

## 1.0 General

This document standardizes the technical requirements for interconnection of Distributed Generation (DG) equipment to the Vineland Municipal Electric Utility (VMEU) Distribution facilities in all sizes to a maximum of 4,000 kW, and up to 2,000 kW for net metered. After VMEU reaches 50 MW of distributed generation connected to its electric system, additional distributed generation or net metering will no longer be accepted. VMEU will establish a secondary queue for customers who wish to install DG after a feeder or the system has reached its allotment. Refer to Section 4.2 for more information on net metering availability. In addition, this document also contains a standardized application process and a standardized interconnection agreement for facilities with distributed generation. (All references to kW or MW are in AC.<sup>1</sup>)

**Generation not operating in parallel, i.e. isolated from VMEU grid, does not qualify for interconnection under these terms.**

## 2.0 Scope

This set of interconnection requirements defines the application process, technical interconnection requirements and agreement elements for interconnecting new distributed generation facilities to **Sub-transmission Circuits, Primary Distribution Circuits and to Customer Secondary Services.**<sup>1</sup> This document addresses only those points in which the customer, developer, operator, equipment manufacturer and the utilities have a mutual interest and is primarily directed toward the safety aspects of the interconnected distributed generator. **This document also provides for an expedited streamlined approval process for small Distributed Resources (less than 50 kW) that utilize Solar Photovoltaic or Wind Technology and qualify for Net Metering under VMEU rules.**

**If the Applicant is proposing the interconnection of equipment that would normally qualify under the Net Metering program but the tariffed service is not RS or GLP, VMEU will permit the filing of the expedited application form (Appendix B) and will waive the Insurance Requirements described in Section 5.0.**

The Distributed Generator may also need to get approval from other entities, including but not limited to the PJM Interconnection, Atlantic City Electric (ACE), NJ Department of Environmental Protection (NJDEP), and the Federal Energy Regulatory Commission (FERC) depending on size and power export plan. This document does not address the policies and procedures of any organization outside of VMEU.

<sup>1</sup> See Glossary for definition.

## 3.0 Application Process

**Key Steps in the Application Process for the Interconnection of New Distributed Generation Connected to Primary Distribution Circuits and to**

## Customer Secondary Services Operating in Parallel with the VMEU Grid (General Guidelines)

### Introduction

This section outlines a framework for processing interconnection applications and ensuring that applicants are aware of the VMEU's Standardized Interconnection Requirements (SIR), as described in **Section 5**. This section Provides applicants with an understanding of the process and information required to permit VMEU to review and accept the applicants' equipment for interconnection in a reasonable and expeditious manner.

The time required to complete the process will reflect the complexity of the proposed project. Projects using previously submitted designs that have been satisfactorily **Type tested**<sup>1</sup> will move through the process more quickly, and several steps may be satisfied with an initial application depending on the detail, completeness of the application, and supporting documentation submitted by the applicant. Applicants submitting Type tested systems, however, are not exempt from providing VMEU with a complete design package necessary to verify the electrical characteristics of the generator system, the interconnecting device, and the impacts of the applicants' equipment on the utilities' systems. The application process and associated services are offered by VMEU on a non-discriminatory basis. The applicant is responsible for those costs that VMEU would not have incurred but for the applicants' interconnections.

### 3.1 Application Process for Qualified Net Metering Installations 50 kW or Less (Commercial or Residential)

Applications for small residential, commercial or industrial distributed generation systems less than 50 kW shall strictly adhere to the requirements outlined in the National Electrical Code NFPA-70-2017, list all proposed equipment.

- 1) Prior to fully filing an interconnection application, with appropriate fees, you must request an Interconnection Verification Study. This verification document will:
  - a. Provide the applicant with the maximum allowable interconnection size based on circuit capacity (based on forecasted and historical information) in kWAC. The circuit will be labeled as one of the following:
    - i Open – VMEU allows 90% of the average of either the last one or three years, whichever is lower for residential applicants, and 90% of the last 12 months peak demand for commercial customers.
    - ii Limited – Circuit is reliably at its injection capacity. VMEU will allow an interconnection of 5kw or less.
    - iii Closed – Circuit interconnection is not available.
  - b. Provide the applicant with a queue position for 4 weeks from date of Verification. Should an applicant proceed to step 2, this position will transfer to

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<sup>1</sup> See Glossary for definition

the Application process and be held for 6 months from date of application. After 4 weeks, the queue position will be lost.

To request an Interconnection verification, completely fill out and have signed, Appendix E. This process takes approximately 10 business days to complete.

- 2) Prior to installation of a qualified net metered system (50 kW or less), applicants must submit a fully completed Net Metering Application (see Appendix B) to VMEU, as well as the Customer Service Agreement (Appendix F) and Application Fee.
- 3) After VMEU receives the completed application and applicable fees, it will conduct the appropriate review and inform the applicant if it can proceed with the interconnection, or if a more detailed interconnection study is required (see Step 4 below). This process can take up to 30 days and may require additional information outside of what is requested initially in Appendix B. VMEU performs an in depth system performance and reliability study to determine an applicant's maximum installation value. If an applicant is located on a closed feeder, no interconnection will be permitted.
- 4) After the applicant has received permission to interconnect from VMEU, has completed the installation and has received the appropriate municipal inspection, the applicant must submit a fully completed and signed application (all pages) to VMEU. This application must include the signature of the local inspection official, or a copy of the approved municipal inspection certificate.
- 5) The following sections apply to Net Metering 50 kW or less installations:
  - a. **4.2** Metering
  - b. **4.2.1** Net Metering
  - c. **4.3** Grounding
  - d. **4.6** Disconnect switch or device
  - e. **4.7** Power Quality
  - f. **4.10.1 A** Compliance with IEEE 929-2000
  - g. **4.10.2** Verification Testing
  - h. **4.12** Connections to Network Systems

### **3.2 Application Process for Qualified Non-Net Metering Installations 50 kW or Less (Commercial or Residential), and greater than 50kW**

#### **STEP 1 - Initial Communication from the Applicant**

Communication will range from a general inquiry to a completed application. The applicant should supply as much technical information as possible. At this point in the application process VMEU shall make the determination on whether the proposed installation is an application that qualifies for VMEU net metering (**See Section 4.2.1 and Section 3.1**) or is an application for a conventional form of Distributed Generation. If the Applicants proposed unit is not a qualified

net metering unit of 50 kW or less and it is the intention of the applicant to export power or to sell power to VMEU, then the VMEU shall also review the application and determine what type of interconnection, if any is appropriate.

For **Non Net Metering Qualified Systems** Applications for small residential, commercial or industrial distributed generation systems less than 50 kW, applicants shall strictly adhere to the requirements outlined in the National Electrical Code NFPA-70-2017, list all proposed equipment and also include an interconnection diagram signed and sealed by a licensed New Jersey Electrical Contractor.

Applications for all commercial or industrial distributed generation systems greater than 50 kW shall strictly adhere to the requirements outlined in the National Electrical Code NFPA-70-2017, where applicable, the National Electrical Safety Code IEEE C2-2017, include a listing of all proposed equipment and include a one line control /interconnection diagram signed and sealed by a licensed New Jersey Professional Engineer.

## **STEP 2 - The Inquiry is reviewed by VMEU to Determine the Nature of the Project.**

A VMEU representative shall discuss the scope of the project with the potential applicant (either by phone or in person) to determine what specific information and documents (such as an application, agreement, technical requirements, specifications, listing of qualified Type tested equipment/systems, application fee information, applicable rate schedules and metering requirements) will be required by the applicant. The preliminary technical feasibility of the project at the proposed location may also be discussed at this time. All such information, and a copy of this application, will be sent to the applicant in no more than twenty (20) business days following the initial communication from the applicant. A VMEU representative will serve as the single point of contact for the applicant in coordinating the project.

## **STEP 3 - Filing an Application**

Applicants for wind or solar photovoltaic net metering installations of 50 kW and less must file an application in the form of **Appendix B** as described in Step 1A. Applicants for wind or solar photovoltaic installations greater than 50 kW, and all other proposed installations, shall file an application in the form of **Appendix C**. The filing must include a completed application form, a Customer Service Agreement (**Appendix G**) and/or other information as indicated in **STEP 2**. Within thirty (30) business days of receiving the application, VMEU will notify the applicant of receipt and whether the application has been completed adequately. Several exchanges of information between VMEU and applicant might occur until the application has been completed according to VMEU's technical requirements for interconnection. VMEU will review all applications over 50 kW and may restrict systems sized over 50 kW due to available distribution feeder capacity. VMEU feeder sizing prohibits installations above 4,000 kW or those installations that represent, along with all distributed generation on the circuit where the applicant proposes to install the distributed generation that have a capacity rating of greater

than 1/3 of the circuit load. Maximum size for net metering is 2,000 kW. The amount of distributed generation VMEU will accept is 50 MW. Applicant's application & payment of application fees will hold the applicant's position in the approval queue for one year. If the project has not been completed during that period the applicant will lose the queue position. After the 50 MW allotment of distributed generation is filled no further applications will be approved unless approved applicants drop out. In addition, VMEU will establish a secondary queue for customers who wish to install DG after a feeder or the system has reached its allotment. Residential and small commercial applications of 5 kW or less are exempt from the allotment.

#### **STEP 4 – Preliminary Coordinated Interconnection Review and Cost Estimate Development**

Upon completion of the application, VMEU will conduct a preliminary Coordinated Interconnection Review<sup>2</sup> and will inform the applicant of any necessary VMEU system additions/modifications, and of any agreement requirements which VMEU may require for interconnection. Applicant will be provided with an assessment of the technical feasibility of the proposed interconnection, a preliminary schedule, and a good faith, detailed estimate of the interconnection costs, if applicable agreement elements might include a parallel interconnection agreement, coverage of interconnection costs, agreement to tariff conditions, requirements for design, and O&M specifications.

Depending on unit size, export capability, and or circuit characteristics, a full Coordinated Interconnection Review may need to be performed by VMEU to determine if the new generation on the circuit results in any relay coordination, fault current, and/or voltage regulation problems.

#### **A full Coordinated Interconnection Review may not be needed if:**

- The aggregate generation is less than 50 kW on a single-phase branch of a distribution circuit; or
- The proposed installation is not interconnected to a Network System; or
- The proposed generator has no power export capability.

**For Net Metering qualified units 50 kW or less whose total output is less than the 90% of maximum demand of the customer and meets the criteria listed above, the study fee may be waived.**

**Note:** Units without export capability must either be sized for 50% or less of peak facility demand or be equipped with Reverse Power Relays to prevent power export into the VMEU System.

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<sup>2</sup> See Glossary for definition

**Framework for Standardized Interconnection Study Costs for Net Metered Qualified Systems that do not meet the criteria outlined above:** The following are "standardized" study costs for customers seeking to interconnect net metering qualified systems to VMEU's Electric Distribution System, when such Distributed Generation systems (individually or in aggregate) meet the criteria specified below. These charges would be in addition to any application fee.

1) For requests to interconnect (i) single phase systems on single phase branches where the total aggregate generation is greater than 50 kW but less than or equal to 100 kW, or (ii) single phase and 3 phase systems on 3 phase feeders where the total aggregate generation is greater than 150 kW but less than or equal to 300 kW, the study cost may be up to, but not exceed, the cost of 3 man-days of study labor at the current VMEU loaded labor rate.

As an example, for VMEU this cost would not exceed \$2,880 (based on the current loaded labor rate). These charges will be based on actual time incurred up to the maximum cost.

2) Requests to interconnect any generation up to 100 kW for network service installations may incur a maximum study cost based on 5 man-days of study labor at the current VMEU loaded labor rate. As an example, for VMEU this cost would not exceed \$4800 (based on the current loaded labor rate). These charges will be based on actual time incurred up to the maximum cost. (Note: depending on the proposed size of the unit and the data available for the network, this cost to the customer may be significantly less than this maximum amount). Study costs for proposed installations that fall outside of the "standards" will be estimated for the facility owner before any work is performed and billed at VMEU's loaded labor rate.

3) Requests for network interconnection larger than 100 kW by commercial/industrial generators designed for export of power service (merchant plant) installations shall be subject to all study costs and charges based on utilization of the VMEU distribution and sub-transmission system. Additionally, they may be required to enter contracts with other parties.

The following charges shall apply to generators larger than 100 kW designed for export of power to PJM:

- Application fee of \$500 for initial project review.
- VMEU interconnection study costs based on current loaded labor rates.
- System upgrade charges for all costs required to build distribution/transmission facilities to meet the anticipated needs of the merchant plant.
- Applicable VMEU tariffs designed for net metering and/or merchant plant operation. These tariffs may include decoupling of existing tariffs and may include uplift tariffs based on existing VMEU system capacity and investment.
- Atlantic City Electric Company contracts or agreements and associated interconnection study and facilities fees.
- PJM contracts or agreements and associated queue position and interconnection fees.

**STEP 5 - Applicant Commits to VMEU's Coordinated Interconnection Review of the Project Design.**

If discussions with the applicant, review of the application or review of the proposed design indicate a major impact on the interconnected VMEU facilities. The applicant will be required to:

- Provide VMEU with a cost-based advance payment for the VMEU review of the proposed generator.
- Submit a detailed design package.
- Confirm with VMEU a mutually agreeable schedule for the project based on the applicant's work plans and the discussions held in **STEP 4**.

Additional exchanges of information between VMEU and the applicant may be required to complete the design package according to VMEU's technical requirements for interconnection.

**STEP 6 – VMEU Review of Applicant's Design Package** VMEU will:

Conduct a review of the design package to ensure that the plans / design satisfy the technical requirements for interconnection.

Upon completion of the review, notify the applicant of its final acceptance of the applicant's design **or** an explanation of the technical requirements the design fails to meet. In addition, this notice will include any site-specific test requirements applicable to **STEP 9**.

For Type tested systems, VMEU will complete its review in ninety (90) days.

**STEP 7 - Applicant Commits to VMEU Construction of VMEU's System Modifications**

The applicant will:

- Execute a standardized interconnection agreement or commit in writing to the applicable tariff requirements; and
- Provide VMEU with an advance payment for VMEU's estimated costs associated with system modifications, metering, and on site verification. (Estimated costs will be reconciled with actual costs in **Step 11**.)

**STEP 8 - Project Construction**

The Applicant's facility will be constructed in accordance with VMEU accepted design. VMEU will commence construction/installation of system modifications and metering requirements. VMEU system modifications will vary in construction time depending on the extent of work and equipment required. The schedule for this work is to be discussed with the applicant in **STEP 5**.

**STEP 9 - The Testing of the Applicant's Facility in Accordance With VMEU's Technical Requirements.**

The applicant will develop a written testing plan to be submitted to VMEU for review and acceptance. This testing plan will be designed to verify compliance of the facility with the applicant's VMEU accepted drawings and details of the interconnection. The final testing will

include testing in accordance with the SIR and the site-specific requirements identified by VMEU in **STEP 6**. The final testing will be conducted at a mutually agreeable time, and VMEU shall be given the opportunity to witness the tests.

#### **STEP 10 - Interconnection**

The applicant's facility will be allowed to commence parallel operation upon satisfactory completion of the tests in **STEP 9**. In addition, the applicant must have complied with VMEU's contractual, tariff, and/or technical requirements.

#### **STEP 11 - Final Acceptance and VMEU Cost Reconciliation**

Within 30 days after interconnection, VMEU will review the results of its on-site verification and issue to the applicant a formal letter of acceptance for interconnection. VMEU will also reconcile its actual costs related to the applicant's project against the application fee and advance payments made by the applicant. The applicant will receive either a bill for any balance due or a reimbursement for overpayment as determined by VMEU's reconciliation.

Commercial operation of the customer's generator will begin after balance due is paid to VMEU or overpayment is refunded to applicant. Failure of the customer to begin construction within one (1) year of receiving VMEU letter of acceptance will cause interconnection approval to be revoked and queue position to be forfeited.

### **4.0 Standardized Interconnection Requirements (SIR)**

#### **4.1.1 Common**

The generator-owner shall provide appropriate protection and control equipment, including **an interrupting device, that will disconnect<sup>3</sup>** the generator in the event that the portion of VMEU system that serves the generator is de-energized for any reason or for a fault in the generator-owner's system. The generatorowner's protection and control equipment shall be capable of disconnecting the generation upon detection of an **Islanding<sup>5</sup>** condition and upon detection of a VMEU system fault.

**Note:** For certain generators without export capability Reverse Power Relays must be used to prevent export. These Reverse Power Relays will also effectively prevent any possibility of **Islanding**.

The generator-owner's protection and control scheme shall be designed to allow the generation, at steady state, to operate only within the limits specified in this proposal for frequency and voltage. Upon request from VMEU, the generator owner shall provide documentation detailing compliance with the requirements set forth in this proposal.

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<sup>3</sup> See Glossary for definition      <sup>5</sup>See Glossary for definition

The specific design of the protection, control and grounding schemes will depend on the size and characteristics of the generator. In addition the facility load level and the characteristics of the particular portion of VMEU's system where the generator-owner is interconnected must also be considered.

**Note:** Additional Islanding protection or Interrupting devices are NOT required for Net Metering Qualified <10 kW units that are compliant to IEEE 929-2000.

#### **4.1.2 Single Phase and Three Phase Generators and Inverters with an aggregate capacity of 100 kW and Less**

The generator-owner shall have, as a minimum, an interrupting device(s) sized to meet all applicable local, state and federal codes and operated by over and under voltage protection (installed in each phase and wired phase to ground), as well as additional loss of phase protection. The interrupting device(s) shall also be operated by over and under frequency protection.

- The interrupting device shall automatically initiate a disconnect sequence from VMEU system within six (6) cycles if the voltage falls below 60 V RMS phase to ground (nominal 120 V RMS base) on any phase.
- The interrupting device shall automatically initiate a disconnect sequence from VMEU system within two (2) seconds if the voltage rises above 132 V RMS phase to ground or falls below 104 V RMS phase to ground (nominal 120 V RMS base) on any phase.
- The interrupting device shall automatically initiate a disconnect sequence from VMEU system within two (2) cycles if the voltage rises above 165 V RMS phase to ground (nominal 120V RMS base) on any phase.
- The interrupting device shall automatically initiate a disconnect sequence from VMEU system within six (6) cycles if the frequency rises above 60.3 Hz or falls below 59.3 Hz.

#### **4.1.3 Three-Phase Inverters and Generators with an Aggregate Capacity of 100 kW and Greater**

Distributed Generators with an aggregate capacity greater than 100 kW shall utilize special voltage and frequency settings to adhere to Pennsylvania, New Jersey, Maryland (PJM) interconnection requirements and VMEU system requirements. The use of Multi-Function Micro-processor based protective relays will require utilization of a second unit for back-up. Further, these distributed generators shall limit operation to 98.5% leading or lagging power factor (pf) or better.

Voltage sensing shall be three phase line to line with a protective relay or internal element on each line to line voltage. The secondary line to line voltage maybe either 120 Volts or 208 Volts, the Distributed Generator shall utilize appropriate relays whose range shall match that of the secondary line to line voltage.

- **Undervoltage** - 3 phase line to line. Pick-up at 90% nominal with a 5second trip at 0% nominal.
- **Overvoltage** - 3 phase line to line. Pick-up at 110% nominal with a 10cycle trip at 120% nominal.
- **Under Frequency \*** – 5 second delayed trip if frequency is less than 57.5Hz. (PJM requirement) It may be necessary to use an external time delay relay to achieve the desired 5 second delay.
- **Over Frequency** – 10 cycle delayed trip if frequency exceeds 60.5 Hz.13
- **Directional Power \***– If the Applicants installation will not export power into the VMEU system, it shall be equipped with a Directional power relay. In order to avoid unnecessary operations during faults on the Distribution system the Directional power relay should be equipped with a 5 second time delay relay.

\* Note: VMEU operational and maintenance procedures may require the ability to by-pass and physically block the time delays associated with Under Frequency and Directional Power during "Live Line" maintenance. VMEU personnel shall have reasonable access to the DG facility to by-pass and block the time delays and temporarily place these devices on instantaneous operation.

The need for additional protection equipment shall be determined by VMEU on a case-by-case basis. VMEU shall specify and provide settings for those relays that VMEU designates as being required to satisfy protection practices. Any protective equipment or setting specified by VMEU shall not be changed or modified at any time by the generator-owner without written consent from VMEU.

To avoid out-of-phase reclosing, the design of the generator-owner's protection and control scheme shall take into account the VMEU practice of automatically reclosing the feeder without synchronism check after being tripped. Before the distributed Generation device is re-connected to the system after a Trip, the control system shall wait five (5) minutes after normal system conditions are reestablished.

The generator-owner shall be responsible for ongoing compliance with all applicable local, state and federal codes and VMEU system design and operating changes as they pertain to the interconnection of the generating equipment.

**Protection circuitry, potential and current sensing shall not be connected with VMEU revenue metering.**

A failure of the generator-owner's interconnection protection equipment, including loss of control power, shall open the interrupting device, thus disconnecting the generation from

VMEU system. A generator-owner's protection equipment shall utilize a non-volatile memory design such that a loss of internal or external control power, including batteries, will not cause a loss of interconnection protection functions including all pickup set points.

All interface protection and control equipment shall operate as specified independent of the calendar date.

#### **4.1.4 Synchronous Generators**

Synchronous generators shall require synchronizing facilities. These shall include automatic synchronizing equipment or manual synchronizing with relay supervision, voltage regulator and power factor control. Synchronous generators shall normally require the below listed minimum protective equipment:

- 1) Directional Power Relay – ANSI device # 32**, Single phase sensing .Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover. **Note:** The directional power relay is used in those systems without export capability.
- 2) Reverse VAR Relay – ANSI device # 40**, Acts as a loss of excitation relay, single phase sensing. Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover. **3) Current Balance Relay – ANSI device # 46**, three phase sensing. Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover.
- 4) Over Voltage Relay – ANSI device # 59**, single phase sensing. Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover.
- 5) Phase Sequence / Under Voltage Relay – ANSI device # 47 / 27**, three phase sensing. This relay protects both the Distributed Generator and the VMEU circuit from either loss of VMEU power and or fault during parallel operation. Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover.
- 6) Over / Under Frequency Relay – ANSI device # 81 O/U**, single phase sensing, with settings for over and under frequency the time delays adjustable in cycles. This relay protects both the Distributed Generator and the VMEU circuit from either loss of VMEU power and or fault during parallel operation. Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover.
- 7) Generator Overcurrent, time and instantaneous – ANSI device # 50 / 51**, 3 phase sensing. This relay protects both the Distributed Generator and the VMEU circuit from either loss of VMEU power and or fault during parallel operation. Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover.
- 8) Ground Overcurrent - ANSI device 51G**, includes a grounding and current sensing system mounted in the generator neutral / ground lead. Activation of this relay causes immediate tripping of the generator breaker and immediate shutdown of the engine / prime mover.

**9) Automatic Lock Out Relay w/ manual reset – ANSI device # 86**, all generator electrical protective devices shall actuate an electrically operated / manual reset lock out relay. This lockout relay shall be a high speed tripping grade device that trips and blocks closing of the generator circuit breaker. Manual reset can be accomplished only after all protective trips have been cleared.

**10) Auxiliary Trip Input** – The Distributed Generator shall be equipped with an auxiliary trip input to be used by VMEU, if required, to initiate a **Direct Transfer Trip (DTT)**<sup>4</sup> (See last paragraph of Section 4.2).

**11) Surge Arrestors** – All three phases of the load side of the Distributed Generator circuit breaker shall be equipped with metal oxide type surge arrestors. These arrestors shall be sized in accordance with accepted standards to the appropriate maximum VMEU interconnection circuit voltage.

**Note:** Protective functions 1 through 8 may be accomplished with either discrete devices or with a multifunction device. Depending on the size of the Distributed Generator and / or types of protective devices used, the Applicant may be required to provide a level of redundancy for safety. Also the Applicant should be aware that the listed minimum protective functions are designed to primarily protect VMEU personnel and circuits, and that total protection of the applicants equipment may require additional protective functionality.

#### **4.1.5 Induction Generators**

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 at the point of common coupling is acceptable based on current inrush limits. Generally, Induction Generators greater than 100 kW shall not be allowed to be brought up to speed as an Induction Motor, without specific VMEU review and approval. The same requirements also apply to Induction Generation connected at or near synchronous speed because a similar voltage dip is present due to an inrush magnetizing current. The generator-owner shall submit number of starts per specific time period and maximum starting KVA draw data for VMEU to verify that the voltage dip due to starting is within the visible flicker limits as defined by IEEE 519-2014, "Recommended Practices and Requirements for Harmonic Control in Electric Power Systems (IEEE519)".

Starting or rapid load fluctuations on Induction Generators can adversely impact VMEU's system voltage. Corrective step-switched capacitors or other techniques may be necessary. These measures can, in turn, cause ferro-resonance. If these measures (additional capacitors) are installed on the customer's side of the **Point of Common Coupling**<sup>5</sup>, VMEU will review these measures and may require the customer to install additional switching

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<sup>4</sup> See Glossary for definition

<sup>5</sup> See Glossary for definition.

#### **4.2.1 Net Metering**

equipment. In all cases where Induction Generators are deployed it shall be the owners' responsibility to supply the necessary VAR requirements of the Induction Generator so that the total Power Factor as seen by VMEU at the Point of Common Coupling is better than .85 lagging with the customer importing power from VMEU. If a "Purchased Electric Power" agreement (See the VMEU Tariff for Electric Service) is in effect, during those periods that the customer is exporting excess power into the VMEU system, the Power Factor as seen by VMEU at the Point of Common Coupling shall be Unity or up to .9 Leading. **Also see Section 4.8**

#### **4.1.6 DC to AC Inversion Systems**

Direct current generation (Fuel Cells, Photovoltaics and even high frequency Permanent Magnet Generators) can only be installed in parallel with VMEU's distribution system using a synchronous inverter for power conversion and conditioning. The design of the inverter shall be such as to disconnect this synchronous inverter from the VMEU distribution system upon a VMEU system interruption. Line-commutated inverters do not require synchronizing equipment if the voltage drop is determined to be acceptable, as defined in Section 4.5, Power Quality, of this document. Self-commutated inverters with external frequency sensing can be used to synchronize to VMEU. Stand-alone, self-commutated inverters with internal frequency references shall not be used for parallel operation with the VMEU system.

#### **4.2 Metering**

The need for additional metering or modifications to existing metering will be reviewed on a case-by-case basis and shall be consistent with VMEU metering requirements.

Net Metering will be available to all residential and small commercial customers at a premise with qualifying facilities installed capacity of 5 kW or less or to those that represent, along with all distributed generation on the circuit where the applicant proposes to install the distributed generation, less than 1/3 of the total load of the circuit. Net metering treatment is granted to a premise and not available on the same account to adjacent properties or in any form of "virtual" net metering or aggregated net metering. After VMEU reaches 50 MW of distributed generation connected to its electric system, additional distributed generation or net metering will no longer be accepted. VMEU will establish a secondary queue for customers who wish to install DG after a feeder or the system has reached its allotment.

VMEU recognizes that distributed generation must be integrated into its distribution system without impacting the quality of service to all customers, therefore, VMEU will not accept distributed generation systems sized larger than 90% of the applicant's maximum demand or those that may produce more than 90% of the applicant's annual kWh energy needs as determined by VMEU. Consumption must be maintained to remain as a Net Metering customer.

Residential or Commercial Customers may request permission to “bank” energy credits by allowing the billing meter to subtract registration (spin backwards) during periods of excess generation. Under this option, the Commercial Customer must agree to receive electrical service under VMEU’s Demand Metered rates. The Customer will be subject to the applicable monthly minimum customer service charge, facilities charges and demand charges in effect at the time of billing, regardless of accrued energy credits.

There shall be no net payment(s) from VMEU to Customer for excess energy or capacity delivered to VMEU’s system. However, energy credits may accumulate but cannot be carried over from year to year. Energy credits shall not be sold, transferred, or assigned to any other individual, account, customer or service location. Energy credits have no monetary value and cannot be traded. Energy credits cannot be used to offset the monthly minimum customer service charge, facilities charges, connection fees or demand charges in effect at the time of billing. In the event a meter must be changed, credits will be transferred to the new meter by adjusting the start reading accordingly.

VMEU will implement decoupled electric tariffs to more accurately reflect the cost of building and maintaining the electric system in comparison to the cost of generation and distribution of electric energy. As decoupled rates are phased in, VMEU will continue to advise all customers. VMEU reserves the right to modify or eliminate existing tariffs as needed. Net metered customers must sign a Service Agreement as a part of the application process. Other documents may be required for interconnection of non-net metered DG equipment. Customer agrees to waive all rights to recover monies due to metering inaccuracies caused by allowing a conventional meter to spin in the “wrong” (reverse) direction.

VMEU will charge the Customer a one-time fee based on the cost of special electronic bi-directional meters, testing and installation at the site. Minimum charges for net metering installations made after 9/15/18:

- Residential: self-contained: \$295; transformer-rated: \$395
- Commercial: single-phase: \$345; single-phase transformer-rated: \$445; polyphase self-contained: \$726; Polyphase transformer-rated: \$1,276 ☐ 100 kW and larger: Additional fees may be required based on costs. Uplift charges and other costs related to system capacity and stability may also be the responsibility of the customer.

### **4.3 Grounding, Neutrals, & Service Compatibility**

All Distributed Generation connected to the VMEU Distribution and SubTransmission System shall meet the grounding requirements and the physical electrical characteristics of the system to which the DG is connected. Direct Physical connections of shall meet the criteria listed below. Net Metering qualified units 5 kW or less do not need to meet the physical interconnection criteria outlined below. In many cases especially at the Primary and SubTransmission level, due to either limitations in generator single phase to ground short circuit duty (impedance grounding) and or generator terminal voltage, a two winding interface

transformer will be required. Before proceeding with equipment purchase the DG applicant must have the proposed system reviewed by VMEU for physical interconnection suitability.

**Also see Section 4.5 - Dedicated Transformer.**

- Secondary Service Interconnections – Single phase 120 VAC devices shall have one leg solidly connected to the system neutral which is solidly grounded.
- Secondary Service Interconnections – Single Phase 240 VAC devices shall have center point Neutral solidly ground referenced. If the device generates at 240 VAC and does not have a ground referenced center point neutral, the device will be connected to the grounded system through a 2 winding transformer whose Primary (generator side) is 2 wire 240 VAC and whose Secondary ( VMEU System side) is 240 VAC 3 wire with a grounded center point Neutral. Exception will be made for Net Metering Qualified units 5 kW or less that generate at 240 VAC 2 wire and do not have a grounded neutral reference.
- Secondary Service Interconnections – 3 Phase – 120 / 208 VAC & 277 /480 VAC, WYE connected, neutral solidly connected to ground with balanced electrical output. DELTA connected induction generators directly interconnected to 4 wire WYE services shall require a DELTA /WYE transformer. DELTA connected induction generators directly connected to 240 VAC open or closed DELTA services may be connected without the use of an interface transformer. One or more Net Meter qualified single phase inverters producing a **total** output of 5 kW or less may be interconnected as a single phase device to a 3 phase system or in a 3 phase open DELTA configuration. If the **total** output of any Net Meter qualified system interconnected to a 4 wire, 3 phase service exceeds 5 kW, that system shall be connected as a 4 wire, 3 phase balanced system.
- Primary Service Interconnections – 3 Phase - 2,400 / 4,160 VAC & 7,620/13,200 VAC, WYE connected, neutral solidly connected to ground. This application may require a dedicated interface transformer. Impedance grounded generators cannot be directly connected to these systems without an interface transformer.
- All interconnections at 69,000 VAC and above, are complex applications that will require a full VMEU interconnection / PJM coordination study.

**4.4 Operating Requirements (Does not apply to Qualified Net Metering units that are 50 kW or less)**

The generator-owner shall provide a 24-hour telephone contact(s). This contact will be used by VMEU to arrange access for repairs, inspection or emergencies. VMEU will make such arrangements (except for emergencies) during normal business hours. The generator-owner shall not be connected or export power to the VMEU system during any outages of the feed that serves the Point of Common Coupling. The applicant's generation may be operated during such outages only with an open tie to VMEU. Islanding will not be permitted under any circumstance.

The generator must be equipped with an automatic, electrically operated interrupting device that will disconnect the generator from the VMEU system if system voltage parameters fall out of the ranges described in Section 4.1.1. That interrupting device may be the Disconnect Switch described in Section 4.4, if it is capable of both automatic and manual operation, or other VMEU approved device. This generator disconnect shall utilize potential monitoring of the incoming VMEU feed and interlock the generator circuitry to prevent the generator from being connected to the VMEU feeder if the system parameters are out of the ranges described in Section 4.1.1.

Certain protective functions that are equipped with time delays may be required to have a provision to allow instantaneous operation when VMEU Line Crews are performing "Live Line" maintenance. In these cases VMEU shall be provided reasonable access to the DG facility to by-pass and physically block time delays during "Live Line" maintenance.

**A Generator that cannot operate in parallel with the VMEU's system is not subject to these requirements but requires a site specific interconnection agreement.**

**The generator-owner shall not energize a de-energized VMEU's circuit for any reason.**

The **Disconnect Switch**<sup>8</sup> specified in Section 4.4 of this document may be opened by VMEU at any time for any of the following reasons:

- To eliminate conditions that constitutes a potential hazard to VMEU personnel or the general public.
- Pre-emergency or emergency conditions on the VMEU system.
- A hazardous condition is revealed by a VMEU inspection.
- Protective device tampering.

The Disconnect Switch may be opened by VMEU for the following reasons, after notice to the responsible party has been delivered and a reasonable time to correct (consistent with the conditions) has elapsed:

- A generator-owner has failed to make available records of Verification tests and maintenance of its protective devices.
- A generator-owner's system interferes with VMEU equipment or equipment belonging to other VMEU customers.
- A generator owner's system is found to affect quality of service of adjoining customers.

The customer shall be allowed to disconnect from VMEU without prior notice in order to self-generate.

Following a generation facility disconnect as a result of a voltage or frequency excursion (parameters are described in Section 4.1.1), the generation facility shall remain disconnected until the service voltage and frequency has recovered to VMEU's acceptable voltage and frequency limits for a minimum of five (5) minutes.

VMEU may require **Direct Transfer Trip (DTT)**<sup>9</sup> whenever:

1. the minimum load to generation ratio on a circuit is such that a ferro-resonance condition could occur;
2. it is determined that the customer's protective relaying may not operate for certain conditions or faults and/or
3. the installation could increase the length of outages on a distribution circuit or jeopardize the reliability of the circuit. The Distributed Generator shall be responsible for all costs required to deploy a DTT protective scheme

<sup>8</sup>See Glossary for definition <sup>9</sup>See Glossary for definition.

#### **4.5 Dedicated Transformer<sup>10</sup>**

VMEU reserves the right to require a generation facility to connect to VMEU system through a dedicated transformer. The transformer shall either be provided by VMEU at the generator-owner's expense, purchased from VMEU, or conforms to VMEU's specifications. The transformer may be necessary to ensure conformance with VMEU safe work practices, to enhance service restoration operations or to prevent detrimental effects to other VMEU customers. The dedicated transformer that is part of the normal electrical service connection of a generator-owner's facility may meet this requirement if there are no other customers supplied from it. A dedicated transformer is not required if the installation is sized, designed and coordinated with VMEU to protect VMEU system and its customers adequately from potential detrimental net effects caused by the operation of the generator. **Also see Section 4.3 –Grounding.** If VMEU determines a need for a dedicated transformer, it shall notify the generator-owner in writing of the requirements.

#### **4.6 Disconnect Switch or Device**

All generating equipment shall be capable of being isolated from VMEU system by means of an external, manual, visible, gang-operated, load break disconnecting switch or circuit breaker. The disconnect device shall be installed, owned and maintained by the generator-owner and located between the power producing equipment and its interconnection point with VMEU system. The Disconnect Switch or Device must be rated for the voltage and current requirements of the installation. The Basic Insulation Level (BIL) of the disconnect device shall be such that it will coordinate with that of VMEU's equipment. Disconnect devices shall meet applicable UL, ANSI and IEEE standards, and shall be installed to meet all applicable local, state and federal codes. The Disconnect Switch or Device shall be clearly marked, "Generator Disconnect", with permanent 1 inch letters or larger. Whenever possible, the disconnect device shall be located within 10 feet of VMEU's external electric service meter, or the location and nature of the distributed power disconnection switches shall be indicated in the immediate<sup>10</sup>proximity of the electric service entrance.

The Disconnect Switch shall be readily accessible for operation / locking and or disabling by VMEU personnel in accordance with Section 4.2 of this proposal.

The Disconnect Switch or device shall be lockable in the open position with a standard VMEU padlock with a 3/8-inch shank. If the disconnect device cannot be physically locked in the open position, it must be able to made in operative and the operating mechanism locked, blocked or drawn out. VMEU shall review and assist the generator owner design an acceptable disconnect device.

<sup>10</sup> See Glossary for definition.

**4.7 Power Quality** The maximum harmonic limits for electrical equipment shall be in accordance with IEEE 519 - 2014. The objective of IEEE 519 - 2014 is to limit the maximum individual frequency voltage harmonic to 3% of the fundamental frequency and the voltage Total Harmonic Distortion (THD) to 5% on VMEU side of the point of common coupling. In addition, any voltage flicker resulting from the connection of the customer's energy producing equipment to VMEU system must not exceed the limits defined by the maximum permissible voltage fluctuations border line of visibility curve, Figure 10.3 identified in IEEE 519 -2014. This requirement is necessary to minimize the adverse voltage effect upon other customers on VMEU system.

**4.8 Power Factor Correction (Does not apply to Qualified Net Metering units that are 50 kW or less)**

No Distributed Generation Installation shall degrade the Reactive performance of the VMEU system. All facilities, utilizing Distributed Generation resources providing 90% or less of the required electrical load of a given facility, shall have a Power Factor at the Point of Common Coupling of 98.5% lagging or 98.5% leading or better. If the Distributed Generation Resource can at times provide more than 90% of the facilities electrical power or is designed for export, the Power Factor shall range from unity to .9 leading.

In all cases where Induction Generators are deployed, it shall be the owners' responsibility to supply the necessary VAR requirements of the Induction Generator so that the total Power Factor as seen by VMEU at the Point of Common Coupling is in accordance with the criteria described above. The method of power factor correction necessitated by the installation of the generator will be negotiated with VMEU as a commercial item.

Induction power generators may be provided VAR capacity from VMEU system at the generator-owner's expense. The VMEU Tariff for Electric Service, Standard Terms and Conditions, makes provision for Special Facilities Charges. If it is necessary for VMEU to provide the necessary reactive compensation to correct the generator-owner's facility's Power Factor at the PCC to unity, the generator-owner shall be charged on an ongoing monthly basis, 1.66% per month of the capital costs of a capacitor bank, switching devices and controls to supply the required reactive correction. Capitals costs are dependent on the amount of reactive power required; VMEU shall give the generator-owner an estimated cost before installing said reactive

compensation. The installation of VAR correction equipment by the generator-owner on the generator-owner's side of the point of common coupling must be reviewed and approved by VMEU prior to installation.

#### **4.9 Stand Alone Islanding**

Interconnected Distributed Generation systems must be designed and operated so that stand alone islanding is not sustained on any distribution circuit. The requirements listed in this document are designed and intended to prevent islanding. See the first paragraph of Section 4.1.1 for more information.

#### **4.10 Required Testing of Distributed Generation Systems**

This section is divided into Type testing and Verification testing. Type testing is performed once by an independent testing laboratory for a specific equipment /protection package. Once a package meets the basic type-test criteria defined by UL-1741-2010 the design is accepted by VMEU. If any changes are made to

the hardware, software, firmware, or verification test procedures, the manufacturer must notify the independent testing laboratory to determine what, if any, parts of the type testing must be repeated. Failure of the manufacturer to notify the independent test laboratory of changes may result in withdrawal of approval and disconnection of units installed since the change was made. The equipment in the field must have a nameplate that clearly shows the model number, firmware version (if applicable) and that it meets the requirements of UL1741-2010. The manufacturer shall certify in their literature and technical brochures that a unit meets the requirements of UL1741-2010.

This certification applies only to devices and packages associated with protection of the interface between the generating system and VMEU. Interface protection is usually limited to voltage relays, frequency relays, synchronizing relays, reverse current or power relays, and anti-islanding schemes. Testing of relays or devices associated specifically with protection or control of generating equipment is recommended, but not required unless they impact the interface protection. At the time of production, all interconnecting equipment including inverters and discrete relays must meet or exceed the requirements of ANSI/IEEE Standards C37.90.1-1989, IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems, or the most current version or one year after the issuance of the revised standard, but not earlier than one year after the commercial availability of test equipment required to demonstrate conformance.

Verification testing is site-specific, periodic testing to assure continued safe acceptable performance.

##### **4.10.1 Type Testing**

All interface protective equipment must meet the Utility Compatibility criteria as defined in 5 Section 46. Type testing shall be utilized by the manufacturer to determine if the protection system and settings meet these requirements. Underwriters Laboratory or other qualified

independent testing laboratory shall conduct the tests prescribed by UL 1741-2010 to determine and certify performance consistent with UL 1741-2010.

Prior to testing, all batteries shall be disconnected or removed for a minimum of ten (10) minutes. This test is to verify the system has a non-volatile memory and that protection settings are not lost. A test shall also be performed to determine that failure of any battery not used to supply trip power will result in an automatic shutdown.

#### **Single-Phase Generators and Inverters equal to or less than 10 kW and Three-Phase Inverters 50 kW or Less**

All generators and inverters shall be designed as non-islanding systems as defined by IEEE 929 - 2000. Small generators and inverters 10 kW and below shall at the time of production meet or exceed the requirements of IEEE 929 2000 and UL 1741- 2010. Specifically, the generator or inverter shall automatically disconnect for an islanding condition with a Load Quality Factor of 2.5 or worse within two (2) seconds. All inverters and equipment protected by voltage / frequency relay systems shall initiate a Trip from the Utility system for Voltage and Frequency variations as shown in UL 1741-2010.

#### **4.10.2 Verification Testing**

Upon initial parallel operation of a generating system, or any time interface hardware or software is changed, a verification test must be performed. A New Jersey Licensed Professional Engineer or qualified individual working under the direction of a New Jersey Licensed Professional Engineer must perform verification testing in accordance with the manufacturer's published test procedure. Qualified individuals include factory trained and certified technicians, and licensed electricians with experience in testing protective equipment. VMEU reserves the right to witness verification testing or require written certification that the testing was performed.

Verification testing shall be performed every four years. All verification tests prescribed by the manufacturer shall be performed. If wires must be removed to perform certain tests, each wire and each terminal must be clearly and permanently marked. The generator-owner shall maintain verification test reports for inspection by the connecting VMEU.

Single-phase inverters rated 10 kW and below may be verified once per year as follows: once per year, the owner or his agent shall operate the load break Disconnect Switch and verify the power producing facility automatically shuts down and does not restart for five minutes after the switch is closed. Any system that depends upon a battery for trip power shall be checked and logged once per month for proper voltage. Once every four (4) years the battery must be either replaced or a discharge test performed.

#### **4.11 VMEU Back-up or Stand-by Power and Capacity**

The VMEU Tariff for Electric Service makes provision for the costs associated with VMEU providing Back-up and Stand-by service for Distributed Generators under certain rate

schedules. Stand-by Service agreements are contractual vehicles committing both the Applicant and VMEU for a minimum 12-month period.

#### **4.12 Interconnections to Primary and Secondary Network Distribution System<sup>6</sup>**

Distributed Generators including Photovoltaic or wind systems that can export power beyond the common network bus will **not** be permitted to be interconnect to VMEU's distribution system in primary and secondary Network areas. Further, all such systems, even those proposed as non-export, must be reviewed and approved by VMEU prior to installation to ensure that network system safety and integrity will not be affected by the installation. For those systems proposed to be installed in a network area, the maximum size of the units must be 100 kW or less, or represent 33 % of the minimum load on the network bus to which the Distributed Generator is connected, whichever is less. Net metering billing and/or credits will **not** apply to any load which may inadvertently be supplied to the utility system (beyond the Network Bus) in this type of installation in a network area.

### **5.0 Insurance Requirements**

#### **5.1 Qualified Net Metering Units 100 kW and Less:**

For units that meet the requirements as specified in the Board Order In the Matter of the Electric Discount and Energy Competition Act of 1999 – Net Metering Standards, Docket No. EX99030182, dated June 11, 2001, no additional insurance is required.

#### **5.2 Non-Qualified Net Metering Installations 100 kW and Less Utilizing Net Metering Qualified Equipment:**

For installations that do not meet the requirements as specified above **only** because the installation is not tariffed service RS or GLP, but otherwise use Net Metering Qualified equipment and meet all the other criteria outlined in this document, no additional insurance is required.

#### **5.3 Non-Net Metering Units of 20 kW or Less:**

If the Distributed Generator has a nameplate rating of 20 kW or less, the owner shall demonstrate prior to the date on which the Unit is first placed into operation, and continuing all the while the generator is interconnected with the VMEU system, the under writing of at least \$100,000 in liability coverage through a homeowner's or commercial policy issued by an insurer licensed to do business in the State of New Jersey and naming VMEU as an additional insured.

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<sup>6</sup> See Glossary for Definition

#### **5.4 Non-Net Metering Units Greater Than 20 kW:**

If the Distributed Generator has a nameplate rating greater than 20 kW, the owner shall demonstrate prior to the date on which the Unit is first placed into operation, and continuing all the while the generator is interconnected with the VMEU system, at its cost and expense, shall maintain and keep in full force and effect, for the term of this Agreement the following insurance coverage by an insurer licensed to do business in the State of New Jersey.

- A. Workers' Compensation Insurance in accordance with statutory requirements and Employers' Liability Insurance with a minimum limit of \$500,000 each occurrence.
- B. Comprehensive General Liability Insurance (occurrence form) including premises, contractual liability, products liability, completed operations, independent contractors, broad form property damage and coverage for explosion, with the following minimum limits of liability: bodily injury \$2,000,000 each occurrence; property damage - \$2,000,000 each occurrence.
- C. Comprehensive Automobile Liability Insurance including coverage for all owned, non-owned and hired automobiles used by owner during the time the Distributed Generator is interconnected with the VMEU system with the following minimum limits of liability: bodily injury \$1,000,000 each occurrence; property damage \$1,000,000 each occurrence.
- D. All risk Property Insurance to cover the replacement cost of owners facilities where the Distributed Generator is installed. This coverage shall contain a waiver of subrogation against VMEU.
- E. All Liability coverage shall name VMEU as an additional insured to support the obligations assumed by the owner as described in this Section 5 and provide that this coverage is primary and without right of contribution from insurance carried by VMEU.
- F. The completed operations coverage shall be provided and remain in effect for a period of at least two (2) years after the owner disconnects and removes the Distributed Generator.
- G. Prior to the start of interconnected Distributed Generation under this agreement, the owner will deliver Certificates of Insurance to VMEU evidencing this coverage is in effect and providing at least thirty (30) days notice to VMEU of any cancellation, termination or material alteration of required insurance. The owner shall be obligated to furnish these Certificates on an annual basis as long as the Distributed Generator is interconnected with the VMEU system, to show evidence of continuing insurance protection

H. The owner shall notify the VMEU Claims Department immediately by telephoning 856-794-4000 Ext 4602 and in writing within twenty-four(24) hours via FAX at 856-205-9541 after the occurrence of any accident as a result of the owner's Distributed Generation activities.

I. The insurance requirements as described are to protect VMEU from claims by third parties including, but not limited to, employees of the owner or its agents, subcontractors and invitees. Required insurance is not to relieve or release the owner, its agents, subcontractors and invitees from, or to limit their liability as to any and all obligations that result from Distributed Generator operation. The owner shall carry insurance naming VMEU as an additional insured so that this coverage is primary and without right of contribution from insurance carried by VMEU.

## APPENDIX A

### Glossary of Terms

**Automatic Disconnect Device** – An electronic, electro-mechanical or mechanical switch used to isolate a circuit or piece of equipment from a source of power without the need for human intervention.

**Alternating current (AC)** the movement of electric charge periodically reverses direction. It is the usable form of energy which may be produced by an inverter and necessary to interconnect with VMEU.

**Coordinated Interconnection Review** - Any studies performed by VMEU to ensure that the safety and reliability of the Electric Distribution System with respect to the interconnection of Distributed Generation as discussed in this document.

**Dedicated Service Transformer or Dedicated Transformer** – A transformer with a secondary winding that serves only the Applicant/generator owner. **Direct current (DC)** is the unidirectional flow of electric charge which may converted to AC by an inverter

**Direct Transfer Trip (DTT)** - Remote operation of the Distributed Generator Automatic Disconnect Device by means of a communication channel by VMEU.

**Disconnect** (verb) - To isolate a circuit or equipment from a source of power. **Disconnect Switch**– A mechanical device used for isolating a circuit or equipment from a source of power. In some applications the Automatic Disconnect Device and the Disconnect Switch maybe the same device. **Energy Conversion Device** – A machine or solid state circuit for changing direct current to alternating current or a machine that changes shaft horsepower to electrical power.

**Islanding** – A condition in which a portion of VMEU system that contains both load and distributed generation is isolated from the remainder of VMEU system.

[Adopted from IEEE 929 - 2000].

**Point of Common Coupling (PCC)** – The point at which the VMEU and the Grantee electric interface occurs. Typically, this is the Grantee side of VMEU revenue meter. [Adopted from IEEE 929 – 2000].

**Primary Distribution Circuit** – Refers to the circuit that originates from a VMEU substation and distributes 3 phase power at a primary level voltage of 4 kV or 13 kV.

**Grantee Secondary Services** - Refers to the Grantee service connection at voltage levels of: 120 V / 240 V single phase, 120V/208V 3 phase, or 277V/480V3 phase.

**Sub-transmission Circuit** – Refers to a circuit supplying 3 phase power at a primary level voltage of 69 kV.

**Type tested** - A protection device or system that has been certified by a qualified independent testing laboratory as to meeting the requirements listed in the testing section of this proposal is considered “Type tested”. It is expected by VMEU, that equipment manufacturers will sponsor Type testing. **Network Distribution System** – means an electric delivery system characterized by multiple uni-directional sub-transmission or primary level voltage feeders that are transformed and converge to a secondary voltage level, where secondary conductors are commonly interconnected via automated secondary switches.

**VMEU** – Vineland Municipal Electric Utility a department of City of Vineland

## APPENDIX B

### N.J. INTERCONNECTION APPLICATION FOR NET METERING SYSTEMS 50 KW OR SMALLER

#### A. Applicant Information

Name: \_\_\_\_\_  
 Mailing Address: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_  
 Street Address (if different from above): \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code : \_\_\_\_\_  
 Daytime Phone: \_\_\_\_\_ Fax: \_\_\_\_\_ Email: \_\_\_\_\_  
 Electric Utility Name (from utility Bill): \_\_\_\_\_  
 Electric Utility Account Number: Customer ID \_\_\_\_\_ ; Location ID: \_\_\_\_\_  
 Electric Energy Third Party Supplier \_\_\_\_\_  
 Electric Energy Third Party Supplier Account No.: \_\_\_\_\_

#### B. System Information

Manufacturer Name Plate AC Power Rating (for the entire installation) : \_\_\_\_\_ kW  
 System Type: Solar Wind Other (circle one)  
 System Location: \_\_\_\_\_  
 Inverter Manufacturer: \_\_\_\_\_  
 Inverter Model No: \_\_\_\_\_ Inverter Serial No: \_\_\_\_\_  
 Inverter Location: (Indoor) (Outdoor) (Self Contained) Location: \_\_\_\_\_  
 Outdoor Manual AC Disconnect Switch -Location: \_\_\_\_\_

#### C. Installation Contractor Information/Hardware and Installation Compliance Installation

Contractor (Company Name) \_\_\_\_\_  
 Contractor's License No.: \_\_\_\_\_ Proposed Installation Date: \_\_\_\_\_  
 Mailing Address: \_\_\_\_\_ City: \_\_\_\_\_  
 State: \_\_\_\_\_ Zip Code: \_\_\_\_\_ Daytime Phone: \_\_\_\_\_  
 Fax: \_\_\_\_\_ Email: \_\_\_\_\_

If PV, the proposed System hardware is in compliance with *Underwriters Laboratories (UL) 1741, Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Systems; UL 1703, Standard for Safety: Flat-Plate Photovoltaic Modules and Panels; and IEEE 1262-1995, IEEE Recommended Practice for Qualification of Photovoltaic (PV) Modules*. If PV, System must be installed in compliance with *IEEE Standard 929-2000, Recommended Practice for Utility Interface of Photovoltaic Systems*. All System types must be installed in compliance with applicable requirements of local electrical codes, the Electric Utility and the *National Electrical Code® (NEC)* and must use a non-islanding inverter as defined under *IEEE Standard 929-2000 (section 3.2 to 3.4)*. The System must have a lockable, visible disconnect device, accessible at all times to Electric Distribution Company personnel. If the System is designed to provide uninterruptible power to critical loads, either through energy storage, back-up generator, or the generation source, the System will include a parallel blocking scheme for this backup source. This function may be integral to the inverter manufacturer's packaged system.

Signed \_\_\_\_\_ Date: \_\_\_\_\_  
 (Contractor)

Contractor Name (Print): \_\_\_\_\_

#### D. Additional Terms and Conditions

**a) Operation/Disconnection** If it appears to the Electric Distribution Company, at any time, in the reasonable exercise of its judgment, that operation of the System is adversely affecting or may adversely affect the Electric Distribution Company's electrical system, the Electric Distribution Company may immediately take any and all steps it reasonably believes necessary to mitigate or cure the conditions including, without limitation, disconnecting the System from the Electric Distribution Company's electrical system. Applicant/Owner shall at all times permit Electric Distribution Company employees and inspectors reasonable access to inspect, test, or examine the System or metering equipment after notice by the Electric Distribution Company. Applicant/Owner may be liable for the costs and expenses incurred by the Electric Distribution Company related to disconnection and reconnection of the System by the Electric Distribution Company when disconnection is permitted under this paragraph D.

**b) Liability/Indemnity** Applicant/Owner hereby covenants and agrees to assume all risk of and liability for personal injuries (including death) and damage to property arising out of or caused by the operation of the System. Applicant/owner hereby covenants and agrees to indemnify, protect, defend and save harmless the Electric Distribution Company, its affiliates, officers, directors, employees and agents from and against any and all claims and demands for damages to property and injury or death to persons which may arise out of, or be related to, or caused by, the operation of the System or its interconnection to the Electric Distribution Company's electrical system, except if caused solely by the gross negligence or willful misconduct of the Electric Distribution Company as determined by New Jersey court of law.

**E. Electrical Code Inspection**

The System referenced above satisfies applicable electrical code requirements.

Inspector Name (Print): \_\_\_\_\_

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
(Inspector)

**(In lieu of the signature of the Inspector, a copy of the final Inspection Certificate may be attached)**

Date: \_\_\_\_\_  
Municipality: \_\_\_\_\_

**F. Customer Acknowledgment**

The System has been installed to my satisfaction and I have been given System warranty information, and an operation manual. Also, I have been informed as to whether my PV or Wind System is eligible for net metering, and been provided with a copy of the applicable Electric Distribution Company's net metering tariff and interconnection requirements. I have also been instructed in the operation of the System by the manufacturer and/or the installer of the System. I agree to abide by the terms of this Application /Agreement and I agree to operate and maintain the System in accordance with manufacturer's recommended practices as well as the Electric Distribution Company's interconnection standards. Further, I agree to notify the Electric Distribution Company 30 days prior to modification or replacement of the System's components or design. Any such modification or replacement may require submission of a new Application to the Electric Distribution Company. I agree not to operate the System in parallel with the Electric Distribution Company until the final inspection has been completed and accepted per *VMEU Interconnection Requirements Version XIII*. I also agree to install a warning label provided by the Electric Distribution Company on or near my service meter location.

Signed (Owner): \_\_\_\_\_ Date: \_\_\_\_\_

Name (Print): \_\_\_\_\_

**N.J. INTERCONNECTION APPLICATION**

**FOR NET METERING SYSTEMS 50 kW OR SMALLER (Continued)**

**G. Utility Application Acceptance**

The Vineland Municipal Electric Utility does not, by acceptance of this Application/Agreement, assume any responsibility or liability for damage to property or physical injury to persons. Further, this Application/Agreement does not constitute a dedication of the customer's System to VMEU's electrical system equipment or facilities. This Application is accepted by VMEU on this

\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

Vineland Municipal Electric Utility Signed VMEU Representative):

\_\_\_\_\_ Date: \_\_\_\_\_

Name (Print): \_\_\_\_\_

**Please note: Applications will ONLY be processed when they are fully completed, without exception, and in the order in which they are received.**

Please send completed applications to:

**Vineland Municipal Electric Utility**

**415 N West Ave**

**P.O.Box 1508**

**Vineland, NJ 08360**

**Attn: Renewable Energy**

**Phone: 856-794-4000 Ext 4298**

**Fax: 856-408-4623**

**E-mail: [renewableenergy@vinelandcity.org](mailto:renewableenergy@vinelandcity.org)**

## Appendix C

### Application for Connection of Distributed Generation to the VMEU Distribution System Wind or Photovoltaic Greater than 50 kW and all other Proposed Installations

#### Applicant Information

Company: \_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_, State: \_\_\_\_\_ Zip: \_\_\_\_\_

Tel: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail \_\_\_\_\_

Existing VMEU Account Number: \_\_\_\_\_ Customer ID: \_\_\_\_\_ Location ID: \_\_\_\_\_

Location of proposed Distributed Generation Equipment: \_\_\_\_\_

Estimated Service Date: \_\_\_\_\_ Size in KW: \_\_\_\_\_

**Application Fee: All units up to and including 50 kW - \$100**

**All units greater than 50 kW - \$500**

Size of unit as % of facility normal load: \_\_\_\_\_

Size of unit as % of facility peak load: \_\_\_\_\_

If unit size is greater than 100% of facility peak load, state intended use of excess capacity:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If the Applicant does not plan to export excess power, explain the mechanism to be used to prevent export: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If the Applicant intends to export excess power out side of the Local Distribution Circuit, explain intended Grantees and location: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Note:** If the Applicant intends to export and sell excess Distributed Generation capacity outside of the Local Distribution Circuit utilizing the Pennsylvania-New Jersey-Maryland (PJM) Interconnection High Voltage Transmission System and the Atlantic City Electric (ACE) Transmission System, it will be necessary to file an application and secure permission from PJM and ACE before any such exports are made.

PJM can be reached on the Internet at [www.pjm.org](http://www.pjm.org)

Will VMEU be expected to supply Back-up power to support the facility in case the Distributed Generator is unavailable? Yes No (circle one)

Terminal Voltage: \_\_\_\_\_

Generator or Inverter: \_\_\_\_\_

Single or 3 Phase: \_\_\_\_\_

Inverter Type: Line commutated or Line Synchronized

Generator type: Induction or Synchronous

Method of Neutral Point Grounding: \_\_\_\_\_

If Induction, list full load VAR requirement: \_\_\_\_\_

Source of Capacitive VARs: \_\_\_\_\_

Proposed point of connection: \_\_\_\_\_

Prime Mover: Reciprocating Engine, Combustion Turbine, Fuel Cell, Photo-Voltaic or other (circle one or describe other)

Other: \_\_\_\_\_

Manufacturer \_\_\_\_\_

Fuel Type \_\_\_\_\_

If Natural Gas \_\_\_\_\_ SCFM and Pressure @ Full load

**Utility Application Acceptance** The Electric Distribution Company does not, by acceptance of this Application/Agreement, assume any responsibility or liability for damage to property or physical injury to persons. Further, this Application/Agreement does not constitute a dedication of the owner's System to the Electric Distribution Company's electrical system equipment or facilities. This Application is accepted by the Electric Distribution Company on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
(Electric Distribution Company Representative)

Name (Print): \_\_\_\_\_

Please send completed applications to:

**Vineland Municipal Electric Utility**  
**415 N West Ave**  
**P.O. Box 1508**  
**Vineland, NJ 08360**  
**Attn: Renewable Energy**  
**Phone: 856-794-4000 Ext 4294**  
**Fax: 856-405-4623**  
**E-mail: renewableenergy@vinelandcity.org**

## Appendix D

### Example of Safety Disconnect Tag

The Tag should be either glued with Silicone adhesive or mechanically attached. Size of the Tag should be as large as practical to fit on or near the disconnect switch. In any case it should not be less than 4 inches by 6 inches. The Tag shall be made of yellow laminated engraving stock with at least 5/16 inch high black letters.

# Customer Owned Parallel Generation VMEU Safety Disconnect Switch

If the disconnect switch is not located at the meter, than another Tag must be made that will be placed at the meter and direct VMEU personnel to the Disconnect location. The following tag shall be placed at the meter, on the meter pan or on the CT cabinet.

## Customer Owned Parallel Generation Safety Disconnect Switch is located at rear of building

If the Disconnect Switch is located at the side of the building it should say so. It should be specific enough so that VMEU personnel can easily find the disconnect switch.

## Appendix E

### Interconnection Verification Request Form

#### A. Applicant Information

Name: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_  
Street Address (if different from above): \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip Code: \_\_\_\_\_  
Daytime Phone: \_\_\_\_\_ Fax: \_\_\_\_\_ Email: \_\_\_\_\_  
Electric Utility Name (from utility Bill): \_\_\_\_\_  
Electric Utility Account Number: Customer ID \_\_\_\_\_; Location ID: \_\_\_\_\_  
Electric Energy Third Party Supplier \_\_\_\_\_  
Electric Energy Third Party Supplier Account No.: \_\_\_\_\_

#### B. System Information

Manufacturer Name Plate AC Power Rating (for the entire installation) : \_\_\_\_\_ kW  
System Type: Solar Wind Other (circle one)  
System Location: \_\_\_\_\_

#### C. Authorization of Release of Account Information

Because of customer concerns regarding confidentiality of electric history, a release letter signed by the customer is required **before** we can release information regarding their electric account. The release **MUST** provide:

1. The customer name and address as appears on the bill,
2. account number
3. a statement that the customer of record requests VMEU release their electric account information to the specified third party
4. signature and printed name of the owner of the account
5. the date when the document was signed
6. Customer contact information

**This request will not be considered until both this form, completed in full, and the Interconnection Request fee of \$50 is received.**

Please send completed verification requests to:

**Vineland Municipal Electric Utility**

**415 N West Ave**

**P.O.Box 1508**

**Vineland, NJ 08360**

**Attn: Renewable Energy**

**Fax: 856-405-4623**

**E-mail: [renewableenergy@vinelandcity.org](mailto:renewableenergy@vinelandcity.org)**

**Subject: Interconnection Verification Request – [Street Address of applicant]**

Example Subject:

Interconnection Verification request – 123 Power Dr.

## **Appendix F**

### VMEU Service Agreement for Renewable Energy Installations of Less than or equal to 50kW



# VINELAND MUNICIPAL ELECTRIC UTILITY SERVICE AGREEMENT

Service Agreement Number:

Customer File:

Street Address: \_\_\_\_\_ acct # \_\_\_\_\_ - \_\_\_\_\_

Property Owner/Developer: \_\_\_\_\_

**Scope:**

This agreement shall apply to residential, commercial and industrial customers that install “clean energy” generating devices meeting the requirements of the New Jersey Board of Public Utility’s Clean Energy Program.

This agreement is between the City of Vineland, is hereinafter referred to as “VMEU”, and \_\_\_\_\_ is hereinafter referred to as “Owner” and/or “Customer”.

**Purpose:**

The work described herein shall provide Owner with the availability to install a solar photovoltaic system as outlined in the New Jersey Clean Energy Program Technical Worksheet and Appendix B NJ Interconnection Allocation for Net Metering System 50 KW or smaller which was provided to Customer by VMEU.

**Owner** agrees to the following:

**1. Installation Requirements**

Equipment installation shall meet the requirements of the New Jersey Clean Energy Program. Customer shall provide VMEU with a copy of completed New Jersey Clean Energy Program Technical Worksheet with Application Number assigned by NJBPU. Owner must maintain the system including the disconnect switch at VMEU’s meter and as outlined in the Technical Worksheet according to manufacturer’s specifications.

**2. Generating Capacity**

The generator shall not be sized in excess of the Customer’s load. While VMEU recognizes there may be periods of excess generation, such excess generation shall only be used to generate credits in order to offset current or future “positive” billing. The current approved size for Customer’s location is \_\_\_\_\_ KW (AC).

**3. Fees**

Customer will remit to VMEU a one-time fee as noted below for interconnection service. VMEU will charge the Customer a one-time fee based on the cost of special electronic bi-directional meters, testing and installation at the site. Charges for net metering installation is \$\_\_\_\_\_.

Uplift charges and other costs related to system capacity and stability may be the responsibility of the customer.

**4. Net Metering**

Residential or Commercial Customers will “bank” energy credits by allowing the billing meter to subtract registration (spin backwards) during periods of excess generation. Under this option, the Commercial Customers only must agree to receive electrical service under VMEU’s Rate 20 (Commercial Rate Service with Demand Meter). The Customer will be subject to the applicable monthly minimum customer service charge under this rate, regardless of accrued energy credits.

There shall be no net payment(s) from VMEU to Owner for excess energy or capacity delivered to VMEU’s system. However, energy credits may accumulate but cannot be carried over from year to year. Energy credits shall not be transferable to any other account or service location. Energy credits cannot be used to offset the monthly minimum customer service charge, facilities charges and demand charges in effect at the time. In the event a meter must be changed, credits will be transferred to the new meter by adjusting the start reading accordingly.

VMEU will implement decoupled electric tariffs to more accurately reflect the cost of building and maintaining the electric system in comparison to the cost of generation and distribution of electric energy. As decoupled rates are phased in, VMEU will continue to advise all customers. There will be distribution charges for each kW/kWh generated by the customer owned generation. We anticipate these charges to be approximately \$0.03 per kWh. As we begin to phase in these new rates, we will continue to advise all customers. VMEU retains the right to modify or eliminate existing agreements and tariffs as needed. This Agreement does not guarantee or imply continuation of any existing tariff.

Customer agrees to waive all rights to recover or claim monies and/or energy credits caused by metering inaccuracies as a result of allowing a utility-owned meter to spin in the “wrong” (reverse) direction.

I \_\_\_\_\_, residing/operating at

\_\_\_\_\_, agree to the terms and

conditions as described herein.

Customer Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

## **Appendix G**

VMEU Service Agreement for Renewable Energy Installations of greater than 50kW



## VINELAND MUNICIPAL ELECTRIC UTILITY SERVICE AGREEMENT

Service Agreement Number: \_\_\_\_-\_\_\_\_

Customer File: \_\_\_\_\_

Street Address: \_\_\_\_\_, Vineland, NJ acct # \_\_\_\_\_-\_\_\_\_\_

Property Owner: \_\_\_\_\_

### Scope:

This agreement shall apply to residential, commercial and industrial customers that install “clean energy” generating devices meeting the requirements of the New Jersey Board of Public Utility’s Clean Energy Program. This agreement is between the City of Vineland, is hereinafter referred to as “VMEU”, and \_\_\_\_\_ is hereinafter referred to as “Owner” and/or “Customer”.

### Purpose:

The work described herein shall provide Owner with the availability to install a solar photovoltaic system as outlined in the New Jersey Clean Energy Program Technical Worksheet and the current revision of Appendix C of the VMEU Interconnection Requirements for Net Metering Systems larger than 50 KW (AC) which was provided to Customer by VMEU.

**Owner** agrees to the following:

#### 1. Installation Requirements

Equipment installation shall meet the requirements of the New Jersey Clean Energy Program. Customer shall provide VMEU with a copy of completed New Jersey Clean Energy Program Technical Worksheet with Application Number assigned by NJBPU. Owner must maintain the system including the disconnect switch at VMEU’s meter as outlined in the Technical Worksheet according to manufacturer’s specifications. Additionally, as a requirement of acceptance, the customer will provide a one-line diagram of the entire project including all technical information on solar cells, inverters, transformers and any other equipment which is a part of the system. Transformation information must include capacity, operating voltages, ratios and taps as installed. VMEU must be notified prior to changing tap settings to adjust for system voltage.

#### 2. Generating Capacity

The generator shall not be sized in excess of the Customer’s load. While VMEU recognizes there may be periods of excess generation, such excess generation shall only be used to generate credits in order to offset current or future “positive” billing.

The current approved size for Customer’s location is \_\_\_\_\_ KW(AC).

#### 3. Fees

Customer will remit to VMEU a one-time fee as noted below for interconnection service.

VMEU will charge the Customer a one-time fee based on the cost of special electronic bi-directional meters, testing and installation at the site. Charges for net metering installations are \$1,276.

Uplift charges and other costs related to system capacity and stability may be the responsibility of the customer as VMEU decouples rates.

**4. Net Metering**

Residential or Commercial Customers will “bank” energy credits by allowing the billing meter to subtract registration (spin backwards) during periods of excess generation. Under this option, the Commercial Customers only must agree to receive electrical service under VMEU’s Rate 31 (Industrial Rate Service with Demand Meter). The Customer will be subject to the applicable monthly minimum customer service charge under this rate, regardless of accrued energy credits.

There shall be no net payment(s) from VMEU to Owner for excess energy or capacity delivered to VMEU’s system. However, energy credits may accumulate but cannot be carried over from year to year. Energy credits shall not be transferable to any other account or service location. Energy credits cannot be used to offset the monthly minimum customer service charge, facilities charges and demand charges in effect at the time. In the event a meter must be changed, credits will be transferred to the new meter by adjusting the start reading accordingly.

VMEU will implement decoupled electric tariffs to more accurately reflect the cost of building and maintaining the electric system in comparison to the cost of generation and distribution of electric energy. As decoupled rates are phased in, VMEU will continue to advise all customers. There will be distribution charges for each kW/kWh generated by the customer owned generation. We anticipate these charges to be approximately \$0.03 per kWh. As we begin to phase in these new rates, we will continue to advise all customers. VMEU retains the right to modify or eliminate existing agreements and tariffs as needed. This Agreement does not guarantee or imply continuation of any existing tariff.

**5. Real Time Generation Information**

Customer agrees to provide real time generation information on a dedicated website 24/7 for use by VMEU in monitoring loads on the feeder(s) in a form usable to VMEU. Information will include power (kW), reactive power (kVAr), and voltage (V) for the life of the project.

**6. Additional Requirements**

If additional requirements or regulations are promulgated by PJM, FERC, the State of New Jersey or other regulatory agencies affecting VMEU or the Customer because of the solar voltaic project, the customer agrees to abide by any such legal regulations or requirements and to perform such work or make such payments as necessary to satisfy said regulations or requirements and to hold VMEU harmless.

Customer agrees to waive all rights to recover or claim monies and/or energy credits caused by metering inaccuracies as a result of allowing a utility-owned meter to spin in the “wrong” (reverse) direction.

I \_\_\_\_\_, residing/operating at

\_\_\_\_\_, agree to the terms and conditions as described herein.

Customer Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Approved by: \_\_\_\_\_

Date: \_\_\_\_\_