Power Delivery System for a fault condition in the Generation Owner's Facility.
- 7) Protection at the Point of Common Coupling must detect and isolate from the Company Grid the Generation Owner's Facility for a fault condition on the PHI Power Delivery System circuit that supplies the Customer generator site.
- 8) The protection scheme should permit the desired range of power transfer without false operation. The protection scheme should also prevent excessive or unnecessary tripping that would adversely affect the Company's service reliability to other Customers or Generator Owners.
- 9) The generator protection or protection at the Point of Common Coupling must insure that the generator is disconnected from the Company Grid before any automatic re-energizing of the PHI Power Delivery System supply circuit.

- 10) The protection at the Point of Common Coupling must recognize and disconnect the Generator from the Company Grid if the generator is Islandized with other Customer load. Exceptions are those generators with specific contractual obligations to supply other Customer load and who have installed the necessary equipment to control and stabilize voltage and frequency within the Island.
- 11) Any automatic re-connection of the generator to the Grid following a loss and subsequent restoration of the PHI Power Delivery System source must occur only after the Company Grid has Stabilized.

Note: This preceding list of design requirements is not intended to be all-inclusive. Other hazards and conditions may need to be taken into consideration by the design engineer based upon the circumstances, the specific site, the Generation Owner's needs and other appropriate criteria.

E. Grid Interconnection Point Information

A Generator Owner will normally want to interconnect their generator to a PHI Power Delivery System circuit or power substation that is near their site. Some details on the Company Grid are noted below to assist the Generator Owner in the design of their Facility.

- 1) The PHI Power Delivery System distribution facilities consist of voltages shown in the following table:

Table 1, PHI Distribution Facility Voltages (Phase-Phase)

Voltages	ACE Region
34,500	3-Wire; Single Source End or Networked
23,000	3-Wire; Single Source End or Networked
12,470	4-Wire; Single Source End, Grounded Wye
4,160	4-Wire; Single Source End, Grounded Wye
	DPL Bay Region
24,940	4-Wire; Single Source End, Grounded Wye
12,470	4-Wire; Single Source End, Grounded Wye
4,160	4-Wire; Single Source End, Grounded Wye
	DPL Newcastle Region-Christiana District
34,500	4-Wire; Single Source End, Grounded Wye
24,940	4-Wire; Single Source End, Grounded Wye
11,870	4-Wire; Single Source End, Grounded Wye
4,160	4-Wire; Single Source End, Grounded Wye
	DPL Newcastle Region-Northeast District
33,260	4-Wire; Single Source End, Grounded Wye
4,160	4-Wire; Single Source End, Grounded Wye
	PEPCO
13,200	4-Wire; Single Source End, Grounded Wye
13,200	3-Wire; Networked
4,160	4-Wire; Single Source End, Grounded Wye

- 2) The PHI Power Delivery System transmission facilities consist of 69kV, 115kV, 138kV, 230kV and 500kV circuits. The vast majorities of PHI Power Delivery System transmission circuits are networked and all are grounded wye at the source end(s).

- 3) Not all delivery voltages are available at any particular location. The Company must be contacted regarding the availability of specific delivery voltages for interconnection at a particular site.
- 4) The PHI Power Delivery System can only accept 60 Hz. alternating current from parallel generators. All AC generators within the size range covered by this document must be 3-phase.
- 5) The Company may limit the size of the generator that can be interconnected at any particular location due to the existing infrastructure and loading of the Grid surrounding the proposed generator site. The presence of existing interconnected generators on the circuit may also limit the size of any new proposed generator interconnection. Any Company Grid upgrades or new construction necessary to interconnect a generator larger than the existing Grid will support will be done at the Generator Owner's expense, unless otherwise allocated in accordance with PJM Tariff, PJM Operating Agreement or State regulation.
- 6) The following table provides typical maximum generator size in MW that can be interconnected at the various PHI Power Delivery System voltage levels from both a practical and economic prospective. Existing installed generation may further limit the size of additional generation that can be added.

Table 2, Typical Maximum Size Generation in MW

Voltage Level	4kV	12/13.2kV	23/25kV	34.5kV	69kV	115/138kV	230kV
Maximum Typical Generator Size Allowed on Non-Express Circuits	0.5	3.0	6.0	10.0	50.0	250.0	500.0
Maximum Typical Generator Size Allowed on Express Circuits	-	10.0	15.0	20.0	50.0	250.0	500.0

Note: Express Circuits are new dedicated facilities specifically constructed to interconnect the Generator Owner facilities with the PHI system. The need for an Express Circuit will be based on the results of the Pre-Interconnection Study.

- 7) Most distribution and transmission lines have automatic line restoration following a line trip. The majority of faults (short circuits) are temporary in nature such as a flashed insulator or a tree limb that brushed against a line. Once the fault has been detected and the affected circuit de-energized, the circuit can normally be successfully re-energized. This re-energizing or automatic reclose could occur after the line has been dead for 0.20 second, up to a minute or more. The net result of automatic line restoration is to restore the integrity of the Grid and to minimize any Customer outage time. The Generator Owner will have to take into account the impact of automatic circuit restoration in the design and operation of their Facility.

The Generator Owner may request the Company to delay any high speed reclosing on the PHI Power Delivery System supply circuit to allow the Parallel Operation generator sufficient time to remove itself from an islanded or de-energized circuit prior to automatic reclose. Since delaying the automatic reclose time degrades the level of service to other Customers on the circuit, the Company may limit any delay of the automatic reclose to a few seconds or less. A direct transfer trip scheme is often needed to disconnect the interconnected generator prior to automatic reclosing. The transfer trip scheme will utilize a communication channel between the Company facility and the Generator Owner's site. A synchronizing check or reclose-blocking scheme may need to be installed on the Company's

source circuit to prevent out of phase reclosing. The Generator Owner is responsible for all costs associated with the installation and maintenance of these improvements that may be necessary for the generator interconnection.

- 8) Generators connected to a distribution circuit and are capable of exporting 2 MW or more will require an Automatic Line Recloser (ALR) or Circuit Breaker with appropriate protective relaying be installed at the Point of Common Coupling. Generators less than 2 MW may also require that an ALR be installed if Pre-Interconnection Studies have identified a need for steady state or dynamic voltage control.

F. Interface (Isolation) Transformer

- 1) In most cases, an Interface (Isolation) Transformer will be required to interconnect the Generator Owner's Facility to the PHI Power Delivery System voltage. This Interface (Isolation) Transformer will decrease possible voltage variations seen by other Company Customers, attenuate any possible harmonics and reduces the effects of fault currents.
- 2) The Company reserves the right to specify the type of Interface (Isolation) Transformer connection (e.g. delta-delta, wye-delta, wye-wye) that should be utilized, consistent, where reasonable, with the needs of the Generator Owner's Facility. The intent here is to best integrate the transformer with the circuit grounding and area ground fault detection schemes.
- 3) In general, for generators in excess of 20 MW, or connected to the Company Grid at 69kV or higher, or have the contractual authority to operate and carry other Customer load in a Island mode, the Interface (Isolation) transformer shall have a grounded wye connection to the Company Grid.
- 4) An Interface (Isolation) Transformer that interfaces to the Company Grid with an ungrounded connection (delta or ungrounded wye) requires a special protection scheme to detect a grounded high side conductor. (See Protection Scheme Details, Section X - C, Table 7)
- 5) The Interface (Isolation) Transformer must be sized to support maximum anticipated power transfers to and from the Company Grid.
- 6) Interface (Isolation) Transformers up to 10 MVA can be fuse protected on the high side. Transformers larger than 10 MVA require a high side circuit breaker or circuit switcher along with appropriate protective relaying. (See Protection Scheme Details, Section X-B.) When fuses are used, the Generator Owner's equipment must detect an open fuse and protect the generator from single phasing caused by a blown fuse.

G. Power Quality Considerations

- 1) The Generator Owner's Facility shall be designed and operated in such a manner that there are no noticeable adverse impacts to system voltage, frequency, harmonics etc.
- 2) The parallel generator shall not cause excessive voltage flicker on the PHI Power Delivery System. (Voltage flicker is defined as variations in system voltage magnitude and with duration sufficient to allow visual observation of a change in electric light source intensity.) Any flicker shall not exceed the "Borderline of Irritation" Curve, Fig. 10.3, as defined in IEEE Std. 519-2004, *Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*. The Company reserves the right to require tighter flicker control in

situations where other Customer's or the Company's equipment or operations (computers, instrumentation, process controls, etc.) are impacted.

- 3) The parallel generator could introduce harmonics distortion into the Company Grid if equipment such as DC to AC inverters are used in the Facility. (Harmonic distortion is defined as continuous distortion of the normal 60 Hz. sine wave typically caused by non-linear loads or by inverters, measured in total harmonic distortion, THD.) Any voltage harmonic distortion shall not exceed the limitation as defined in IEEE Std. 519-2004, *Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*, Table 11.1. The limits vary dependent on the voltage. In addition, the level of harmonic current that the Generator Owner shall inject into the Company Grid should not exceed the level specified in Tables 10.3, 10.4 and 10.5 in IEEE Std. 519-2004.
- 4) Any DC to AC inverter should not inject DC current greater than 0.5% of the rated inverter capacity into the Point of Common Coupling during both normal and abnormal operation.

H. Power Factor Considerations

- 1) A parallel generator shall not adversely impact the power factor of the PHI Power Delivery System at or near the Point of Common Coupling. The type of generator impacts the power factor. The inverters of most DC generators are designed to operate close to unity power factor unless otherwise configured. Induction generators absorb vars from the PHI Power Delivery System. Synchronous generators can either absorb or produce vars thus having a varying power factor depending upon excitation control.
- 2) Synchronous generators shall have and maintain a minimum design capacity to operate at a power factor between 0.85 to 1.0 lagging, i.e. supplying vars to the PHI Power Delivery System.
- 3) Synchronous generators shall generally be operated so as not to absorb vars from the PHI Power Delivery System unless directed by the Control Center. In certain cases, larger synchronous units will be required to have and maintain a minimum design capacity to operate at a power factor between 0.95 and 1.0 leading, i.e. absorbing vars from the PHI Power Delivery System. These operating requirements will be reviewed and discussed on a case-by-case basis.
- 4) The dispatching authority (PJM or PHI) can request that the generator real and reactive power output be adjusted to best meet the needs of the overall Grid.
- 5) Depending on the Point of Common Coupling location, the PHI Power Delivery System can be limited in the amount of reactive power capacity available to the Generator Owner. The Generator Owner must provide for his own reactive power requirements (via generator control, capacitors, etc.) so as to operate at no less a power factor (drawing vars from the PHI Power Delivery System) at the Point of Common Coupling than existed prior to the installation of the Facility. Any reactive power requirements in excess of this limit may require upgrades and/or the installation of capacitor units on the PHI Power Delivery System. The costs for any such upgrades will be charged to the Generator Owner. Specific purchase power arrangements, including power factor requirements, are defined in appropriate tariffs and Interconnection Agreements.
- 6) It is the Generator Owner's responsibility to provide adequate mitigation equipment or controls to insure that any variation in voltage at the Point of Common Coupling does not exceed the limits defined in the tariff and by the local regulatory jurisdiction. When the generator is connected to distribution circuits at 34.5kV or below, the generator voltage

regulation must to be set to properly coordinate with voltage regulating equipment on the PHI Power Delivery circuit.

- 7) For intermittent type generators such as wind and solar (photovoltaic) the generator may be required to operate in a fixed absorbing vars power factor schedule to mitigate voltage impacts caused by power output fluctuations. If the generating facility is capable and obtains permission from PHI, it may operate in a dynamic mode to mitigate voltage impacts by dynamically controlling vars.

I. Inverter Considerations

Photovoltaic, fuel cell and wind DC generation sources will utilize inverters to convert their DC output to AC power acceptable to the Grid.

- 1) The Generator Owner must use a non-islanding type inverter as defined in IEEE 929 2000, *IEEE Recommended Practices for Utility Interface of Photovoltaic (PV) Systems* and UL 1741, 2005, *Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*. (See I.3 below for possible exception.)
- 2) Non-islanding type inverters are inherently designed to automatically disconnect from the Grid if the Generator Owner's site becomes isolated from the PHI Power Delivery System. This type inverter also prevents the Generator owner from inadvertently supplying other Company Customers in an isolated Island situation.
- 3) The inverter output specifications must meet the power quality considerations detailed in Section VIII - G. Inverters used in energy farm type installations may need to include dynamic var compensation or use other mitigating means to maintain voltage regulation at the Power of Common Coupling. Dynamic inverters that do not meet the anti-islanding provisions of IEEE 929 2000 & IEEE 1741 2005 will generally require transfer trip from the upstream protective device(s).

J. Induction Generator Considerations

Wind and other generation sources utilizing induction generators, singularly or in aggregate, could fall within the lower range of parallel generator sizes covered by this Technical Consideration document.

- 1) The reactive supply for induction generators may impose some design and generator size constraints because these generators obtain their excitation from the Grid. Capacitors may have to be added either at the Generator Owner's site or on the PHI Power Delivery System. (See Section VIII - H) The addition of capacitors may also cause undesirable ferroresonance. The cost to install and maintain capacitors on the PHI Power Delivery System specifically for the generator is the Generator Owner's responsibility.
- 2) Any flicker produced in the course of starting an induction generator and bringing it up to synchronous speed (as an induction motor) must not exceed the flicker limit detailed in Section VIII - G 2.
- 3) The installation of capacitors for reactive supply at or near an induction generator site greatly increases the risk that the induction machine may become self-excited if somehow isolated from the Grid. A self-excited induction generator can rapidly produce abnormally high voltages which can damage equipment on the Grid and at other Customer sites. Self-excitation is more likely where the Grid capacity and the circuit load density are both low.

- 4) The Generator Owner with an induction generator must include protection at their facility to detect self-excitation operation and disconnect the generator from the PHI Power Delivery System.
- 5) By their design, induction generators can only supply fault current for a short period of time as the field flux decays rapidly on removal or decay of the source voltage.

K. Synchronous Generator Considerations

- 1) By their design and generally larger size, synchronous generators are capable of supporting sustained fault currents. As such, the protection scheme associated with the Point of Common Coupling must be designed to insure detection of fault conditions in the PHI Power Delivery System.
- 2) Synchronous generators are capable of operating independently irrespective of the Grid source. They can continue to operate after being isolated from the Grid providing the load is within the generator's capacity. Consequently, a more robust protection scheme is generally needed to detect isolation from the Grid. Transfer trip from the Company is generally required.
- 3) Sufficient generator reactive power control capability shall be provided to withstand normal voltage changes on the PHI Power Delivery System.

L. Interval (Revenue) Metering Considerations

The requirements for each parallel generator installation will be reviewed and determined on a case-by-case basis. Listed below are the most common requirements for generator Interval Metering. The Company, however, reserves the right to specify the required interval metering equipment for each paralleled generator site.

- 1) All paralleled generator Facilities shall be metered in accordance with applicable tariffs and specifications provided in approved Company publications.
- 2) An Interval (Revenue) Meter must be located at each Point of Common Coupling. The Interval Meter will record MW-Hour and MVAR-Hour input and output.
- 3) The Generator Owner may net retail site load behind a single meter at the Point of Common Coupling except:
 - a) A separate Interval Meter is required for each generator if the generator or aggregate generation is greater than 2 MW.
 - b) In cases where the generation is served under a generator "Standby Tariff". Under this tariff, each generator must have a separate Interval Meter to record MW-Hour and MVAR-Hour input and output.
- 4) Generator site auxiliary loads that are not measured by the generator Interval Meter will require a separate meter.
- 5) The Generator Owner shall supply a telephone line for the Interval Meter data recorder which allows the Company to dial up and retrieve the Interval Meter data remotely. Specific requirements will be determined on a case-by-case basis.

- 6) Unless otherwise mutually agreed upon by the Company and Generator Owner, the Company shall install and own all Interval Metering equipment at the Point of Common Coupling and on the generator(s). The Generator Owner shall pay the Company the initial costs to procure, install, test and startup the metering and associated related equipment. Thereafter, the metering equipment shall be owned, operated and maintained by the Company. (These provisions are subject to possible modification by PJM, regulatory commissions or applicable tariffs.) The Company and the Generator Owner may agree to have the Generator Owner install the metering PTs (potential transformers) and CTs (current transformers) within the Generator Owner's switchgear equipment.
- 7) All metering shall comply with ASNI and Company technical requirements (including meter model, options & programming). The Point of Common Coupling and generator Interval Meters shall be bi-directional so that power deliveries (including reactive) to and from the Generator Owner's site can be separately recorded. The Point of Common Coupling Interval Meter shall be equipped with detents to prevent reverse registration.
- 8) The Generator Owner may, at its sole option and cost, install or have the Company install additional metering equipment to meet any special needs that the Generator Owner may have.

M. Monitoring, Control and Remote Telecommunication Considerations

Since parallel generators, particularly the larger units, have a direct impact on the overall operation and performance of the Grid, it is important that the Company monitor and, in some cases, have emergency trip control of the generator interface breaker(s). The requirements for each parallel generator installation will be reviewed on a case-by-case basis.

- 1) Telemetered data for each meter required in preceding Section VIII.L shall be telemetered to PHI's designated Control Center via a dedicated data circuit (See M.3 for an exception.)
- 2) The Generator Owner shall purchase and install a Remote Terminal Unit (RTU) of a suitable vendor to enable the Company and, if required, PJM to monitor the status of the data points at the Generator Owner's site and to control certain breakers, if required. This RTU shall utilize DNP 3.0 protocol, or other such protocol compatible with the existing Supervisory Control System at the Company. Required data points are listed in M.6 below. In addition, the Generator shall supply a data link for transmitting the telemetry data between the Generator Owner's RTU and the appropriate PHI Control Center.
- 3) A generator or aggregate generation of 10 MW or less behind a Point of Common Coupling that is exporting energy and/or capacity to PJM may send telemetry data for the Point of Common Coupling and generator meters to PJM via an internet option in lieu of sending telemetry directly to PHI. The Generator Owner must authorize PJM to resend the telemetry data to PHI. PHI may still require direct telemetry under special circumstances. The required data points are listed in M.6 below. PJM should be contacted for detailed information on the internet option.
- 4) Specific data points will vary depending upon on the size of the interconnected generation. Analog telemetry and status indication points are listed below in M.6. In addition, certain control functions may be required to allow remote dispatch of generation or for isolating the generation from the PHI Power Delivery System in the event of a System Emergency. Specific monitoring and control requirements will be determined on a case-by-case basis.
- 5) Remote tripping capability by PHI System Operations is required for all generator interconnections larger than 2 MW as noted below in M.6.

6) Telemetry and control requirements by generator capacity:

- Units 1 MW to 2 MW Capacity

Generation MW and MVAR Output, MW-Hours and MVAR-Hours for each generator if Standby Tariff applies.

- Units Greater Than 2 MW to 10 MW Capacity

- a) Point of Common Coupling MW, MVAR, MW-Hours, MVAR-Hours, Amp Flow on each Point of Common Coupling.
- b) Generation Bus and Point of Common Coupling Bus Voltages.
- c) Status indication of generator breaker(s) and Point of Common Coupling breaker/switch.
- d) Remote generator breaker tripping capability by PHI System Operations.
- e) Generation MW and MVAR Output, MW-Hours and MVAR-Hours for each generator if Standby Tariff applies.

The Generator Owner's RTU shall connect directly to PHI. For PJM projects, the required telemetry data may be re-transmitted to PHI. If data is retransmitted by PJM, the Generator Owner shall grant PJM permission to retransmit the data to PHI.

- Units Greater Than 10 MW to 50 MW Capacity

- a) MW and MVAR Output, MW-Hour and MVAR-Hour for each generator.
- b) MW, MVAR, Amp Flow, MW-Hour and MVAR-Hour on each Point of Common Coupling.
- c) Generation Bus and Point of Common Coupling Bus Voltages.
- d) Frequency at the Point of Common Coupling.
- e) Status indication of generator breaker(s) and Point of Common Coupling breaker.
- f) Remote generator breaker tripping capability by PHI System Operations.

The Generator Owner's RTU shall connect directly to PHI.

- Units Greater Than 50 MW to 500 MW Capacity

- a) MW and MVAR Output, MW-Hour and MVAR-Hour for each generator.
- b) MW and MVAR load of generator auxiliaries and Facility.
- c) MW, MVAR, Amp Flow, MW-Hour and MVAR-Hour on each Point of Common Coupling.
- d) MW, MVAR, Amp Flow through the Interface Transformer if site loading causes the flow through the Interface Transformer to be different than the generator.
- e) Generation Bus and Point of Common Coupling Bus Voltages
- f) Frequency at the Point of Common Coupling.
- g) Status indication of generator breakers and all substation breakers.
- h) Remote generator breaker tripping capability by PHI System Operations.

The Generator Owner's RTU shall connect directly to PHI.

Notes:

1. The Generator Owner shall contact PJM directly and review PJM documents to insure compliance with all the PJM RTU monitoring/control requirements for their proposed site.

2. The Company will allow multiple generator unit data to be combined into a single unit for Facilities not exceeding 10 MW total for all units.

N. Event Recording Considerations

- 1) The Generator Owner shall purchase and install recording equipment to monitor the performance of their protection and control equipment for those parallel generator sites interconnected with the PHI Power Delivery System at a voltages level of 69kV and above.
- 2) The Company reserves the right to specify the voltages, currents, device status, etc. to be monitored and recorded by this event recording equipment.
- 3) Event information may be recorded by event record features internal to microprocessor type protective relays, by separate digital fault/event recorders or by a combination of these two methods.
- 4) When a digital fault/event recorder is installed, the Company will specify a manufacturer and type to insure compatibility with other digital fault/event recorders in the PHI Power Delivery System.
- 5) The Company shall have remote access to any recorded information for use in analyzing the performance of the overall electric Grid.
- 6) The Generator Owner will supply a dialup telephone line for the event recording equipment for remote access of the data.
- 7) RFC (ReliabilityFirst Corporation) has additional fault recorder requirements for generator sites interconnected at 200kV or above and having either a single generator 250 MVA or greater or an aggregate generating plant capacity of 750 MVA or greater. The prospective Generator Owner should review RFC Standard PRC-002, FRC-01, 5/14/09, *Disturbance Monitoring and Reporting Requirements*.
- 8) Digital fault recorders should be time synchronized to a reference traceable to the National Institute of Standards and Technology (NIST).

IX. Performance Considerations

A. General

- 1) The interconnection of parallel generation with the PHI Power Delivery System is permissible only if the system voltage, frequency and current flow at the Point of Common Coupling are within normal limits. Parallel operation must cease immediately and automatically for abnormal voltage, frequency, or current flow as defined below.
- 2) Parallel operation must also cease automatically for operation outside the power quality limitations detailed in Technical Design Considerations, Section VIII - G.

B. Voltage Limits

- 1) The Generator Owner's equipment shall be operated in such a manner that the voltage levels on the Company's Grid remain within the operating limits defined by ANSI C84.1 and within the limits defined by tariff and local regulatory jurisdiction.
- 2) The generator must immediately and automatically cease parallel operation and disconnect from the PHI Power Delivery System if the voltage at the Point of Common Coupling exceeds the limits defined below:

Table 3, Voltage Trip Points

DC Generating Systems with Non-Islanding Inverters	Induction and Synchronous Generators All Sizes
a) Trip in 0.16 Second for $V < 50\%$ b) Trip within 2.0 Seconds for $50\% \leq V < 88\%$ c) Trip within 2.0 Seconds for $110\% < V < 120\%$ d) Trip in 0.16 Second for $V \geq 120\%$ Note: Voltage and time delay set points taken from IEEB Std. 1547-2008 & UL 1741 - 2005	a) Trip in 0.16 Second for $V < 50\%$ b) Trip in 2.0 Seconds for $50 \leq V < 88\%$ c) Trip in 1.0 Second for $110 < V < 120\%$ d) Trip in 0.16 Second for $V \geq 120\%$ Note: Specific voltage and time delay set points vary for each installation. Typical set points from IEEE 1547 are shown above and are applicable for small generators. IEEE Std. 1547-2008

Notes:

- i. Trip time refers to the time between when the abnormal voltage condition occurs and the generator being disconnected from the Company Grid.
- ii. Three-phase voltage sensing shall be used.
- iii. The voltages must be sensed on the high side of any Interface (Isolation) Transformer if the high voltage winding is ungrounded. Such a scheme is necessary to rapidly detect severe over voltages that occur for a grounded high side conductor being energized from an ungrounded generation source. These high voltages can quickly cause catastrophic failure of lightning arresters and lead to other equipment insulation failures.
- iv. Exceptions to these limits may be granted or required for bulk synchronous generators with a contractual obligation and authority to supply other Customer load in an Island mode arrangement. These generators must install appropriate equipment to control and stabilize voltage within the Island.

- 3) The Generator Owner may reconnect to the Grid when the system voltage returns to normal range and the Grid is Stabilized. Reconnection approval shall be requested from the

Company Control Center. NEM generators and other generators 2 MW or less are generally exempt from receiving reconnection approval.

C. Frequency Limits

- 1) The generator must immediately and automatically cease parallel operation and disconnect from the PHI Power Delivery System if the operating frequency exceeds the limits defined below:

Table 4, Frequency Trip Points

DC Generating Systems With Non-Islanding Inverters	Induction/Synchronous Generators Non PJM Market Less Than 20 MW	Synchronous Generators In PJM Market or 20 MW or Greater
a) Trip in 0.1 Second for $F < 59.3$ Hz. b) Trip in 0.1 Second for $F > 60.5$ Hz. Note: Set points taken from IEEE Std. 1547 - 2008. & UL 1741 - 2005	a) Trip in 0.16 Second for $F < 57.0$ Hz. b) Trip in 0.16 - 300 Second(s) for $57.0 < F < 59.8$ Hz. c) Trip in 0.16 Second for $F > 60.5$ Hz. Note: Frequency and time delay set point for 57.0-59.8 Hz. will be determined for each specific installation. IEEE Std. 1547-2008.	Frequency and time delay set points will be determined for each specific installation. Set points will be selected to: a) Coordinate with area under frequency load shedding programs. b) Meet RFC under frequency guidelines in PRC-006-RFC-01, <i>Automatic Under Frequency Load Shedding Requirements</i> . c) Meet the frequency operational requirements in PJM Manual 14D, <i>Generator Operational Requirements</i> , Section 7, <i>Generator Operations</i> .

Notes:

- i. Trip time refers to the time between when the abnormal frequency condition occurs and the generator being disconnected from the Company Grid.
 - ii. Synchronous Generators less than .20 MW whose output is netted with peak load (net system load reducer) to calculate PJM under frequency load shedding needs, will also have to meet frequency requirements for PJM Market generators.
 - iii. PJM Frequency requirements are to provide uniformity across the entire Grid and to insure that all generator units will remain online until the frequency limits are reached.
 - iv. PJM can grant an exception to the trip frequency requirement if warranted.
2. The Generator Owner may reconnect to the Grid when the system frequency returns to normal range and the Grid is Stabilized. Reconnection approval shall be requested from the Company Control Center. NEM generators and other generators 2 MW or less are generally exempt from receiving reconnection approval.

D. Synchronization

- 1) In order to avoid damaging a generator during synchronizing, the generator manufacturer will generally provide synchronizing limits in terms of breaker closing angle, slip frequency and voltage matching. Those manufacturer limits should be followed but in no case should they exceed the limits listed on Table 5 on the next page.

Table 5, Synchronization Limits

Frequency Difference (Slip)	Voltage Difference	Phase Angle Difference
0.2 Hz.	10%	10 Degrees

- 2) Generators with a Stiffness Ratio of 20 or less, or those units where a stability study has indicated possible unstable operation shall be equipped with a protective functions suitable for detecting loss of synchronism (out of step or pole slipping).
- 3) Induction generators that are started across the line shall not cause voltage flicker to exceed the limitation defined in Technical Design Considerations, Section VIII - G 2. If these flicker limits are exceeded, the induction generator shall be accelerated to synchronous speed by the prime mover prior to paralleling with the Company Grid.
- 4) The inverters of DC generating systems shall obtain their commutation reference from the Company Grid and thus synchronization will not be an issue.

E. Island Operation

- 1) The generator must automatically and immediately disconnect from the PHI Power Delivery System if the source from the Grid is lost. This separation must occur irrespective of connected load or other generators on the circuit.
- 2) The generator must be disconnected from the Company Grid before any automatic reclose or re-energizing of the Company source.
- 3) Operating an intentional Island using Customer owned generation with other Customers will be permitted only if specific contractual arrangements have been made and the necessary equipment has been installed by the Generator Owner to control and Stabilize the Island voltage and frequency within the limitations defined in Sections IX - B and C. In general, this will require the Interface (Isolation) Transformer to provide a grounded source to the Island and a generator capable of isochronous operation. The design and operational requirements noted in IEEE P1547.4/D10.0 *Draft Guide for Design, Operation and Integration of Distributed Resource Island Systems with Electric Power Systems*, should be taken into account for any planned Island.
- 4) Reconnecting the Island to the Company Grid must be done at a tie location with facilities for synchronizing the Islanded generation to the Grid. Otherwise, the Island generation must be disconnected before the tie is made to the Grid.

F. Fault Detection and Isolation

- 1) The Generator Owner must have protective relaying to detect a fault condition on the Company source circuit that interconnects with the Generator Owner's Facility. The protective relaying must detect the Company circuit fault and disconnect the generator from the Grid. The required operating time of the protection scheme is dependant on many variables such as voltage class, generator stability concerns, primary verses backup relaying, coordination requirements with Company relaying scheme, etc. The Company will work with the Generator Owner and ascertain the performance requirements on a case by case basis.

- 2) In cases where clearing time from the Generator Site is critical and/or when a high speed auto reclose is needed on the source circuit, transfer trip from the Company end of the circuit to the Generator Owner's site will be required.
- 3) For a fault condition within the Generator Owner's Facility, the Generator Owner must have protective relaying to detect and isolate the fault from the PHI Power Delivery System. The required clearing time of the Facility's protection schemes is dependent on many variables such as voltage class and the operating time of any Company protection schemes that reach into the Facility. The Company will review the proposed operating time of the Facility's protection schemes and ascertain the performance requirements on a case by case basis.

G. Closed Transition Switching Installations

Some privately owned generation may be paralleled only momentarily with the PHI Power Delivery System during part of a source or load transfer sequence. Generators used primarily for load reduction or emergency power are sometimes operated in this manner.

- 1) At the time of momentary parallel operation, these installations must meet the voltage, frequency and synchronization requirements outlined in preceding Sections IX - B, C, and D. The synchronizing may be manual for generators up to 10 MW if the closed transition is manually initiated. Otherwise, the synchronizing should be automatic.
- 2) The transition scheme must have an additional safeguard to limit the amount of time the generator is paralleled with the Grid. The scheme shall trip the generator if the closed transition mode remains in effect longer than some predetermined time, typically 0.1 second. The PHI subsidiary (ACE, DPL or PEPCO) to which the Generator Owner is requesting interconnection will determine the allowable time span for parallel operation of the generator.

X. Protection Scheme Details

A. General

- 1) The protection schemes described in this section are intended to be typical for illustration purposes and not specific design requirements for any particular site. They are intended to guide the proposed Generator Owner and provide basic information on the types of protection schemes necessary for generator Parallel Operation.
- 2) Protective relays, wherever possible, shall be microprocessor type with integral trip record and fault recording, self-checking and remote communications. Remote communications should be provided through a digital switching device to allow a single communication line to service multiple protective relays.
- 3) All protective relays must have the desired sensitivity and speed for its intended application and be of utility grade. The Company can provide feedback to the Generator Owner in this regard.
- 4) All equipment, lines and busses operating at 69kV and above shall be protected by two independent protective schemes.
- 5) Primary and backup protection schemes shall be supplied via independent current/potential circuits and independently protected DC control circuits.
- 6) DC circuits supplying protective relaying schemes shall be continuously monitored and fused separately from any other DC control circuits. Loss of any control power bus including DC trip and close busses of each breaker shall also be monitored and alarmed to a manned location so that corrective action can be taken. Relay failure alarms shall be handled in a similar manner.
- 7) Generator units selling into the PJM marketplace, or interconnected at 230kV and above, must meet the protection requirements detailed in the *PJM Protective Relaying Philosophy and Design Standards* document.
- 8) All protective relay systems, equipment, design, operation and maintenance shall be in accordance with all applicable Federal, State and Local requirements, National and Regional Reliability Criteria and Industry Recognized Standards and Guidelines. References to such requirements may be found in Section XIII of this document. The listing is not intended to be all-inclusive.

B. Interface (Isolation) Transformer Protection

Typical protection schemes for various size Interface Transformers are illustrated below.

Table 6, Interface Transformer Protection

Up to 10 MVA	10 – 50 MVA	Greater than 50 MVA
<ul style="list-style-type: none"> • High Side Fuse (4kV, 12kV, 13.2kV, 23kV, 25kV, 34.5kV or 69kV only) 	<ul style="list-style-type: none"> • Transformer Differential • Fault Pressure • Time/Inst. Over Current 	<ul style="list-style-type: none"> • Transformer Primary Differential • Transformer Backup Differential • Fault Pressure • Time/Inst. Over Current • Over Excitation

Notes:

- i. For transformers needing two differential protection schemes, one of the differential schemes may also include the generator.
- ii. The location of the transformer over current relaying may be dependent on the transformer connections.
- iii. Generators with a fuse protected Interface (Isolation) Transformer must include protection to detect an open fuse condition.

C. Interconnection Line Protection

The protection applied to a line terminal at the Generator Owner's site that interconnects the privately owned generator with the PHI Power Delivery System will vary depending on the voltage class and existing line relaying scheme at the Company end(s).

Typical protection schemes for various voltage interconnection lines are provided below. The actual schemes used will vary for each specific site.

Table 7 Typical Line Terminal Protection Schemes

Line Voltage Class	Possible Line Protection Schemes
4kV, 12kV, 12.47kV & 13.2kV	<ul style="list-style-type: none">• Phase & Ground Over current (May need to be directional)• 3-Phase to Ground Connected Under Voltage & Over Voltage (For line terminating in delta or ungrounded wye connected transformer)
23kV, 25kV, 34.5kV	<ul style="list-style-type: none">• Phase & Ground Over current (May need to be directional)• 3-Phase to Ground Connected Under Voltage & Over Voltage (For line terminating in delta or ungrounded wye connected transformer)
69kV	<ul style="list-style-type: none">• Phase & Ground Directional Over current• Phase & Ground Distance Pilot (DCB, POTT, PUTT, DTT)• Phase & Ground Step Distance Backup• 3-Phase Overvoltage (For line terminating in delta or ungrounded wye connected transformer)
115kV & 138kV	<ul style="list-style-type: none">• Phase & Ground Distance Pilot (DCB, POTT, PUTT, DTT)• Phase & Ground Step Distance Backup• Direct Transfer Trip Send/Receive
230 & 500kV	<ul style="list-style-type: none">• Phase & Ground Distance Pilot (DCB, POTT, PUTT, DTT)• Phase & Ground Step Distance Backup• Direct Transfer Trip Send/Receive

Notes:

- 1) Generators that can go unstable due to delayed fault clearing if line pilot protection scheme fails will require two independent high speed pilot schemes, with independent communication channels.
- 2) DCB is Directional Comparison Blocking
- 3) POTT is Permissive Overreaching Transfer Trip
- 4) PUTT is Permissive Under Reaching Transfer Trip.
- 5) DTT is Direct Transfer Trip

D. Generator Isolation Detection Schemes

- 1) Under/over frequency and under/over voltage schemes can be used to detect the fact that the generator is Islanded with load (and possibly other generation) and needs to be disconnected from the Company Grid. These schemes are effective where there is a significant mismatch between load and generator rating. IEEE Std. 1547-2008, Footnote 12, requires that the load to generation mismatch be 3 to 1. The detection must also occur within 2 seconds of the formation of an island. (See also Performance Considerations, Sections IX – B2 and C1)
- 2) Under/over frequency and under/over voltage detection becomes less reliable when the Islanded load is more closely matched to the generator capacity so that the resulting voltage and frequency is at or very near normal. In these cases, direct transfer trip from the PHI Power Delivery System to the Generator Owner's site will be necessary.
- 3) Generators selling into the PJM marketplace that have their under frequency trip point set to meet PJM under frequency operational requirements (such as 57.5 Hz. for 5 Seconds) essentially removes under frequency sensing as a sensitive means to detect isolation. In this event, other protective measures, such as transfer trip, will be required.
- 4) Generators using dynamic inverters to regulate voltage at the Point of Interconnection generally will not conform to the requirements of IEEE 1547-2008 and thus will require transfer trip from the upstream protective device(s).
- 5) Generally, combinations of different protection schemes are necessary to be 100% effective and to provide a level of redundancy.

E. Generator Protection Schemes

- 1) The protection schemes on generators will become more complex as the size of the generator unit increases. In addition, those generators selling into the PJM marketplace will require specific protection as required by PJM. The *PJM Relay Subcommittee Protective Relaying Philosophy and Design Standards* should be consulted.
- 2) Multi-function microprocessor relays can be used to provide several generator protection functions. However, a second multi-function relay (preferably from another manufacturer to avoid a common failure mode or defective algorithm) is necessary to provide for a relay failure. Alternatively, the generator could be immediately and automatically tripped off line upon a relay failure alarm and remain off line until the relay is repaired. This arrangement, however, may jeopardize the Generator Owner's ability to sell firm capacity into the PJM marketplace.
- 3) The Generator Owner should consult the generator manufacturer and national standards to develop the appropriate protection for each generator installation. National standards include C37.102-2006 *IEEE Guide for AC Generator Protection* and C37.101-2006 *IEEE Guide for Generator Ground Protection*.
- 4) Generators larger than 100 MW or any generator interconnected at 230kV voltage or above will have to meet the generator protection requirements of the *PJM Relay Subcommittee Protective Relaying Philosophy and Design Standards*.
- 5) Some typical protection schemes for various size generators are noted in Table 7 on the following page. The actual schemes required for each site could vary from these representative samples.

Table 8, Typical Generator Protection Schemes

DC Generating Systems With Non-Islanding Inverters	Induction/Synchronous Generators Up to 10 MW	Synchronous Generators 10MW up to 50 MW	Synchronous Generators 50 MW & Above
<ul style="list-style-type: none"> • Over/Under Voltage • Over/Under Frequency <p>(This preceding protection is integral to the Non-Islanding Inverter.)</p> <ul style="list-style-type: none"> • DC Over current 	<ul style="list-style-type: none"> • Over/Under Voltage • Over/Under Frequency • Directional Power (watt / var) • Phase Over current • Ground Over current • Negative Sequence 	<ul style="list-style-type: none"> • Over/Under Voltage • Over/Under Frequency • Differential • Stator Ground • Loss of Field • Anti-Motoring • Negative Sequence • Voltage Controlled. Over current 	<ul style="list-style-type: none"> • Over/Under Voltage • Over/Under Frequency • Primary Differential • Back Up Differential • 100% Stator Ground • Back Up Stator Ground • Generator Lead Protection • Primary Loss of Field • Back Up Loss of Field • Field Ground • Anti-Motoring • Negative Sequence • Voltage Controlled Over current or Distance Backup • Breaker Flashover • Protection During Unit Start Up & Shut Down • Accidental Energization • Out of Step Protection • Synchronizing Check <p>(Ref. Appendix A)</p>

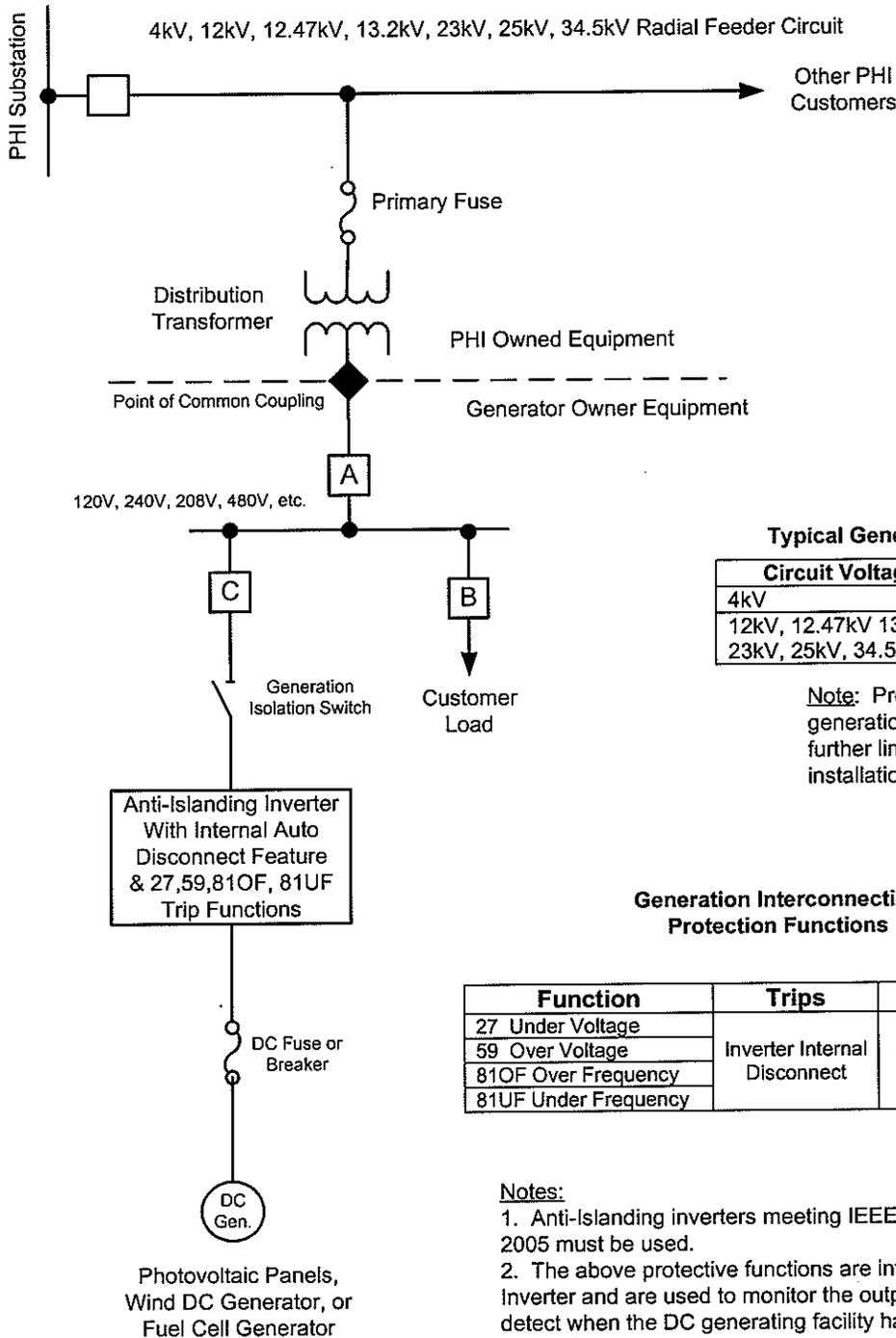
Comments

- a) On generators with primary and backup differentials, one differential may also cover the unit step up transformer.
- b) Additional PJM requirements will apply for units 100 MW and above or units that are interconnected at 230kV and above.
- c) Loss of synchronism (out-of-step) protection is necessary where stability studies have shown this protection to be needed.
- d) Ancillary protection schemes such as breaker failure are also required.

XI. Typical One-Line Diagrams

The following One-Line Diagrams are intended to be typical or representative samples of various types and sizes of generation Facilities that are connected to and operate in parallel with the PHI Power Delivery System. Each site will have to be specifically designed taking into account the unique characteristics of each installation, the specific location of the Point of Common Coupling and the operating and contractual requirements for that site. Additional PJM and RFC requirements may also apply.

The listed voltages on the diagrams represent nominal values. The actual voltage is dependent on the interconnection location on the PHI circuit. Specific distribution facility voltages are provided in Table 1.



Typical Generator Maximum Size

Circuit Voltage	Generator Size
4kV	Up to 0.5 MW
12kV, 12.47kV 13.2kV 23kV, 25kV, 34.5kV	Up to 3 MW

Note: Pre-existing installed generation on the circuit may further limit the size of a new installation.

Generation Interconnection Protection Functions

Function	Trips	Setting
27 Under Voltage	Inverter Internal Disconnect	Set per IEEE 1547 – 2008 & UL 1741 - 2005
59 Over Voltage		
81OF Over Frequency		
81UF Under Frequency		

Notes:

1. Anti-Islanding inverters meeting IEEE 1547-2008 and UL 1741-2005 must be used.
2. The above protective functions are integral to the Anti-Islanding inverter and are used to monitor the output of the inverter and to detect when the DC generating facility has been isolated from the power Grid.
3. PHI may change the transformer connection to meet area grounding requirements.
4. Required metering is not shown.

Figure 1, Typical DC Generator Less Than 2 MW at Customer Load Location

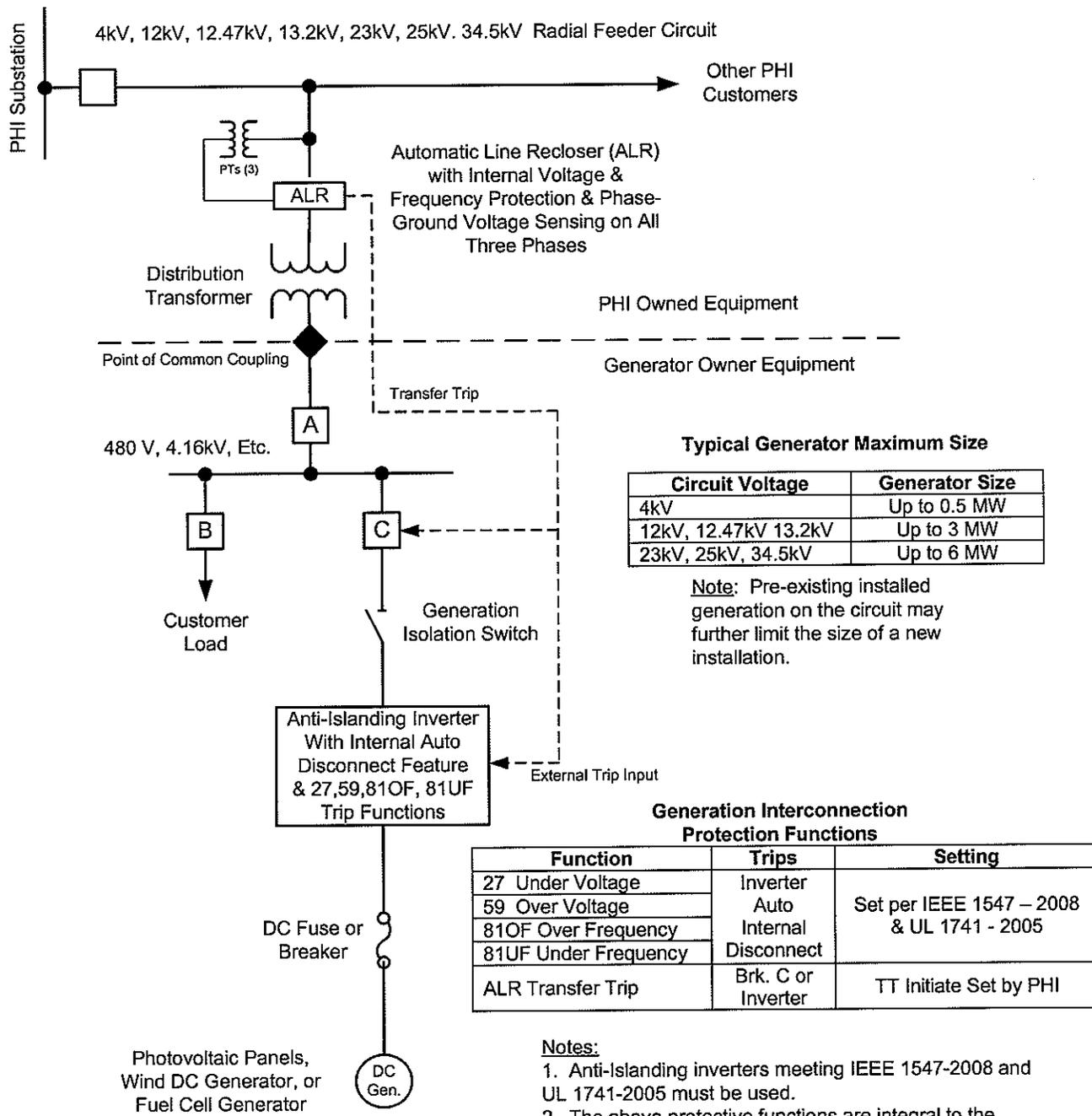


Figure 2, Typical DC Generator Up to 6 MW at Customer Load Location

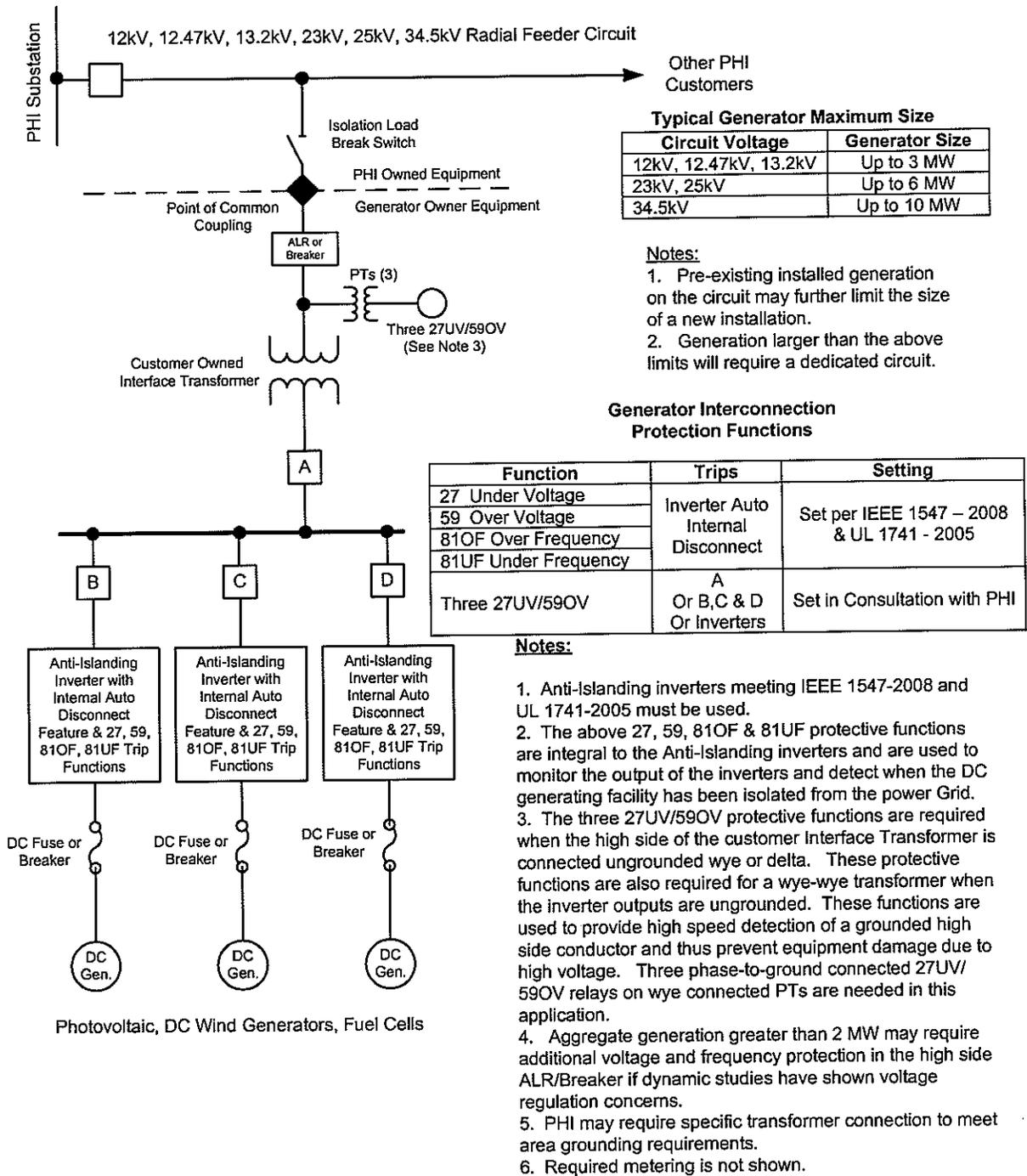


Figure 3, Typical DC Generator Energy Farm Up to 10 MW with Anti-Islanding Inverters

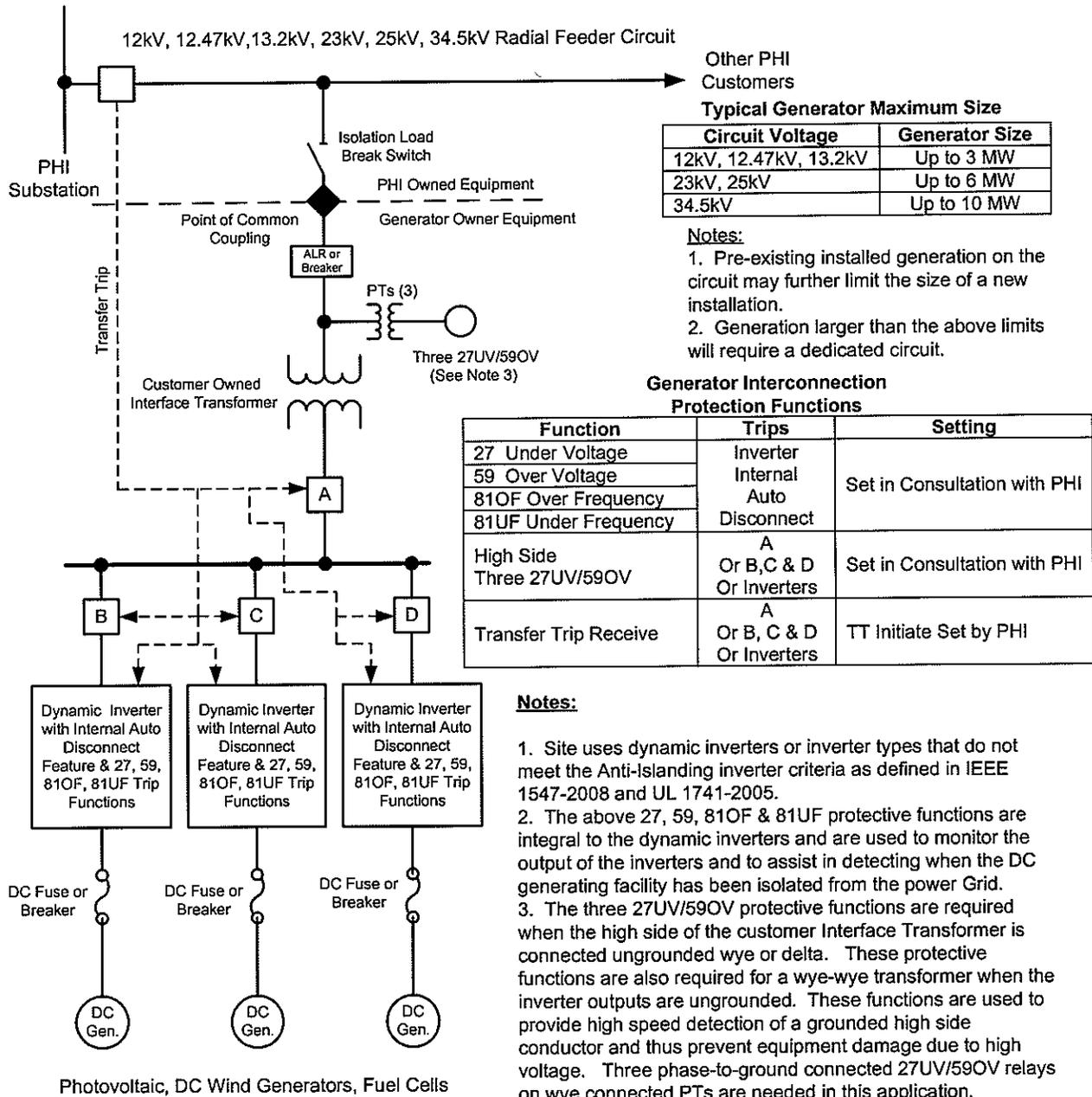
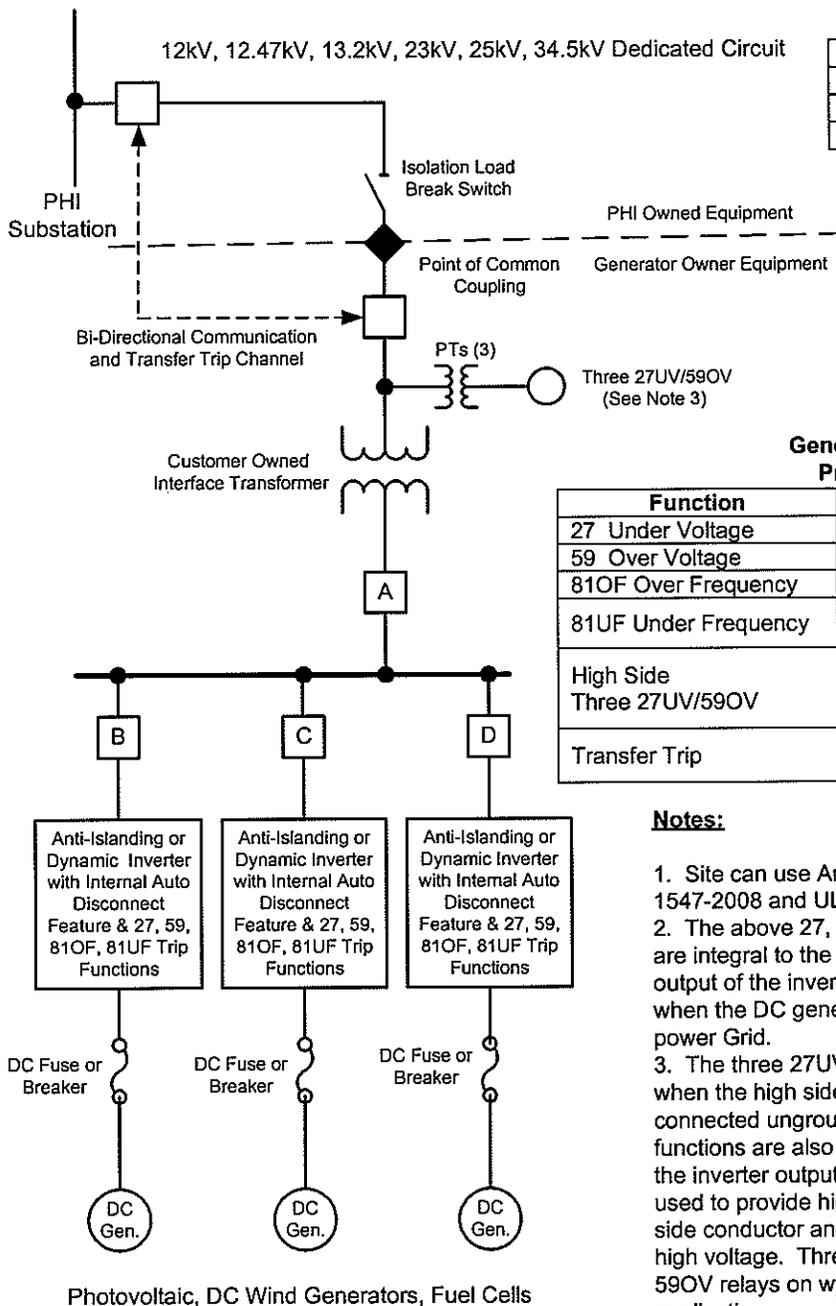


Figure 4, Typical DC Generator Energy Farm Up to 10 MW with Dynamic Inverters



Typical Generator Maximum Size

Circuit Voltage	Generator Size
12kV, 12.47kV, 13.2kV	Up to 10 MW
23kV, 25kV	Up to 15 MW
34.5kV	Up to 20 MW

Note:
Length of the dedicated circuit and other system parameters may further limit the generator size.

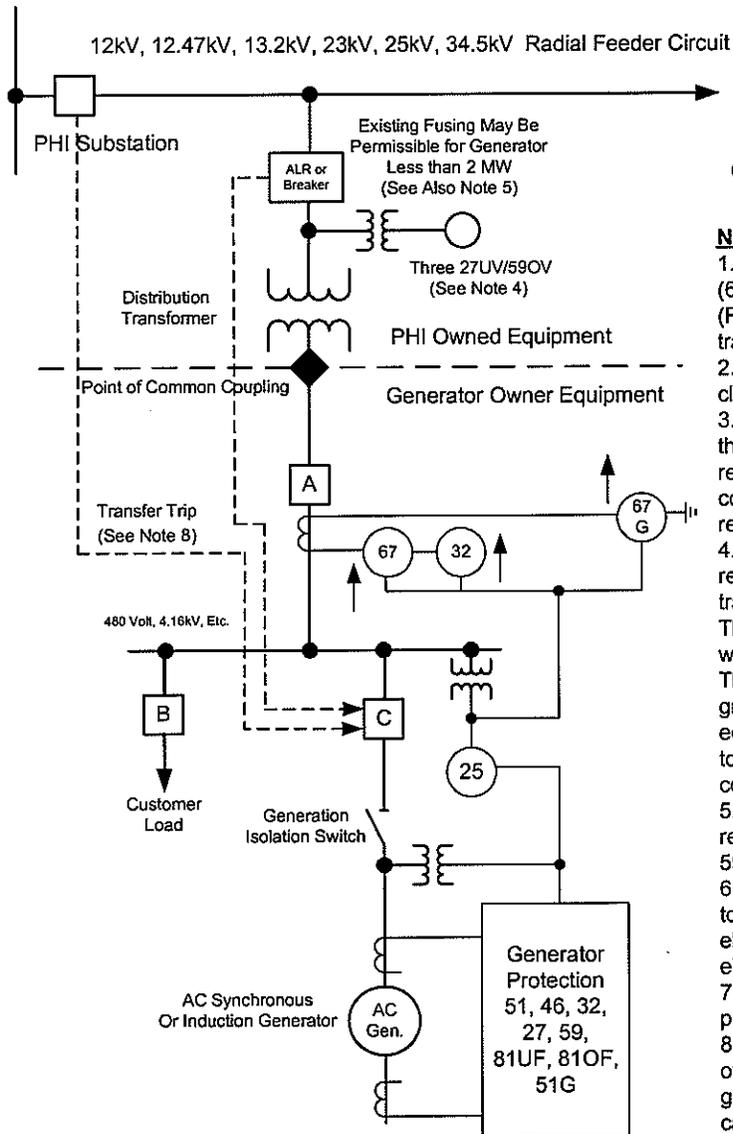
Generator Interconnection Protection Functions

Function	Trips	Setting
27 Under Voltage	Inverter Integral Disconnect Switch	Anti-Islanding Inverters set per IEEE 1547-2008 & UL 1741 – 2005 Dynamic Inverters Set in Consultation with PHI
59 Over Voltage		
81OF Over Frequency		
81UF Under Frequency		
High Side Three 27UV/59OV	B, C & D Or A Or Inverters	Set in Consultation with PHI
Transfer Trip	High Side Breaker	TT Initiate to Generator Site Set by PHI

Notes:

1. Site can use Anti-Islanding Inverters as defined in IEEE 1547-2008 and UL 1741-2005 or Dynamic Inverters.
2. The above 27, 59, 81OF & 81UF protective functions are integral to the inverters and are used to monitor the output of the inverters and to detect or assist in detecting when the DC generating facility has been isolated from the power Grid.
3. The three 27UV/59OV protective functions are required when the high side of the customer interface transformer is connected ungrounded wye or delta. These protective functions are also required for a wye-wye transformer when the inverter outputs are ungrounded. These functions are used to provide high speed detection of a grounded high side conductor and thus prevent equipment damage due to high voltage. Three phase-to-ground connected 27UV/59OV relays on wye connected PTs are needed in this application.
4. Transfer trip is needed for line relaying and for breaker failure. Transfer trip is also needed when inverters not meeting the Anti-Islanding criteria of IEEE 1547-2008 and UL 1741-2008 are used.
5. Generator site main high side breaker must include local breaker failure protection with transfer trip initiation.
6. PHI may require specific transformer connection to meet area grounding requirements.
7. Required metering is not shown.

Figure 5, Typical DC Generator Energy Farm 10 MW or Greater on Dedicated Circuit



Typical Generator Maximum Size

Circuit Voltage	Generator Size
12kV, 12.47kV, 13.2kV	Up to 3 MW
23kV, 25kV	Up to 6 MW
34.5kV	Up to 10 MW

Generator size limit is dependent on capacity of circuit to carry site load when generator is not available.

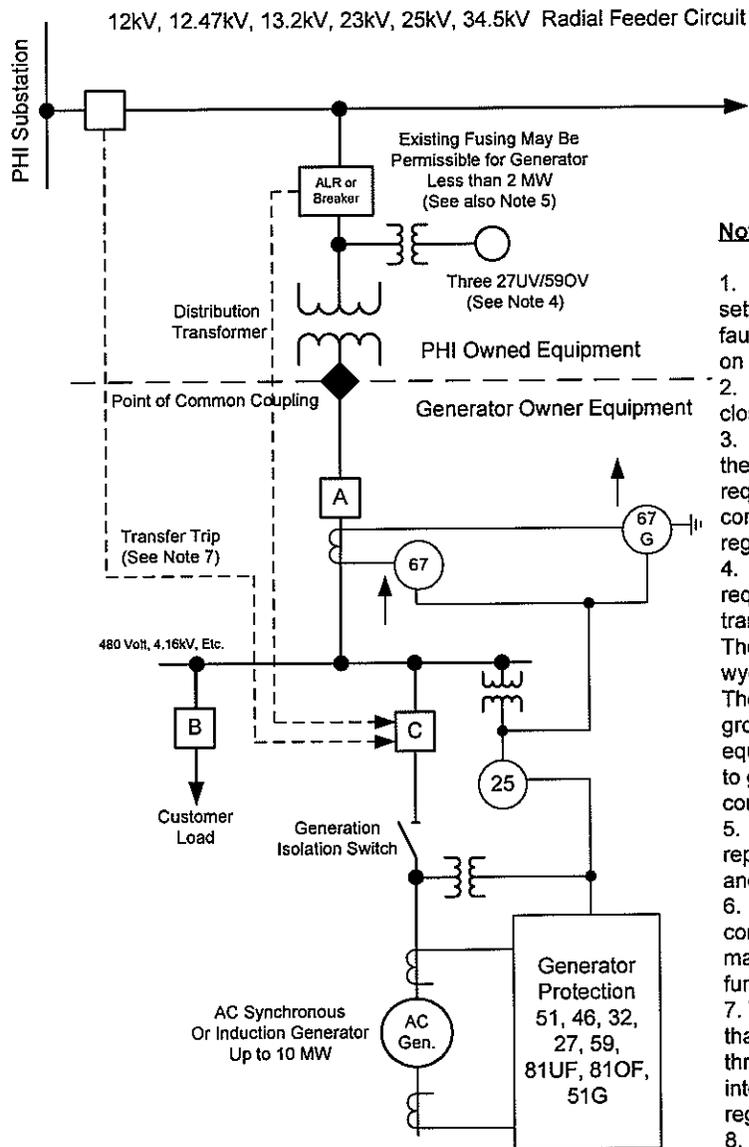
Notes:

- PHI will review directional over current relay settings (67 & 67G) to insure detection of PHI circuit faults. (Relay 67G may not be applicable depending on transformer connection.)
- Breaker A and high side ALR/Breaker designed to close only to a hot source and a dead low side bus.
- Use of an induction generator may adversely affect the power factor at the customer location. This will require the customer to implement power factor correction. The customer should consult with PHI regarding the method of correction.
- The three 27UV/59OV protective functions are required when the high side of the existing interface transformer is connected ungrounded wye or delta. These protective functions are also required for a wye-wye transformer when the generator is ungrounded. These functions provide high speed detection of a grounded high side conductor and thus prevent equipment damage due to high voltage. Three phase to ground connected 27UV/59OV relays on wye connected PTs are needed in this application.
- Existing transformer high side fusing will need to be replaced with an ALR or Breaker if preceding 27UV/59OV protective functions are required.
- PHI may elect to change the transformer connection to meet area grounding requirements. This may eliminate the need for the preceding 27UV/59OV elements.
- Directional power 32 element will be set to limit or prevent power export.
- Transfer trip is required when the combined net load of the site and PHI circuit that can be isolated with the generation is less than three times the generation capacity.
- Required metering is not shown.

Generator & Interconnection Protective Functions

Function	Action	Setting
25 Gen. Check Synch	Supervises Breaker C Close	Per Generator Manufacturer Limits
27 Gen. Under Voltage	Trips Breaker C or A	Per IEEE 1547 – 2008
32 Gen. Anti-Motoring	Trips Breaker C	Per IEEE Std. C37.102 – 2006
32 Brk. Dir. Power	Trips Breaker C or A	Desired Low Power Flow Limit to PHI
46 Gen. Neg. Seq.	Alarm, then Trips Breaker C	Per IEEE Std. C37.102 – 2006
59 Gen Over Voltage	Trips Breaker C or A	Per IEEE 1547 – 2008
51 Gen. Over Current	Trips Breaker C	Per IEEE Std. C37.102 – 2006
51G Gen. Ground OC	Trips Breaker C	Per IEEE Std. C37.101 – 2006
67 Brk. Dir. Over Current	Trips Breaker C	Set in Consultation with PHI
67G Brk. Dir. Grd. OC	Trips Breaker C	Set in Consultation with PHI
81UF Gen. Under Freq.	Trips Breaker C or A	Per IEEE 1547 – 2008
81OF Gen. Over Freq.	Trips Breaker C or A	Per IEEE 1547 – 2008
High Side 27UV/59OV	Trips Breaker C	Set by PHI
Transfer Trip	Trips Breaker C	Transfer Trip Initiate Set by PHI

Figure 6, Typical AC Generator at Customer Load Site, One Way Power Flow



Typical Generator Maximum Size

Circuit Voltage	Generator Size
12kV, 12.47kV, 13.2kV	Up to 3 MW
23kV, 25kV	Up to 6 MW
34.5kV	Up to 10 MW

Pre-existing installed generation on the circuit may further limit the size of a new installation.

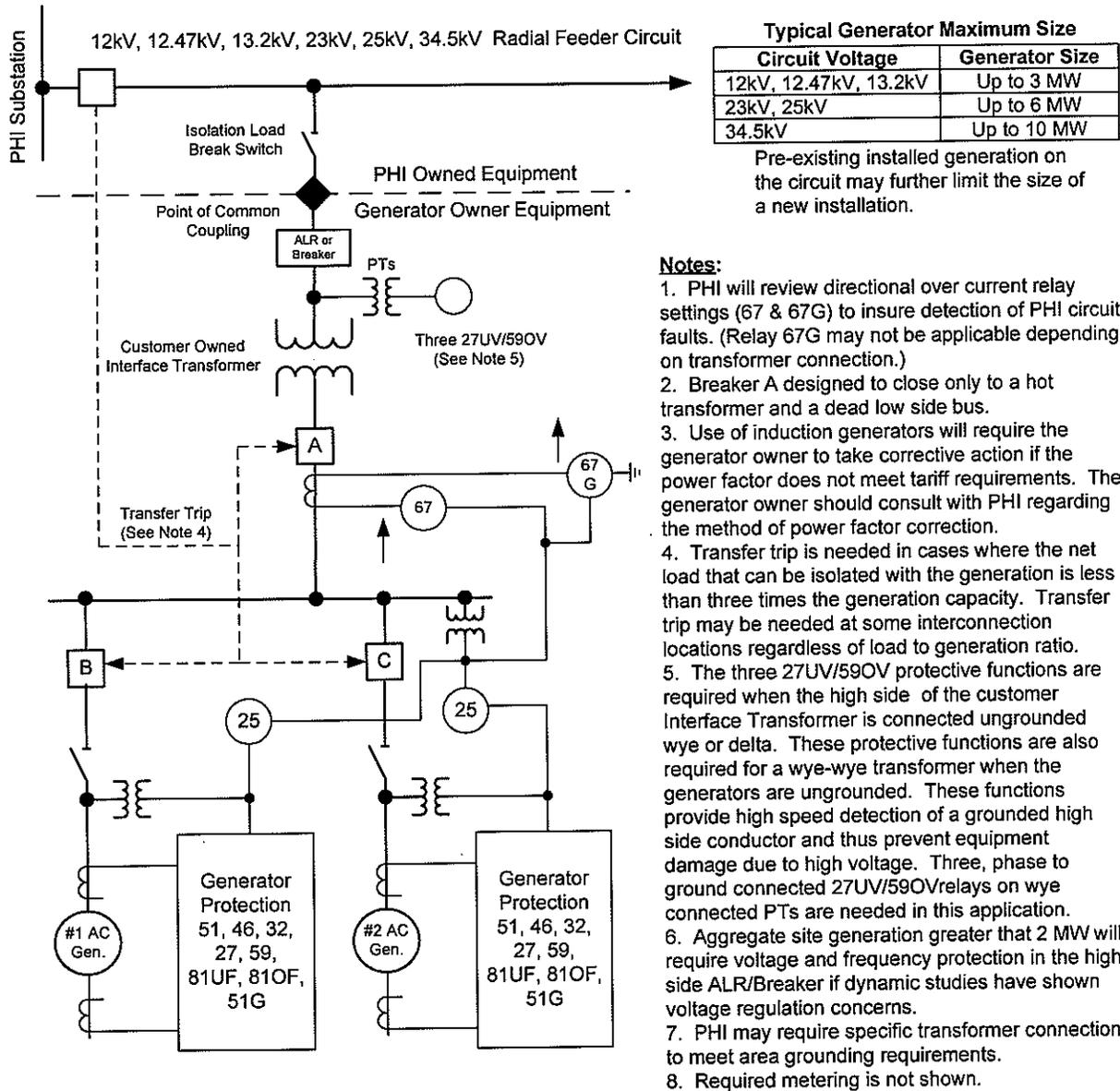
Notes:

1. PHI will review directional over current relay settings (67 & 67G) to insure detection of PHI circuit faults. (Relay 67G may not be applicable depending on transformer connection.)
2. Breaker A and high side ALR/Breaker designed to close only to a hot source and a dead low side bus.
3. Use of an induction generator may adversely affect the power factor at the customer location. This will require the customer to implement power factor correction. The customer should consult with PHI regarding the method of correction.
4. The three 27UV/59OV protective functions are required when the high side of the existing interface transformer is connected ungrounded wye or delta. These protective functions are also required for a wye-wye transformer when the generator is ungrounded. These functions provide high speed detection of a grounded high side conductor and thus prevent equipment damage due to high voltage. Three phase to ground connected 27UV/59OV relays on wye connected PTs are needed in this application.
5. Existing transformer high side fusing will need to be replaced with an ALR or Breaker if preceding 27UV and 59OV protection functions are required.
6. PHI may elect to change the transformer connection to meet area grounding requirements. This may eliminate the need for the preceding 27UV/59OV functions.
7. Transfer trip is required in cases where the net load that can be isolated with the generation is less than three times the generation capacity. Some interconnection locations may require transfer trip regardless of load to generation ratio.
8. Required metering is not shown.

Generator & Interconnection Protective Functions

Function	Action	Setting
25 Gen. Check Synch	Supervises Breaker C Close	Per Generator Manufacturer Limits
27 Gen. Under Voltage	Trips Breaker C or A	Per IEEE 1547 – 2008
32 Gen. Anti-Motoring	Trips Breaker C	Per IEEE Std. C37.102 - 2006
32 Brk. Dir. Power	Trips Breaker C or A	Desired Low Power Flow Limit to PHI
46 Gen. Neg. Seq.	Alarm, then Trips Breaker C	Per IEEE Std. C37.102 – 2006
59 Gen Over Voltage	Trips Breaker C or A	Per IEEE 1547 – 2008
51 Gen. Over Current	Trips Breaker C	Per IEEE Std. C37.102 – 2006
51G Gen. Ground OC	Trips Breaker C	Per IEEE Std. C37.101 – 2006
67 Brk. Dir. Over Current	Trips Breaker C	Set in Consultation with PHI
67G Brk. Dir. Grd. OC	Trips Breaker C	Set in Consultation with PHI
81UF Gen. Under Freq.	Trips Breaker C or A	Per IEEE 1547 – 2008
81OF Gen. Over Freq.	Trips Breaker C or A	Per IEEE 1547 – 2008
High Side 27UV/59OV	Trips Breaker C	Set by PHI
Transfer Trip	Trips Breaker C	Transfer Trip Initiate Set by PHI

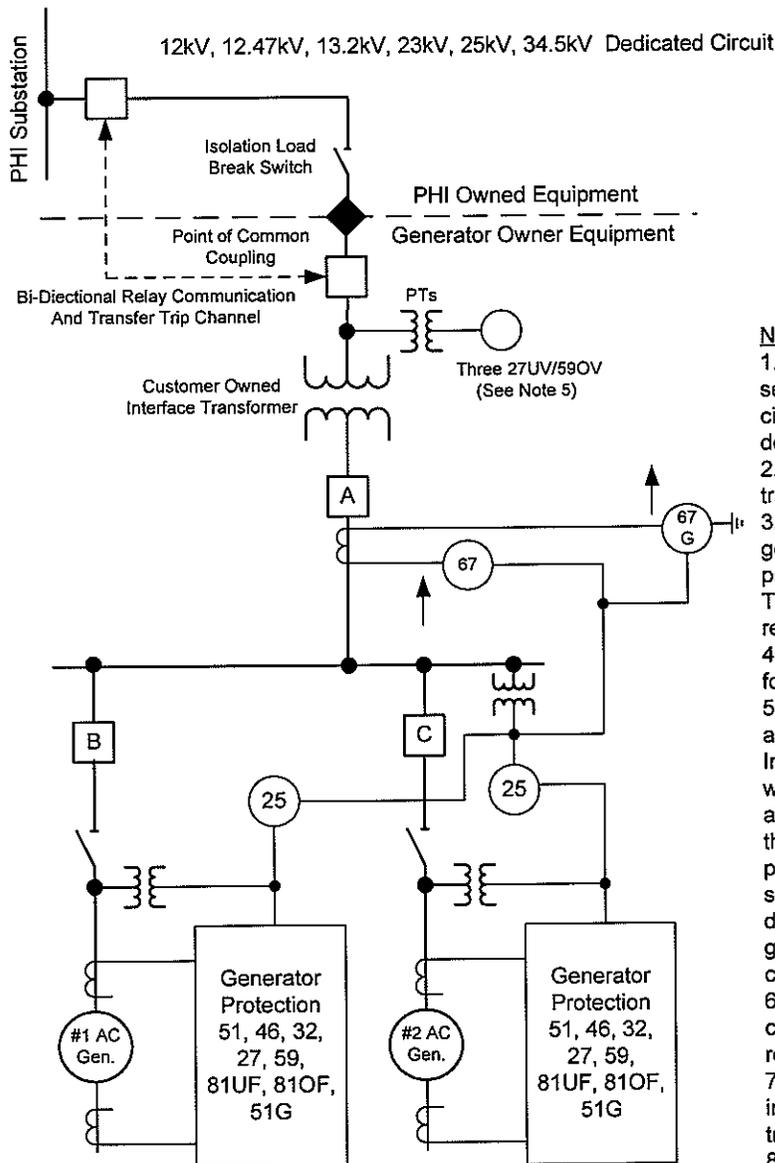
Figure 7, Typical AC Generator at Customer Load Site, Two Way Power Flow



Generator & Interconnection Protective Functions

Function	Action	Setting
25 Gen. Check Synch	Supervises Brk. B & C Close	Per Generator Manufacturer Limits
27 Gen. Under Voltage	Trips Generator Breaker	Per IEEE 1547 – 2008
32 Gen. Anti-Motoring	Trips Generator Breaker	Per IEEE Std. C37.102 - 2006
46 Gen. Neg. Seq.	Alarm, then Trips Gen. Brk.	Per IEEE Std. C37.102 - 2006
59 Gen Over Voltage	Trips Generator Breaker	Per IEEE 1547 – 2008
51 Gen. Over Current	Trips Generator Breaker	Per IEEE Std. C37.102 - 2006
51G Gen. Ground OC	Trips Generator Breaker	Per IEEE Std. C37.101 - 2006
67 Brk. Dir. Over Current	Trips Breaker A	Set in Consultation with PHI
67G Brk. Dir. Grd. OC	Trips Breaker A	Set in Consultation with PHI
81UF Gen. Under Freq.	Trips Breaker A or B & C	Per IEEE 1547 – 2008
81OF Gen. Over Freq.	Trips Breaker A or B & C	Per IEEE 1547 – 2008
Transfer Trip	Trips Breaker A or B & C	Trip Initiation Set by PHI
High Side 27UV/59OV	Trips Breaker A or B & C	Set in Consultation with PHI

Figure 8, Typical AC Generator Energy Farm Up to 10 MW



Typical Generator Maximum Size

Circuit Voltage	Generator Size
12kV, 12.47kV, 13.2kV	Up to 10 MW
23kV, 25kV	Up to 15 MW
34.5kV	Up to 20 MW

Note: Length of the dedicated circuit and other system parameters may further limit the generator size.

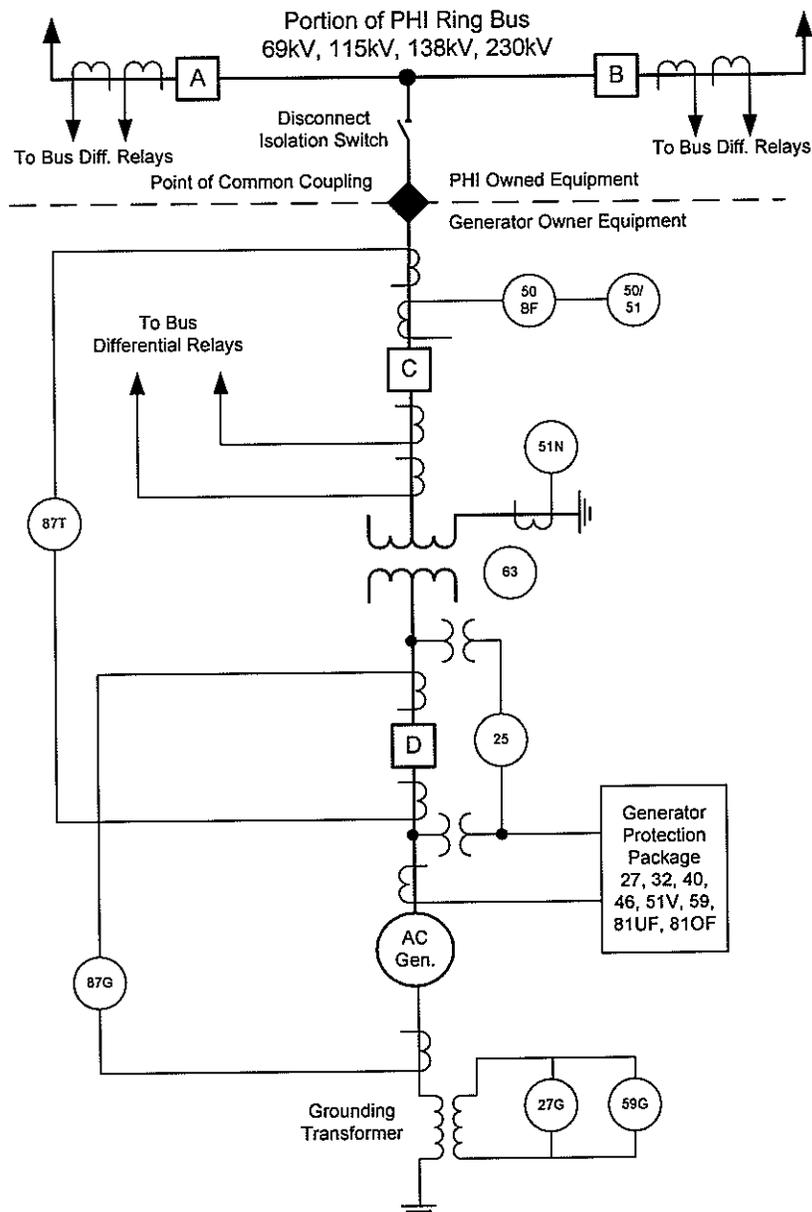
Notes:

- PHI will review directional over current relay settings (67 & 67G) to insure detection of PHI circuit faults. (Relay 67G may not be applicable depending on transformer connection.)
- Breaker A designed to close only to a hot transformer and a dead low side bus.
- Use of induction generators will require the generator owner to take corrective action if the power factor does not meet tariff requirements. The generator owner should consult with PHI regarding the method of power factor correction.
- Transfer trip is needed for line relaying and for breaker failure protection.
- The three 27UV/59OV protective functions are required when the high side of the customer Interface Transformer is connected ungrounded wye or delta. These protective functions are also required for a wye-wye transformer when the generators are ungrounded. These functions provide high speed detection of a grounded high side conductor and thus prevent equipment damage due to high voltage. Three, phase to ground connected 27UV/59OV relays on wye connected PTs are needed in this application.
- PHI may require specific transformer connection to meet area grounding requirements.
- Generator site main high side breaker must include local breaker failure protection with transfer trip initiation to PHI.
- Required metering is not shown.

Generator & Interconnection Protective Functions

Function	Action	Setting
25 Gen. Check Synch	Supervises Brk. B & C Close	Per Generator Manufacturer Limits
27 Gen. Under Voltage	Trips Generator Breaker	Per IEEE 1547 – 2008
32 Gen. Anti-Motoring	Trips Generator Breaker	Per IEEE Std. C37.102 - 2006
46 Gen. Neg. Seq.	Alarm, then Trips Gen. Brk.	Per IEEE Std. C37.102 - 2006
59 Gen Over Voltage	Trips Generator Breaker	Per IEEE 1547 – 2008
51 Gen. Over Current	Trips Generator Breaker	Per IEEE Std. C37.102 - 2006
51G Gen. Ground OC	Trips Generator Breaker	Per IEEE Std. C37.101 - 2006
67 Brk. Dir. Over Current	Trips Breaker A	Set in Consultation with PHI
67G Brk. Dir. Grd. OC	Trips Breaker A	Set in Consultation with PHI
81UF Gen. Under Freq.	Trips Breaker A or B & C	Per IEEE 1547 – 2008
81OF Gen. Over Freq.	Trips Breaker A or B & C	Per IEEE 1547 – 2008
Transfer Trip To Gen.	Trips High Side Breaker	Trip Initiation Set by PHI
High Side 27UV/59OV	Trips Breaker A or B & C	Set in Consultation with PHI

Figure 9, Typical AC Generator Energy Farm 10 MW or Greater on Dedicated Circuit



The PHI Ring Bus portion shown may be an existing substation site or a new substation site specifically constructed for the generator interconnection

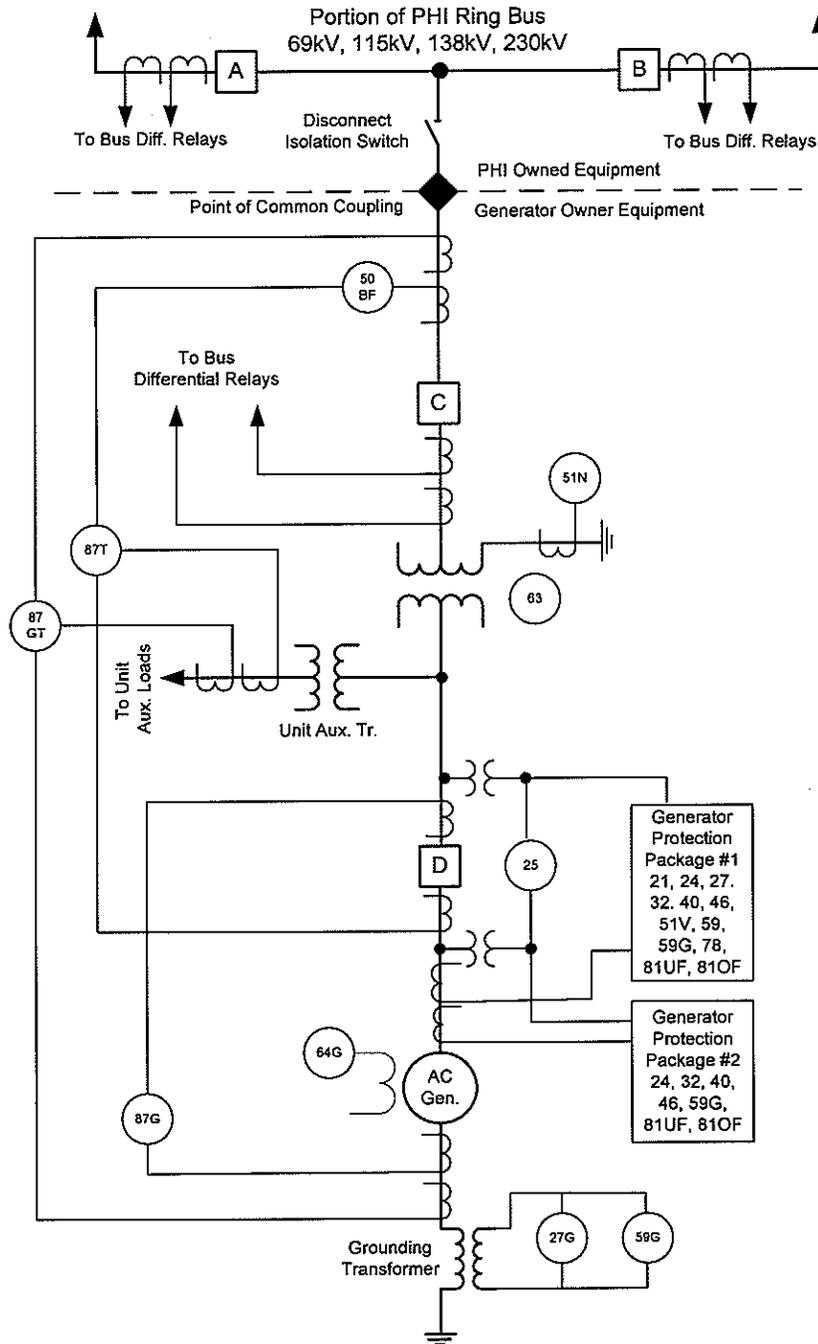
Notes:

1. PHI Bus Section differential relays will trip and lockout PHI Breakers A and B and Generator Owner Breaker C.
2. Breaker failure protection for Generator Owner Breaker C will trip and lockout PHI Breakers A and B.
3. Breaker failure protection for PHI Breakers A and B will trip and lockout Generator Owner Breaker C.
4. Required metering is not shown.

Generator & Interface Protection

Function	Action	Setting
25 Gen. Check Synch	Supervisors Breaker D Close	Per Generator Manufacturer Limits
27 Gen. Under Voltage	Trips Breaker D	Per IEEE 1547 – 2008
27G Grd. 3 rd Harmonic	Trips Breaker D	Per IEEE Std. C37.102 – 2006
32 Gen. Anti-Motoring	Trips Breaker D	Per IEEE Std. C37.102 – 2006
40 Gen. Loss of Field	Trips Breaker D	Per IEEE Std. C37.102 – 2006
46 Gen. Neg. Seq.	Alarm, then Trips Breaker D	Per IEEE Std. C37.102 – 2006
50BF Breaker Failure	Via BF Scheme, Trips A, B, D	Set in Consultation with PHI
50/51 Transf. OC	Trips Breakers C & D	Set in Consultation with PHI
51N Transf. Neut. OC	Trips Breakers C & D	Set in Consultation with PHI
51V Gen. OC Backup	Trips Breaker D	Per IEEE Std. C37.102 – 2006
59 Gen. Over Voltage	Trips Breaker D	Per IEEE 1547 – 2008
59G Gen. Ground OV	Trips Breaker D	Per IEEE Std. C37.101 – 2006
63 Transf. Flt. Pressure	Trips Breakers C & D	Per IEEE Std. C37.91 – 2008
81UF Gen. Under Freq.	Trips Breaker D	Per IEEE 1547 – 2008
81OF Gen. Over Freq.	Trips Breaker D	Per IEEE 1547 – 2008
87G Gen. Differential	Trips Breaker D	Per IEEE Std. C37.102 – 2006
87T Transf. Differential	Trips Breakers C & D	Per IEEE Std. C37.91 – 2008

Figure 10, Typical AC Synchronous Generator Up to 50 MW



The PHI Ring Bus portion shown may be an existing substation site or a new substation site specifically constructed for the generator interconnection.

Notes:

1. PHI Bus Section differential relays will trip and lockout PHI Breakers A and B and Generator Owner Breaker C.
2. Breaker failure protection for Generator Owner Breaker C will trip and lockout PHI Breakers A and B.
3. Breaker failure protection for PHI Breakers A and B will trip and lockout Generator Owner Breaker C.
4. Backup protection is required for some generator protective functions to meet PJM standards.
5. The Unit Aux. Transformer may have its own protection (Not Shown.)
6. Required metering is not shown.

Generator & Interface Protection

Function	Action	Setting
21 Phase Distance	Trips Breaker D	Per IEEE Std. C27.102 – 2006 & Consultation with PHI
24 Transformer Over Excitation	Trips Breaker D	Per IEEE Std. C37.91 – 2008
64G Gen. Field Ground	Alarm, Then Trip Breaker D	Per IEEE Std. C37.102 - 2006
78 Out of Step Protection	Trips Breaker D	Per IEEE Std. C37.102 - 2006
87GT Transf. & Gen. Diff.	Trips Breakers D and C	Per IEEE Std. C37.102 - 2006

Note: Protective functions not listed can be found on the corresponding Table in Figure 10.

Figure 11, Typical AC Synchronous Generator Greater Than 50 MW

Interconnection Application

- A. The proposed Generator Owner shall submit an Interconnection Application to the Company for approval to connect and operate a generating unit in parallel with the Company Grid. This application should be made as far in advance as possible of the tentative planned in service date. In general, the larger the proposed generating unit, the more lead time is needed to review all aspects of the interconnection and to finalize the Facility design. In addition, those Generator Owners who plan to sell into the PJM market must also submit the necessary applications to PJM and enter the PJM application queue. (The PJM application process is outside the scope of this document and the proposed Generator Owner will have to contact PJM directly on these issues. Information can also be found on the PJM website, www.pjm.com)
- B. Early application submission can also be cost advantageous to the proposed Generator Owner. The PHI Power Delivery System near the proposed generator site may require extensive and costly upgrades in order to accommodate the output of the generator. These upgrade costs may make the proposed site undesirable for the project. Early application should make this adverse information known before the proposed Generator Owner has made extensive design and site purchase/work expenditures.
- C. Early application submission is also advantageous to the Company and assists the Company in meeting the Generator Owner's time schedule. The Company will have to assign resources, do engineering and order material necessary for any Grid upgrades. The earlier this process is started, the easier it is for the Company to meet the Generator Owner's proposed in service date.
- D. The Generator Owner shall complete an Interconnection Application Form and supply as much information as possible. It is realized that some information will probably not be available at the time of the initial application submission. However, the Generator Owner should supply as much information and details as possible and forward other necessary information as soon as it becomes available.
- E. A One-Line Diagram for the entire proposed Facility shall accompany the Interconnection Application. The diagram shall include details on the connection and rating of all equipment and show all protective schemes. In addition, transformer and generator impedance characteristics and dynamic modeling data must be submitted. (See Appendix B)
- F. Details on how the proposed Facility is to be operated and the anticipated range of power to be exported into the Company Grid should be included with the Interconnection Application.
- G. The Company reserves the right to request additional data, information details and drawings necessary to fully review the proposed Facility and to insure coordination of all equipment with the Company Grid.
- H. Following submission of the Interconnection Application, the Company, the Generator Owner and the Generator Owner's technical consultants will institute a series of meetings to review and discuss the proposed Facility. The comments and feedback from the Company at these meetings will enable the Generator Owner to finalize his design and operating requirements.
- I. In addition to reviewing the data, drawings and specifications provided by the Generator Owner, the Company may elect to physically inspect the Generator Owner's site during and after construction to insure adherence to the information supplied.
- J. All protection, control schemes, metering and RTU operations must be functionally tested and operating correctly before the Company can approve the Interconnection.
- K. The Company reserves the right to witness testing of the Generator Owner's protection and control schemes and to request copies of any test data/results. In witnessing any testing, the Company assumes no liability as the full responsibility of Facility operation and protection rests with the Generator Owner.

- L. The Generator Owner can interconnect with the Company Grid and commence parallel operation only after the Company has provided written approval to interconnect.

References

The references and standards listed below can provide technical requirements, support and insight into the safe, reliable interconnection of parallel generation with the PHI Power Delivery Grid. It is suggested that those individuals and firms contemplating operation of parallel generation with the Company review these references for applicability to their installation. This listing is not intended to be all-inclusive.

- IEEE C2, National Electric Safety Code® (NESC®)
- NFPA 70, National Electric Code® (NEC®)
- IEEE Std. 493-2007, *IEEE Recommended Practice for Design of Reliable Industrial and Commercial Power Systems* (IEEE Gold Book)
- IEEE Std. 519-1992, Second Printing 2004 *IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems*
- IEEE Std. 242-2001, *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* (IEEE Buff Book)
- ANSI Std. C84.1-1995, *Electric Power Systems and Equipment – Voltage Ratings*
- IEEE Std. 1159-1995 (Reaff. 2001), *IEEE Recommended Practice for Monitoring Power Quality*
- IEEE Std. 929-2000, *IEEE Recommended Practice for Utility Interface of Photovoltaic (PV) Systems*
- ANSI/IEEE Std. C37.1-2007, *IEEE Standard for SCADA and Automation Systems*
- IEEE Std. C37.2-2008, *IEEE Standard for Electric Power System Device Function Numbers, Acronyms and Contact Designations.*
- IEEE Std. C37.90-2005, *Standard for Relays and Relay Systems Associated with Electric Power Apparatus*
- IEEE Std. C37.90.1-2002, *Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems Associated with Electric Power Apparatus.*
- IEEE Std. C37.91-2008, *IEEE Guide for Protecting Power Transformers*
- IEEE Std. C37.93-2004, *IEEE Guide for Power System Protective Relay Applications of Audio Tones over Voice Grade Channels*
- IEEE Std. C37.95-2002, *IEEE Guide for Protective Relaying of Utility Consumer Interconnections*
- IEEE Std. C37.101-2006, *Guide for Generator Ground Protection*
- IEEE C37.102-2006, *Guide for AC Generator Protection*
- IEEE C37.103-2004, *Guide for Differential and Polarizing Relay Circuit Testing*

- IEEE C37.104-2002, *IEEE Guide for Automatic Reclosing of Line Circuit Breakers for AC Distribution and Transmission Lines*
- IEEE C37.106-2003 (Reaff. 2009), *Guide for Abnormal Frequency Protection of Power Generating Plants*
- IEEE Std. C37.110-2007, *Guide for the Application of Current Transformers Used for Protective Relaying Purposes*
- IEEE Std. C37.113-1999 (Reaff. 2004), *Guide for Protective Relaying Applications to Transmission Lines*
- IEEE C37.230-2007, *IEEE Guide for Protective Relaying Applications to Distribution Lines*
- IEEE C37.234-2009, *IEEE Guide for Protective Relay Applications for Power System Busses*
- IEEE Std. C57.13.1-2006, *Guide to Field Testing of Relaying Current Transformers*
- IEEE Std. C57.13.2-2005, *Standard Conformance Test Procedures for Instrument Transformers*
- IEEE Std. C57.13.3-2005, *Guide for the Grounding of Instrument Transformer Secondary Circuits and Cases*
- IEEE 100-2000, *IEEE Authoritative Dictionary of IEEE Standard Terms*
- IEEE Std. 141-1993, *Recommended Practice for Electric Power Distribution for Industrial Plants* (IEEE Red Book)
- IEEE Std. 1001-1988, *Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems*
- IEEE Std. 1021-1988, *IEEE Recommended Practices for Utility Interconnection of Small Wind Energy Conversion Systems*
- IEEE Std. 1547-2003 (Reaff. 2008), *Standard for Distributed Resources Interconnected with Electric Power Systems*
- IEEE Std. 1547.1-2005, *IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems*
- IEEE Std. 1547.2-2008, *IEEE Application Guide for IEEE 1547*
- IEEE Std. 1547.3-2007, *IEEE Guide for Monitoring, Information Exchange and Control of Distributed Resources Interconnected with Electric Power Systems.*
- IEEE Std. P1547.4/D10.0 *Draft Guide for Design, Operation and Integration of Distributed Resource Island Systems with Electric Power Systems.*
- UL Subject 1741, 2005, *Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources.*
- *PJM Protective Relaying Philosophy and Design Standards*
- *PJM Relay Testing and Maintenance Practices*
- *PJM Transmission Substation and Line Design, Application and Maintenance Guidelines*

- *NERC & RFC Planning Standards*

APPENDIX A

PHI POWER DELIVERY GENERATOR PROTECTION GUIDELINES FOR UNITS 50 MW and ABOVE

The following discussion and guidelines are intended to be a basis for considering what protection to apply to both new units and those being upgraded. The *PJM Relay Subcommittee Protective Relaying Philosophy and Design Standards* document is the basis for these guidelines.

Some specific protection applications may also be required as the result of consultation with the generator manufacturer.

Generator protection, like that on transmission lines, buses and transformers should be designed for reliability. This means an artful balance of dependability and security. Dependability is a measure of the protective relaying systems certainty to trip when required and security a measure of the ability not to trip falsely. The balancing of these two requirements involves consideration of independent ac current and voltage sources to the front line and backup relay schemes. Also independently protected dc control circuits should be used with the front-line and backup relay schemes.

In those cases which follow, if the need for both front-line and backup relays is not defined, one protective scheme will be adequate.

1.0 Generator Stator Fault Protection

1.1 General Consideration

Generator stator faults are very serious and cause costly damage. Because of the obvious importance of generators, the fault must be detected and cleared in the least amount of time possible. Because of the stored rotating energy of the generator, damage may occur after all the required breakers have been tripped.

1.2 Phase Fault Protection

Use a front-line current differential relay scheme and an independent backup differential scheme with independent current sources and independently protected dc control circuits. Each of these schemes should trip the generator breakers, excitation system and turbine valves.

1.3 Ground Fault Protection

High impedance grounding of generators is an accepted industry practice. This is done to limit the magnitude of ground fault current. Ground fault protection should include two independent relay schemes, employing independent current or voltage sources and independently protected dc control circuits. Each scheme should trip the generator breakers, excitation system and turbine valves.

2.0 Generator Rotor Field Protection

The generator rotor field winding is ungrounded. One ground on this field will not effect the generator's operation. The first ground, however, greatly increases the likelihood of a second ground occurring, causing imbalances and overheating. Generators should be equipped with rotor ground fault protection which will alarm only. Upon receipt of this alarm, the generator's load should be reduced to zero and the generator shut down as quickly as possible.

3.0 Generator Abnormal Operating Conditions

3.1 Loss of Field

Loss of field (loss of excitation) will result in loss of synchronism. Detection of this loss of field is usually done with impedance type relays. A front-line and independent backup scheme is required with each providing a simultaneous trip of the generator breakers, excitation system and turbine valves.

3.2 Unbalanced Currents

Unbalanced, or negative sequence currents, are the result of unbalanced loading. This could be the result of one phase open or unbalanced system faults which are not cleared properly. The unbalanced currents themselves cause generator rotor overheating. Protection requires a negative sequence time over current relay with sensitivity sufficient to detect unbalanced conditions exceeding the continuous rating of the generator. The protection should initiate an alarm at one level and a unit trip at a higher level.

3.3 Loss of Synchronism

Loss of synchronism, out of step and pole slipping are all synonymous and can result from transients, dynamic instability or loss of excitation. This condition can be damaging to the unit. Detailed stability studies can determine if out of step protection is required. As a rule, if an impedance swing enters the generator or step up transformer impedance, out of step protection is necessary. When out of step protection is required, the generator should be tripped within the first slip cycle.

3.4 Over Excitation

Excessive flux (over excitation) in the generator core can cause rapid overheating. Volts/Hertz is a measure of this condition. Two independent schemes should be used, each providing protection for the volts/hertz rating of the generator. An initial alarm followed by a simultaneous trip of the generator breakers, excitation system and turbine valves is recommended.

3.5 Reverse Power (Anti-Motoring)

Generator motoring is caused by the lack of energy supplied to the prime mover resulting in the electrical system driving the machine as a motor. Synchronous motoring will not damage the generator, but will cause damage to the prime mover. Anti-motoring protection should initiate an alarm which will be followed after a defined time by a unit trip (generator breakers, excitation system and turbine valves).

3.6 Abnormal Frequencies

Generators can withstand off frequency operation for long periods of time, provided the load and voltage are reduced a sufficient amount. The turbine, however, can be subject to resonance caused by the off frequency operation. The usual frequency excursion is to a lower than 60 hertz operation. Automatic system wide load shedding is the primary protection against this condition. For protection of the turbine, under frequency relays set at 57.5 hertz and a five second tripping delay are required. For security, two under frequency relays connected in series for tripping and using independent voltage sources should be used. A sequential trip of the turbine valves, the excitation system and generator breakers are recommended.

4.0 Generator Breaker Failure Protection

Breaker failure protection must be provided for all relay initiated generator trips. It should be noted that all generator abnormalities that require the generator to be tripped will not result in an over current condition (off frequency, unbalanced currents, etc.). For these conditions, current actuated fault detectors lack sensitivity to monitor breaker open/close status and breaker auxiliary switches should be used instead.

5.0 Excitation System Tripping

All protective relay trips of the generator excitation system should trip redundant systems. This could be tripping the main field breaker and exciter field or simultaneous tripping of the main field breaker and activation of the de-excitation system.

6.0 Generator Open Breaker Flashover Protection

Open breaker flashover is more likely on generator breakers. Protection for this must be provided for all gas and/or air circuit breakers.

7.0 Protection During Start Up or Shutdown

During start up or shutdown the generator may be operated at less than rated frequency. During this time, adequate protection must be provided. Some relays, however, are frequency sensitive. Each of the relays' operating characteristics versus frequency must be checked to ensure proper operation at frequencies below 60 Hz. If relay operation is questionable, additional protective relaying will have to be added.

8.0 Protection for Accidentally Energizing a Generator on Turning Gear

Accidental energizing of a generator while off line or on turning gear has become of increasing concern in recent years. Severe damage to the generator can occur in a very short time. To provide adequate protection for accidental energization, a scheme designed specifically for this is required. This scheme must trip all associated generator breakers.

9.0 Synchronizing Equipment

Each generator should be equipped with a scheme that supervises manual synchronizing. For system emergency restoration, the generator breakers should be capable of closing on a dead system.

10.0 Generator Lead Protection

The generator lead, in other words, the phase conductors from the generator terminals to the unit power transformer and the unit auxiliary transformer should be protected by a primary current differential relay scheme. A backup differential relay scheme is required if:

- 1) The conductors are not segregated into bus ducts for their entire exposure, or
- 2) The generator is not grounded through a high impedance to limit ground faults to levels undetectable by current differential relays.

A simultaneous trip of the generator breakers, excitation system and turbine valves are recommended.

APPENDIX B

Information To Be Supplied By Generator Owner

The following information must be supplied by the Generator Owner to allow the Company to conduct necessary studies and reviews to assess the impact of the proposed Facility on the PHI Power Delivery System and to quantify what, if any, upgrades are required to accommodate the proposed generation addition at the specified Point of Common Coupling.

It is recognized that some information will not be available at the time of initial application submission. However, the Generator Owner should supply as much information and detail as possible and forward other necessary information as soon as it becomes available.

At the very least, data requested in Sections A through G, H1 and L should accompany the initial application submission.

- A. Name of Generator Owner
- B. Name, address, telephone number, and E-mail address of individual able to answer technical questions relating to the design and operation of the proposed Facility
- C. Exact location of proposed Point of Common Coupling
- D. Type (Synchronous, Induction, Inverter, etc), and rating of proposed generator(s)
- E. Estimated maximum and minimum Facility load at Point of Common Coupling with generation in service
- F. Estimated maximum and minimum Facility load at Point of Common Coupling without generation in service
- G. Estimated maximum power anticipated to be exported into the PHI Power Delivery System
- H. The Generator Owner shall provide copies of the following drawings to the Company for their review:
 - 1. A one line diagram of Facility.
 - 2. All potential elementary drawings associated with the protection and control schemes for the generator and interconnection equipment.
 - 3. All current elementary drawings associated with the protection and control schemes for the generator and interconnection equipment.
 - 4. A control elementary of the generator breaker and the interconnection breaker.
 - 5. A three line diagram of generation system.

I. The One Line Diagram And Three Line Diagram shall include the following information:

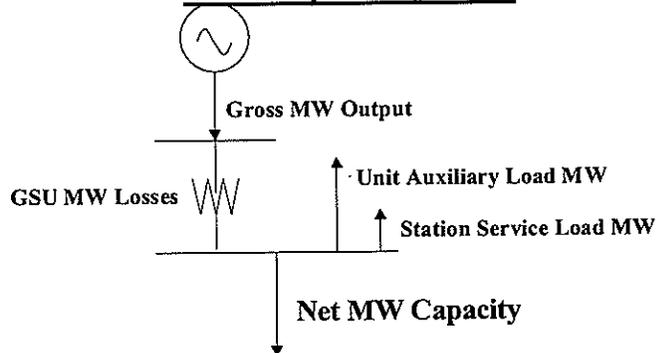
1. Equipment names and/or numerical designations for all circuit breakers, contactors, air switches, transformers, generators, etc. associated with the generation as required by the Company to facilitate switching.
2. Power Transformers – name or designation, nominal kVA, nominal primary, secondary, tertiary voltages, vector diagram showing winding connections, tap setting and transformer impedance. A copy of the transformer nameplate and test report can be substituted.
3. Station Service Transformers – Designate phase(s) connected to and estimated kVA load.
4. Instrument Transformers – Voltage and current, phase connections.
5. Surge Arresters/Gas Tubes/Metal Oxide Varistors/Avalanche Diode/Spill Gaps/Surge Capacitors, etc. – Type and Ratings.
6. Capacitor Banks – kVAR rating.
7. Disconnect Switches – Indicate status normally open with a (N.O.) and whether manual or motor operated. Include switch voltage, continuous and interrupting ratings.
8. Circuit Breakers and/or Contactors – Interrupting rating, continuous rating, operating times.
9. Generators(s) – Include nameplate , test report, type, connection, kVA, voltage, current, rpm, PF, impedances, time constants, etc.
10. Point of Common Coupling with the PHI Power Delivery System and phase identification.
11. Fuses – Manufacturer, type, size, speed, and location.

J. Elementary Diagrams shall include the following information:

1. Terminal designation of all devices – relay coils and contacts, switches, transducers, etc.
2. Relay functional designation – per latest ANSI Standard. The same functional designation shall be used on all drawings showing the relay.
3. Complete relay type (such as CV-2, SEL321-1, REL-301, IJS51A, etc.)
4. Switch contact shall be referenced to the switch development if development is shown on a separate drawing.
5. Switch developments and escutcheons shall be shown on the drawing where the majority of contacts are used. Where contacts of a switch are used on a separate drawing, that drawing should be referenced adjacent to the contacts in the switch development. Any contacts not used should be referenced as spare.
6. All switch contacts are to be shown open with each labeled to indicate the positions in which the contact will be closed.

7. Explanatory notes defining switch coordination and adjustment where mis-adjustment could result in equipment failure or safety hazard.
 8. Auxiliary relay contacts shall be referenced to the coil location drawing if coil is shown on a separate drawing. All contacts of auxiliary relays should be shown and the appropriate drawing referenced adjacent to the respective contacts.
 9. Device auxiliary switches (circuit breakers, contactor) should be referenced to the drawing where they are used.
 10. Any interlocks electromechanical, key, etc., associated with the generation or interconnection substation.
 11. Ranges of all timers and setting if dictated by control logic.
 12. All target ratings; on dual ratings note the appropriate target tap setting.
 13. Complete internal for electromechanical protective relays. Microprocessor relays may be shown as a "black box", however, manufacturer's instruction book number shall be referenced and terminal connections shown.
 14. Isolation points (states links, PK-2 and FT-1 blocks), etc., including terminal identification.
 15. All circuit elements and components, with device designation, rating and setting where applicable. Coil voltage is shown only if different from nominal control voltage.
 16. Size, type, rating and designation of all fuses.
 17. Phase sequence designation as ABC or CBA.
 18. Potential transformers – nameplate ratio, polarity marks, rating, primary and secondary connections (see Guidelines for minimum ratings.)
 19. Current transformers (including auxiliary CTs) – polarity marks, rating, tap ratio and connection.
- K. Documentation of all protective device settings shall be provided. The setting documentation shall also include relay type, model/catalog number and setting range. If automatic transfer schemes, unique or special protective schemes are used, a description of their operation should be included. The Company must review and approve the settings of all protective devices and automatic control equipment which: (1) serve to protect the PHI Power Delivery System from hazardous currents and voltages originating from the Facility or (2) must coordinate with protective devices or control equipment located on the PHI Power Delivery System.
- L. The following modeling data must be supplied to the Company and/or PJM to allow necessary interconnection studies to be performed. It is recognized that some of this data may initially be preliminary in nature. Interconnection studies will be based on data submitted. Any changes or modifications to this data after the interconnection study has been completed may render the analysis invalid and require re-opening of the interconnection study. It is the Generator Owners responsibility to make the Company and/or PJM aware of any changes to this data, and to provide final certified test reports and modeling data as soon as it is available.

Unit Capability Data



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

PJM Queue Letter/Position/Unit ID: _____

Primary Fuel Type: _____

Maximum Summer (92° F ambient air temp.) Net MW Output: _____

Maximum Summer (92° F ambient air temp.) Gross MW Output: _____

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

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

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

Gross Reactive Power Capability at Maximum Gross MW Output (Leading and Lagging): _____

***** Please submit Reactive Capability Curve when available**

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): _____

Please provide any comments on the expected capability of the unit:

Unit Generator Dynamics Data

PJM Queue Letter/Position/Unit ID: _____

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

Nominal Power Factor: _____

Terminal Voltage (kV): _____

Unsaturated Reactances (on MVA Base)

Direct Axis Synchronous Reactance, $X_{d(i)}$: _____

Direct Axis Transient Reactance, $X'd(i)$: _____

Direct Axis Sub-transient Reactance, $X''d(i)$: _____

Quadrature Axis Synchronous Reactance, $X_{q(i)}$: _____

Quadrature Axis Transient Reactance, $X'q(i)$: _____

Quadrature Axis Sub-transient Reactance, $X''q(i)$: _____

Stator Leakage Reactance, X_l : _____

Negative Sequence Reactance, $X_{2(i)}$: _____

Zero Sequence Reactance, X_0 : _____

Saturated Sub-transient Reactance, $X''d(v)$ (on MVA Base): _____

Armature Resistance, R_a (on MVA Base): _____ at _____ °C

Time Constants (seconds)

Direct Axis Transient Open Circuit, T'_{do} : _____

Direct Axis Sub-transient Open Circuit, T''_{do} : _____

Quadrature Axis Transient Open Circuit, T'_{qo} : _____

Quadrature Axis Sub-transient Open Circuit, T''_{qo} : _____

Inertia, H (kW-sec/kVA, on KVA Base): _____

Speed Damping, D : _____

Saturation Values at Per-Unit Voltage [$S(1.0)$, $S(1.2)$]: _____

Please submit generator certified test report information when available

IEEE dynamic model parameters:

Governor Model: _____

Exciter Model: _____

Power System Stabilizer Model: _____

Unit Transformer Data

PJM Queue Letter/Position/Unit ID: _____

Generator Step-up Transformer MVA Base: _____

Generator Step-up Transformer Impedance ($R+jX$, on transformer MVA Base): _____

Generator Step-up Transformer Rating (MVA): _____

Generator Step-up Transformer Low-side Voltage (kV): _____

Generator Step-up Transformer High-side Voltage (kV): _____

Generator Step-up Transformer Off-nominal Turns Ratio: _____

Generator Step-up Transformer Number of Taps and Step Size: _____

Please submit transformer certified test report information when available

In addition, please indicate whether the transformer is shared with other units.