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01-2321-23235

FIRST AMENDMENT CONTRACT 2012-P00080 A

RENEWABLE POWER PURCHASE AND OPERATING AGREEMENT BETWEEN
WINDMAR RENEWABLE ENERGY, INC. AND
THE PUERTO RICO ELECTRIC POWER AUTHORITY

APPEAR

AS FIRST PARTY: Puerto Rico Electric Power Authority, hereinafter referred to as PREPA, a public corporation and government instrumentality of the Commonwealth of Puerto Rico, created by Act 83 of May 2, 1941, as amended, represented in this act by its Executive Director, engineer Juan Francisco Alicea Flores, of legal age, married, and resident of Caguas, Puerto Rico.

AS SECOND PARTY: Windmar Renewable Energy, Inc., hereinafter referred to as SELLER, with its principal office at Calle San Francisco 206, San Juan, Puerto Rico, represented by its President, Víctor Luis González Barahona, of legal age, married and a resident of San Juan, Puerto Rico, who is authorized to sign this Agreement on behalf of SELLER as certified by Corporate Resolution dated May 2, ____, 2014.

WITNESSETH

In consideration of the mutual covenants hereinafter stated, the parties agree themselves, their personal representatives, and successors as follows:

STATE

WHEREAS: SELLER and PREPA executed on February 23, 2012 a Renewable Power *Purchase and Operating Agreement (Agreement), for the development of a 20 MW* photovoltaic solar energy system in the vicinity of Yauco-Guayanilla, Puerto Rico; and

NOW THEREFORE, the Parties hereby agree to amend the following Articles of the Agreement:

1. Article 1, DEFINITIONS, is amended to include the term "Contracted Capacity" and defines it as follows: means the maximum AC Capacity to be exported by SELLER at the Interconnection Point, which shall be 20 MW.

2. Article 5, Term, Section 5.1 is hereby amended by deleting the word "Twenty (20)" and replacing it with the word "Twenty-Five (25)".

3. Article 5, Term, Section 5.2 is hereby amended by deleting the first sentence "The Term of this Agreement may be extended by mutual agreement of the Parties for up to two consecutive periods of five (5) years each, following the expiration of the initial Twenty Agreement Year Term." and replacing it with the sentence "The Term of this Agreement may be extended by mutual agreement of the Parties for one consecutive period of five (5) years, following the expiration of the initial Twenty-Five Agreement Year Term.".

4. Section 7.1 is hereby amended by deleting in its entirety and replacing it with the following language:

   7.1 The Facility will be designated by PREPA as a "must run" unit to the full extent of the Contracted Capacity of 20 MW. The Facility production is intermittent. PREPA agrees to accept and pay for all the Net Electrical Output produced by the Facility according to the terms of this Agreement and will not disconnect the Facility or otherwise reduce the Net Electrical Output in whole or in part except to the extent necessary due to (a) a Force Majeure, or (b) an Emergency that cannot be avoided or mitigated without the shutdown or disconnection of the Facility.

5. Section 8.6 is hereby amended by deleting in its entirety and replacing it with the following language:

   8.6 SELLER shall provide as a minimum at its expense, and PREPA shall install, were applicable, as SELLER expense, the following communication facilities linking the Facility with PREPA's dispatching centers:

   (a) One Remote Terminal Unit ("RTU"), including setup installation and configuration; which shall be specified by PREPA.

   (b) Two independent telecommunication circuits. One voice grade to link the SCADA system to the facility RTU using DNP protocol though a designated PREPA communication node. A second fiber optic circuit to link PREPA's network to the facility in order to access protection equipment, revenue meters and the DSM, trough the ruggedcom security device as specified by PREPA.

(c) A voice telephone extension for the purpose of communicating with Monacillos TC and Ponce TC.

(d) A telephone line and equipment to transmit and receive facsimile messages to confirm the oral communication between PREPA and SELLER.

(e) A Dynamic System Monitor equipment in accordance with APPENDIX D - TECHNICAL SPECIFICATIONS FOR THE DYNAMIC SYSTEM MONITOR, for recording the power disturbance caused by electro-mechanic swings and to measure the system response to the swing disturbance. SELLER shall be responsible of providing, installing, wiring and commissioning of all the equipment and components for the DSM system necessary in the Interconnection Facilities.

The items provided by SELLER in accordance with this Section 8.6 shall be subject to the approval of PREPA, which approval shall not be unreasonably withheld or delayed.

6. Article 11, Compensation , Payment and Billing, Section 11.2 in the PPOA is hereby amended by deleting that Section in its entirety and replacing it with the following:

11.2 (a) Energy Payment - Beginning with the Pre-Operation Period and continuing throughout the Term of this Agreement:

EP = EPP x NEO

Where:

EP is the Energy Payment.

EPP is the Energy Purchase Price, which for the first Agreement Year shall be $0.130/kWh.

NEO is the Net Electrical Output expressed in kilowatt hours.

The Energy Purchase Price for Agreement Years 2 to 12 shall be escalated in an amount equal to two percent (2.0%). For Agreement

Years 13 to 25 the Energy Purchase Price shall be $0.1616/kWh, not subject to escalation.

11.2 (b) Green Credits Payment - Beginning with the Pre-Operation Period and continuing throughout the Term of this Agreement:

GCP = GCPP x NEO

Where:

GCP is the Green Credits Payment

GCPP is the Green Credit Purchase Price for Agreement Years 1 to 20 shall be equal to $0.035/kWh, not subject to escalation. For Agreement Years 21 to 25, SELLER shall transfer the Green Credits at no cost to PREPA.

7. Substitution of Appendix B - INTERCONNECTION: effective as of the date hereof, Appendix B of the Agreement is hereby substituted and replaced in its entirety by APPENDIX B - INTERCONNECTION, attached hereto.

8. Substitution of Appendix C - Price Index Calculation: effective as of the date hereof, APPENDIX C of the Agreement is hereby substituted and replaced in its entirety by APPENDIX C - AMENDED ENERGY AND GREEN CREDIT PURCHASE PRICE, attached hereto.

9. Substitution of APPENDIX D – Technical Specification for Dynamic System Monitor: effective as of the date hereof, APPENDIX D of the Agreement is hereby substituted and replaced in its entirety by APPENDIX D - TECHNICAL SPECIFICATION FOR DYNAMIC SYSTEM MONITOR (DSM), attached hereto.

10. Substitution of APPENDIX E - Minimum Technical Requirements for Interconnection of Photovoltaic (PV) Facilities: effective as of the date hereof, APPENDIX E of the Agreement is hereby substituted and replaced in its entirety by APPENDIX E - MINIMUM TECHNICAL REQUIREMENTS FOR INTERCONNECTION OF PHOTOVOLTAIC (PV) FACILITIES, attached hereto.

11. Substitution of Appendix F - DETERMINATION OF NET ELECTRICAL OUPUT NOT RECEIVED: effective as of the date hereof, APPENDIX F - DETERMINATION OF NET ELECTRICAL OUPUT NOT RECEIVED of the PPOA is hereby substituted and replaced in its entirety by APPENDIX F, attached hereto.

12. The above mentioned amendments apply to all terms and conditions of the Agreement, as applicable.

13. Representations and Warranties of each Party.

(a) PREPA hereby represents and warrants to SELLER: (i) the execution and delivery by PREPA of this Amendment, and the Amendment itself, have been duly authorized by PREPA's Governing Board and any other applicable PREPA governing body in accordance with applicable law, and (A) do not and will not require any additional internal or external consent or approval, (B) do not and will not violate any provision of Act No. 83 of May 2, 1941, as amended, or its regulations, or any material indenture, contract or agreement to which it is a party or by which its properties may be bound; and (ii) this Amendment is a legal, valid, and binding obligation of PREPA, enforceable against PREPA in accordance with its terms, except as may be limited by applicable bankruptcy, insolvency or similar laws affecting the enforcement of rights generally.

(b) SELLER hereby represents and warrants to PREPA: (i) the execution, delivery, and performance by SELLER of this Amendment have been duly authorized, and do not and will not (A) require any additional internal consent or approval of SELLER, or (B) violate any provision of SELLER's certificate of formation or operating agreement, or any material indenture, contract or agreement to which it is a party or by which it or its properties may be bound, or any law, ordinance, rule, regulation, order, writ, judgment, injunction, decree, determination or award presently in effect; and (ii) this Amendment is a legal, valid and binding obligation of SELLER, enforceable against SELLER in accordance with its terms, except as may be limited by applicable bankruptcy, insolvency or similar laws affecting the enforcement of rights generally.

14. Ratification. Except as expressly amended hereby, the Agreement and all documents, instruments and agreements related thereto are hereby ratified and confirmed in all respects.

15. No Implied Waiver. This Amendment shall be limited precisely as written and shall not be deemed to be a consent granted pursuant to, or a waiver or modification of, any other term or condition of the Agreement, whether or not known to the Parties, or to prejudice any other right or rights which the Agreement may now have or have in the future.

16. Counterparts. This Amendment may be executed in multiple original or facsimile counterparts, each of which shall be deemed an original and shall be binding upon the Party who executed the same, but all of such counterparts shall constitute the same Amendment.

17. Governing Law. This Amendment shall be governed by, construed and enforced in accordance with the laws of the Commonwealth of Puerto Rico and, to the extent applicable, the laws of the United States of America. The Parties herein agree that all Disputes arising hereunder shall be resolved pursuant to Section 21.12 of the Agreement.

18. Novation: SELLER and PREPA expressly agree that no amendment or change order which could be made to the Agreement and this Second Amendment, during its term, shall be understood as a Contractual Novation, unless both parties agree to the contrary, specifically and in writing. The previous provision shall be equally applicable in such other cases where PREPA gives the SELLER a time extension for the compliance of any of its obligations under the Agreement as amended or where PREPA dispenses the claim or demand of any of its credits or rights under the Agreement as amended.

19. Capitalized Terms. Unless otherwise stated, capitalized terms used in this Amendment which are not defined in this Amendment have the meaning given in the Agreement.

All other terms and conditions, specifications, stipulations, insurances, and requirements established in the Agreement remain unaltered and fully enforceable.

This is the Agreement between the appearing parties under this First Amendment and so is hereby ratified.

IN WITNESS WHEREOF, the Parties hereto have agreed to execute this First Amendment in San Juan, Puerto Rico, on this 21th day of May, 2014.

Puerto Rico Electric Power Authority

Juan F. Alicea Flores
Executive Director
Social Security 660-43-3747

Windmar Renewable Energy, Inc.

Víctor Luis González Barahona
President
Social Security 660-62-5332

APPENDIX B - INTERCONNECTION

Seller shall provide the following information to PREPA within ninety (90) days following the Effective Date. Data submitted in a preliminary or estimated form shall be updated within thirty (30) days after final equipment arrangements and specifications are established.

1. Electrical one-line diagram of the Facility.

2. Explanation of proposed equipment protection and control scheme (may be shown functionally on the one-line diagram).

3. Site plan showing plant layout, property lines, access roads and switchyard boundaries.

4. Preliminary equipment layout and arrangement for switchyard and PV Facility step-up transformers (GSU).

5. Reactive Power Capacity curve of PV Facility.

6. Station auxiliary load.

7. Station auxiliary transformer data – impedance, connection winding, load loss and no load tap changer.

8. PV Facility step-up transformer impedance, load loss, no load taps changer, connection and winding.

9. PV Facility Short Circuit Ratio.

10. PV Facility kilowatt rating.

11. PV Facility kilovar rating.

12. Equivalent PV Facility modeling for Short Circuit Studies.

13. Seller's requirements for power supplied by PREPA during construction and start-up.

14. Project schedule (I-J or bar chart format) including but not limited to the following milestones:

    - QF status obtained
    - Engineering 30% complete
    - One-line diagram approved
    - Financial Closing Date

- Major licenses/permits
- Major material procurement
- Start Construction
- Engineering 70% complete
- Utility technical submittals complete
- Operating procedures finalized
- Field Test Protocols Finalized
- Start test and start-up
- On-site Field Tests Completed
- Complete Compliance with Minimum Technical Requirements
- Initial synchronizing date
- Commercial operation

15. PSSE Mathematical Model (Parameters and Data Requirements)

The Contractor shall submit to PREPA a PSS/E mathematical model and data related to the proposed PV Facility. When referred to the PV Facility model, this shall include but is not limited to PV converter, transformers, collector systems, plant controllers, control systems and any other equipment necessary to properly model the PV Facility for both steady-state and dynamic simulation modules. It is required that the Contractor submits both an aggregate and detailed model of the PV Facility. The aggregate and detailed model of the PV Facility shall not be submitted in preliminary form.

The Contractor shall be required to submit user manuals for both the PV converter and PV Facility models. The mathematical models shall be fully compatible with the latest and future versions of PSS/E. It is preferred that the models are PSS/E standard models. In the case that the Contractor submits user written models, the Contractor shall be required to keep these models, as well as its corresponding user manual, current with the future versions of the PSS/E program until such time that PSS/E has implemented a standard model. On-site field tests to demonstrate compliance with PREPA's Minimum Technical Requirements for Interconnection of Photovoltaic Facilities (MTRs) shall be performed by the contractor. The data and PSS/E model shall also be validated, updated and officially certified according to PREPA requirements when final field adjustments and parameters measurements are completed during the on-site field tests to be performed to the facility by the contractor. The on-site field tests shall be witnessed and coordinated with PREPA's personnel.

The Contractor shall be responsible to submit PSSE mathematical models of any kind of compensation devices (ie. SVC, STATCOMs, DSTATCOMs, BESS, etc.) used on the PV Facility. It is preferred that the models are standard

models provided with PSS/E. In the case that the Contractor submits user written models, the PV Facility Contractor shall be required to keep these models current with the future versions of the PSS/E program until such time that PSS/E has implemented a standard model. In its final form, the mathematical model shall be able to simulate each of the required control and operational modes available for the compensation device and shall be compatible with the latest and future versions of PSSE. Final adjustments and parameters settings related with the control system commissioning process shall be incorporated to the PSSE mathematical model and tested accordingly by the PV Facility Contractor and PREPA system study groups. .

PV Facility Owners that provide user written model(s) shall provide compiled code of the model and are responsible to maintain the user written model compatible with current and new releases of PSS/E until such time a standard model is provided. PREPA must be permitted by the PV Facility Owner to make available PV models if required to external consultants with an NDA in place.

16. Additional data necessary for dynamic modeling - At a minimum, any necessary control system model (inverter, compensator and excitation limiter models), including the time constants, gains, limits, description, block diagrams and configuration.

17. Transient Mathematical Model

The contractor shall provide a detailed transient mathematical model of the PV Facility with a compliance report that shows the level of compliance of the facility's design with PREPA's Minimum Technical Requirements for Interconnection of Photovoltaic Facilities (MTRs). The contractor shall submit the compliance report for evaluation by PREPA before the on-site field tests. PREPA and the contractor must agree on the compliance report results before the on-site field tests for verifying compliance of the Facility with the MTRs are performed.

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APPENDIX C - AMENDED ENERGY AND GREEN CREDIT PURCHASE PRICE

Agreement Year	Energy Purchase Price* $/kWh	Green Credit Purchase Price** $kWh
1	0.1300	0.0350
2	0.1326	0.0350
3	0.1353	0.0350
4	0.1380	0.0350
5	0.1407	0.0350
6	0.1435	0.0350
7	0.1464	0.0350
8	0.1493	0.0350
9	0.1523	0.0350
10	0.1554	0.0350
11	0.1585	0.0350
12	0.1616	0.0350
13	0.1616	0.0350
14	0.1616	0.0350
15	0.1616	0.0350
16	0.1616	0.0350
17	0.1616	0.0350
18	0.1616	0.0350
19	0.1616	0.0350
20	0.1616	0.0350
21	0.1616	0.0000
22	0.1616	0.0000
23	0.1616	0.0000
24	0.1616	0.0000
25	0.1616	0.0000

*The Energy Purchase Price for Agreement Years 2 to 12 shall be escalated in an amount equal to two percent (2.0%). For Agreement Years 13 to 25 the Energy Purchase Price shall be $0.1616/kWh, not subject to escalation.

**The Green Credit Purchase Price for Agreement Years 1 to 20 shall be $0.035/kWh, not subject to escalation. For Agreement Years 21 to 25, SELLER shall transfer the Green Credits at no cost to PREPA.

APPENDIX D

TECHNICAL SPECIFICATION FOR DYNAMIC SYSTEM MONITOR (DSM)

1. Introduction

The following specification defines the minimum requirements for an instrument used in the monitoring and register of dynamic disturbances on electric power systems and the supervision of generator performance according to Grid Codes.

2. Hardware

2.1 Inputs

2.1.1 The equipment shall have at least 32 analog inputs with the capacity to increase them to a minimum of 96 inputs depending in the application required analog signals. The minimum resolution for the A/D converter shall be of 16 bit. The sampling rate shall be programmable up to a minimum of 250 samples per cycle (15000 samples per second). The analog inputs shall permit at least the following types of signals:

a. PT voltage (150 V rms minimum, Accuracy better or equal to 0.3%)

b. CT currents (5 A rms minimum, Accuracy better or equal to0.3%)

c. DC voltages of at least 800 V (Accuracy better or equal to 0.3%)

d. Small Analog Signals (Accuracy better or equal to 0.3%)

i. Current: 4 – 20 mA
ii. Voltage: 0 – 200 mV, 1V, 10 V

2.1.2 The equipment shall have at least 16 digital inputs with the capacity to increase them to a minimum of 48 inputs depending in the application required digital signals. The minimum input voltage range of the digital inputs should be 0 – 150 V. The digital inputs should be included as a user defined software triggering input.

2.1.3 The equipment shall be able to record power system frequency with a resolution of at least 0.001Hz.

2.2 The equipment shall have a built-in microprocessing unit with color monitor, keyboard and mouse from which all commands, controls and setup parameters may be entered. All setup parameters shall be store in a non-

volatile media, to prevent loss of setup data if power is interrupted. This microprocessing unit shall be of industrial grade to insure long life in a typical substation or generation plant environment.

2.3 Memory and storage capacity

The equipment shall have a non-volatile solid state memory (ex. SSD, flash, etc.) with the required capacity to stores at least one (1) year of continuous data based in typical recording periods and typical recording rates. Also the memory shall have a minimum storage capacity of 1,000 RMS Trigger events and 1,000 Instantaneous trigger events based in typical recording rates and recording periods. Typical recording periods and recording rates are:

a. RMS Trigger Recording Function (Recording rate of 1sample per cycle on all the signals)
    i. Pre-Trigger: 60 seconds
    ii. Post –trigger: 300 seconds

b. Instantaneous Values Trigger Recording Function (recording rate of 250 samples per cycle on all instantaneous signals)
    i. Pre-Trigger: 1 second
    ii. Post-Trigger: 2 seconds

c. Continuous Recording Function
   The recording rate is 1 sample per second on all the signals. This recording function is continuous, but saved in 24 hours period.

All the recording functions mentioned above shall work simultaneously. The equipment shall maintain the date and time in an internal battery-backed clock.

2.4 Communication

The equipment shall have at least two Ethernet 10/100/1000 Mbps port (LAN interface, TCP/IP Protocol) for local and remote network communication.

2.5 Power Source

The equipment shall have a redundant power supply. Two separate inputs (one AC and one DC) 100 – 240 VAC, 60 Hz and 100 – 150 DC. Some applications could require DC supply of 48 VDC $\pm$ 10%, verify before the equipment acquisition.

2.6 Measurement accuracy

2.6.1 Voltage measurement error shall be less than $\pm$ 0.3 % of reading
2.6.2 Current measurement error shall be less than $\pm$ 0.3% of reading

3. Software

3.1 The software platform of the equipment shall be compatible with the latest version of windows operating system.

3.2 The equipment remote communication shall be thru TCP/IP network connectivity (LAN). The remote communication should permit at least the set up and data retrieval of the equipment. The equipment should have the capability to perform at least the following functions remotely:

i. Modification of the configuration
ii. Retrieval of captured events
iii. Remote event triggering

3.3 The equipment shall have the capacity of time synchronization with GPS system. A GPS receiver and GPS antenna shall be included.

3.4 Triggers

3.4.1 The equipment shall support user defined programmable triggers. Triggering shall be initiated based upon primary quantities (voltage, current, and frequency), calculated quantities (watts, Var, power factor, apparent power, etc.), digital signals or small analog signals.

3.4.2 The trigger thresholds shall be based on limits, gradients, equations and status. Examples of trigger conditions that shall be available are:

i. Level threshold (high level, low level, in-band, out-band, etc.)
ii. Rate of change (ex. frequency variation (df/dt))
iii. Manual input (keyboard trigger)
iv. Request from remote computer
v. Event input status (digital signal status)

3.4.3 A re-trigger function shall be available which permits the equipment to generate a new event register if a second disturbance is detected while the recording of the first disturbance is still in process. This process should continue if more disturbances occur in the new registers.

3.5 The acquisition software shall include a user defined pre-trigger interval option as well as a user defined post trigger interval for the information captured in the case of triggered events. The minimum range of the pre-trigger interval should be from 0 to 60 seconds and the minimum range for the post trigger interval should be 0 to 300 seconds. In addition, the date, time, and type of trigger that initiated the event shall be included as part of the disturbance record.

3.6 The acquisition software shall have the following capabilities:

i. Time displays (ex. Oscilloscope)
ii. Digital Status display (ex. High/Low, 1/0)
iii. Multiple displays and multiple signals in displays in real time and off-line
iv. Display resizing
v. Programmable conversion of range and units of signals
vi. Independent range for signals

3.7 The acquired data shall be available in a format directly compatible with Siemens Power Technologies International (Siemens PTI) PSS/E plotting software.

3.8 The software shall support data export in ASCII, CSV and PSS/E formats.

3.9 The software shall support image export in JPG, BMP or WMF formats.

3.10 The software shall have the following analysis capabilities for the data and signals (primary and calculated):

i. Fast Fourier Transform (FFT)
ii. Peak analysis
iii. Filter functions
iv. Series and scalar mathematic (square root, inversion, square, sum, gain, offset, etc.)

3.11 The software shall performs the following power engineering calculations (on-line and off-line) and measurements:

i. Three phase and single phase Power (Real, reactive, apparent)
ii. Power Factor
iii. Power angle
iv. rms line and phase voltage
v. rms current
vi. Power system frequency
vii. DC voltage and currents
viii. AC voltage and currents

4. General

4.1 Environmental Conditions

4.1.1 Operating temperature: 0° C to 50° C
4.1.2 Operating humidity: 95 %, non-condensing

4.2 Equipment cabinet and corresponding accessories

The cabinet should have test switches at the front of the panel for the three phase voltages and currents. The test switches should have a minimum rating of 600 V rms and 30 A rms; semi flush mounted, back connected, equal or similar to ABB FT-1, style no. 129A514G01.

The signals (analog and digital) should terminate on terminal blocks inside the cabinet, before the connection to the Dynamic System Monitor. The AC, DC, digital, exciter voltage and exciter current signals should be in different terminal blocks. The terminal blocks should have a minimum rating of 600 V rms and 30 A rms (**except the exciter voltages signals**, see below). Examples of terminal blocks are: GE CR151B2 and Marathon 1512 STD. The current signals should terminate on shorting type heavy duty terminal blocks equal or similar to Marathon, catalog number 1506SC. The terminal blocks used for the excitation voltage of the generators must have a nominal voltage capacity greater than 800 V DC. A switch or breaker for isolation purposes is also required for the excitation voltage and current signals.

4.3 Documentation

4.3.1 The equipment shall include a documentation package that contains the user, operation and maintenance manuals and the mechanical and electrical equipment drawings. The documentation should be in hard copy and in digital format.

4.3.2 The equipment documentation shall include a copy of the software.

4.4 Spare parts recommended by the equipment manufacturer shall be included in the DSM purchase order.

4.5 Warranty

The equipment warranty shall include part and service for a period not less than 60 months from the delivery day.

4.6 Equipment Training, Installation Support and Commissioning

4.6.1 An on-site equipment operation and configuration training should be included.

4.6.2 The DSM manufacturer shall perform the equipment commissioning and offer installation support.

APPENDIX E

MINIMUM TECHNICAL REQUIREMENTS FOR INTERCONNECTION OF PHOTOVOLTAIC (PV) FACILITIES

The proponent shall comply with the following minimum technical requirements:

1. VOLTAGE RIDE-THROUGH:

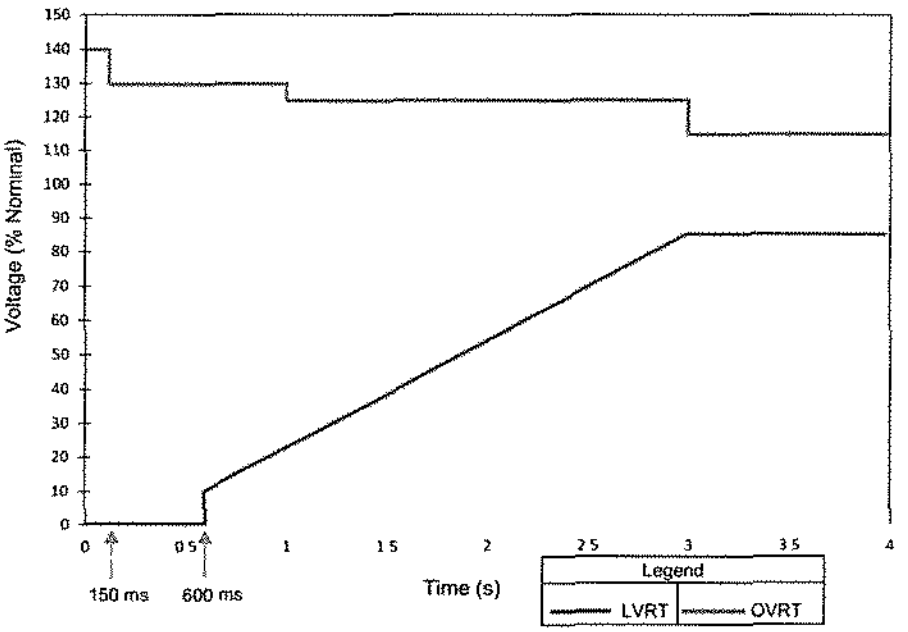

Figure 1 Voltage Ride-Through Requirements

a. PREPA's Low Voltage Ride-Through (LVRT) Requirements:

   i. From Figure 1, PREPA requires all generation to remain online and be able to ride-through three phase and single phase faults down to 0.0 per-unit (measured at the point of interconnection), for up to 600 ms.

   ii. All generation remains online and operating during and after normally cleared faults on the point of interconnection.

iii. All generation remains online and operating during backup-cleared faults on the point of interconnection.

iv. During the low voltage fault conditions, the PV facility shall operate on reactive current injection mode. This mode of operation shall be implemented with a reactive current droop characteristic which shall have an adjustable slope from 1 to 5%. A dead band of 15 % is required.

b. PREPA's Overvoltage Ride-Through (OVRT) Requirements:

i. PREPA requires all generation to remain online and able to ride-through symmetrical and asymmetrical overvoltage conditions specified by the following values illustrated in Figure 1:

Overvoltage (pu)	Minimum time to remain online
1.4 – 1.3	150 ms
1.3 – 1.25	1 s
1.25 – 1.15	3 s
1.15 or lower	indefinitely

2. VOLTAGE REGULATION SYSTEM (VRS)

Constant voltage control shall be required. Photovoltaic System technologies in combination with Static Var Controls, such as Static Var Compensators (SVCs), STATCOMs and DSTATCOMs are acceptable options to comply with this requirement. A complete and detailed description of the VRS control strategy shall be submitted for evaluation.

a) Photovoltaic Facilities (PVF) must have a continuously-variable, continuously-acting, closed loop control VRS; i.e. an equivalent to the Automatic Voltage Regulator in conventional machines.

b) The VRS set-point shall be adjustable between 95% to 105% of rated voltage at the POI. The VRS set-point must also be adjustable by PREPA's Energy Control Center via SCADA.

c) The VRS shall operate only in a voltage set point control mode. Controllers such as Power Factor or constant VAR are not permitted.

d) The VRS controller regulation strategy shall be based on proportional plus integral (PI) control actions with parallel reactive droop compensation. The VRS Droop shall be adjustable from 0 to 10%.

e) At zero percent (0%) droop, the VRS shall achieve a steady-state voltage regulation accuracy of +/- 0.5% of the controlled voltage at the POI.

f) The VRS shall be calibrated such that a change in reactive power will achieve 95% of its final value no later than 1 second following a step change in voltage. The change in reactive power should not cause excessive voltage excursions or overshoot.

g) The generator facility VRS must be in service at any time the PVF is electrically connected to the grid regardless of MW output from the PVF.

h) The VRS dead band shall not exceed 0.1%.

3. Reactive Power Capability and Minimum Power Factor Requirements

The total power factor range shall be from 0.85 lagging to 0.85 leading at the point of interconnection (POI). The reactive power requirements provide flexibility for many types of technologies at the Renewable Energy Facility. The intent is that a PVF can ramp the reactive power from 0.85 lagging to 0.85 leading in a smooth continuous fashion at the POI.

The +/- 0.90 power factor range should be dynamic and continuous at the point of interconnection (POI). This means that the PVF has to be able to respond to power system voltage fluctuations by continuously varying the reactive output of the plant within the specified limits. The previously established power factor dynamic range could be expanded if studies indicate that additional continuous, dynamic compensation is required. It is required that the PVF reactive capability meets +/- 0.85 Power Factor (PF) range based on the PVF Aggregated MW Output, which is the maximum MVAr capability corresponding to maximum MW Output. It is understood that positive (+) PF is where the PVF is producing MVAr and negative (-) PF is where the PVF is absorbing MVAr.

This requirement of MVAr capability at maximum output shall be sustained throughout the complete range of operation of the PVF as established by Figure 2.

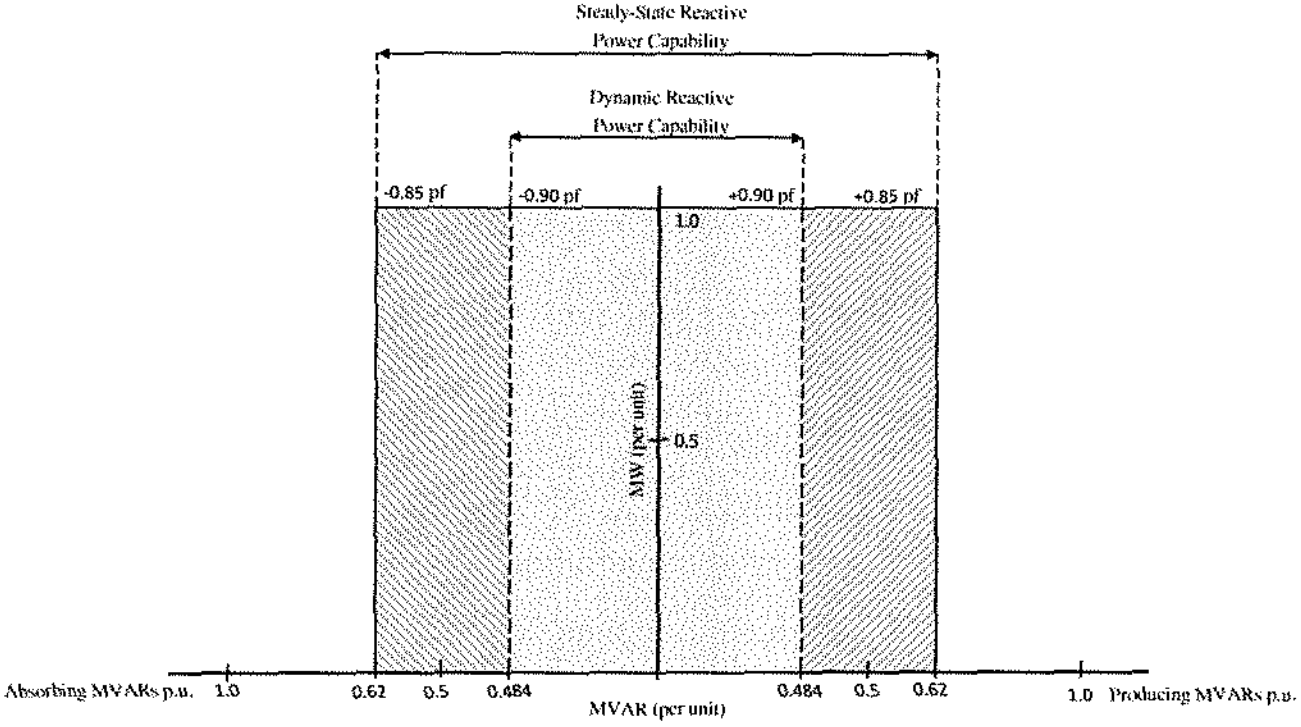

Figure 2 Reactive Power Capability Curve

4. Short Circuit Ratio (SCR) Requirements:

Short Circuit Ratio values (System Short Circuit MVA at POI/PV Facility MVA Capacity) under 5 shall not be permitted. The constructor shall be responsible for the installation of additional equipment, such as synchronous condensers, and controls necessary to comply with PREPA's minimum short circuit requirements.

5. FREQUENCY RIDE THROUGH (FRT):

- 57.5 - 61.5 Hz — No tripping (continuous)
- 61.5 - 62.5 Hz — 30 sec
- 56.5 - 57.5 Hz — 10 sec
- < 56.5 or > 62.5 Hz — Instantaneous trip

6. FREQUENCY RESPONSE/REGULATION:

PV facility shall provide an immediate real power primary frequency response, proportional to frequency deviations from scheduled frequency, similar to governor response. The rate of real power response to frequency deviations shall be similar to or more responsive than the droop characteristic of 5% used by conventional generators. PV facility shall have controls that provide both for down-regulation and up-regulation. PV technologies, in combination with energy storage systems such as, but not limited to BESS, flywheels and hybrid systems are acceptable options to comply with PREPA's frequency response and regulation requirements.

For small frequency deviations (for example less than 0.3 Hz), the PV facility response shall be proportional to the frequency deviation, based on the specified 5% droop characteristic. The frequency response dead band shall not exceed 0.02%. For large frequency deviations (for example in excess of 0.3 Hz), the PV facility shall provide an immediate real power primary frequency response of at least 10% of the maximum AC active power capacity (established in the contract). The time response (full 10% frequency response) shall be less than 1 second.

If energy storage systems are utilized to comply with the frequency regulation requirements, and during a disturbance the system frequency stays below 59.7 Hz, the facility frequency response shall be maintained for at least 9 minutes. After the ninth minute the real power primary frequency response shall not decrease at a ramp rate higher than 10% of the maximum AC active power capacity per minute.

The operational range of the frequency response and regulation system shall be from 10% to 100% of the maximum AC active power capacity (established in the contract). The PV facility power output at the POI shall never exceed the maximum AC active power (established in the contract).

7. Ramp Rate Control:

Ramp Rate Control is required to smoothly transition from one output level to another. The PV facility shall be able to control the rate of change of power output during some circumstances, including but not limited to: (1) rate of increase of power, (2) rate of decrease of power, (3) rate of increase of power when a curtailment of power output is released; (4) rate of decrease in power when curtailment limit is engaged. A 10 % per minute rate (based on AC contracted capacity) limitation shall be enforced. This ramp rate limit applies both to the increase and decrease of power output and is independent of meteorological conditions. The ramp rate control tolerance shall be +10%.

8. Power Quality Requirements:

The developer shall address, in the design of their facilities potential sources and mitigation of power quality degradation prior to interconnection. Design considerations should include applicable standards including, but not limited to IEEE Standards 142, 519, 1100, 1159, and ANSI C84.1. Typical forms of power quality degradation include, but are not limited to voltage regulation, voltage unbalance, harmonic distortion, flicker, voltage sags/interruptions and transients.

9. Special Protection Schemes:

PV facility shall provide adequate technology and implement special protection schemes as established by PREPA in coordination with power management requirements.

10. General Interconnection Substation Configuration:

An interconnecting generation producer must interconnect at an existing PREPA switchyard. The configuration requirements of the interconnection depend on where the physical interconnection is to occur and the performance of the system with the proposed interconnection. The interconnection must conform, at a minimum, to the original designed configuration of the switchyard. PREPA, at its sole discretion, may consider different configurations due to physical limitations at the site.

11. MODELING AND VALIDATION

The Contractor shall submit to PREPA a Siemens - PTI certified PSS/E mathematical model and data related to the proposed PV facility. When referred to the PV facility model, this shall include but is not limited to PV inverters, transformers, collector systems, plant controllers, control systems and any other equipment necessary to properly model the PV facility for both steady-state and dynamic simulation modules. It is required that the Contractor submits both an aggregate and detailed version of the PV facility model. At a later stage in the process, it is also required that the Contractor submits as-built PSS/E mathematical models of the PV Facility.

The Contractor shall be required to submit user manuals for both the PV inverter and the PV facility models including a complete and detailed description of the voltage regulation system (VRS) and frequency regulation system model implementation. The mathematical models shall be fully compatible with the latest and future versions of PSS/E. It is preferred that the models are PSS/E standard models. In the case that the Contractor submits user written models, the Contractor shall be required to keep these models current with the future versions of the PSS/E program until such time that PSS/E has implemented a standard model. The Contractor shall submit to PREPA an official report from Siemens - PTI that validates and certifies the required mathematical models, including subsequent revisions. The data and PSS/E model shall also be updated and officially certified according to PREPA requirements when final field adjustments and parameters measurements and field tests are performed to the facility by the contractor. The mathematical model (either PSS/E standard or user written model) of the PV facility shall be officially certified by Siemens - PTI before a specific and validated PSS/E mathematical model of the complete PV facility be submitted to PREPA. The Contractor shall be responsible of submitting the official reports and certifications from Siemens – PTI, otherwise the mathematical model shall not be considered valid.

The Contractor shall be responsible to submit Siemens – PTI certified PSSE mathematical models of any kind of compensation devices (ie. SVC, STATCOMs, DSTATCOMs, BESS, etc.) used on the PV facility. It is preferred that the models are standard models provided with PSS/E. In the case that the Contractor submits user written models, the PV facility Contractor shall be required to keep these models current with the future versions of the PSS/E program until such time that PSS/E has implemented a standard model. In its final form, the mathematical model shall be able to simulate each of the required control and

operational modes available for the compensation device and shall be compatible with the latest and future versions of PSSE. Final adjustments and parameters settings related with the control system commissioning process shall be incorporated to the PSSE mathematical model and tested accordingly by the PV facility Contractor and PREPA system study groups. The Contractor shall also perform on-site field tests for the identification, development, and validation of the dynamic mathematical models and parameters required by PREPA for any kind of compensation devices used at the PV facility. The mathematical models of the PV facility and its required compensation devices shall be officially certified by Siemens - PTI before a specific and validated PSS/E mathematical model of the complete PV facility be submitted to PREPA. The Contractor shall be responsible of submitting the official reports and certifications from Siemens – PTI, otherwise the mathematical models shall not be considered valid.

PV facility Owners that provide user written model(s) shall provide compiled code of the model and are responsible to maintain the user written model compatible with current and new releases of PSS/E until such time a standard model is provided. PREPA must be permitted by the PV facility Owner to make available PV Facility models if required to external consultants with an NDA in place.

12. TRANSIENT MATHEMATICAL MODEL

The Contractor shall be responsible of providing a detailed transient model of the PV facility and to show that it is capable of complying with PREPA's transient Minimum Technical Requirements.

13. DYNAMIC SYSTEM MONITORING EQUIPMENT

The developer of the PV facility shall be required to provide and install a dynamic system monitoring equipment that conforms to PREPA's specifications.

APPENDIX F

DETERMINATION OF NET ELECTRICAL OUPUT NOT RECEIVED

To calculate the Net Electrical Output not received by PREPA during any time period the following method will be used:

A. First, the specific time period ("Event Hours") of the Day ("Event Day") that PREPA does not receive Net Electrical Output in connection with a disconnection or curtailment of the Facility will be determined.

B. Second, the average solar irradiation as measured by the working pyranometers in the Facility as well as the average temperature will be determined for the Event Hours.

C. Third, SELLER will provide output curves (Output Curves) for the Facility based on the power curves provided by the manufacturer and taking into account all factors that may affect the output such as, but not limited to, temperature derating, DC and AC losses, inverter losses and transformer losses. SELLER will validate the Output Curves during the first three months of operation of the Facility. Output Curves, together with the Event Hours determined under Paragraph A and average solar irradiation and temperature determined under Paragraph B, will be used to calculate the Net Electrical Output that would have been generated by the Facility during the Event Hours. APPENDIX F-1 illustrates the format of Output Curves. SELLER will provide PREPA the actual power curve furnished by the manufacturer of the photovoltaic modules installed in the Facility.

D. Fourth, in order to ascertain the reliability of the above calculation of Net Electrical Output, the same calculations described in the above Paragraphs B and C will be made for the same time period as the Event Hours in the nearest Day prior and in the nearest Day following the Event Day for which data is available ("Comparable Hours"). The Net Electrical Output so calculated will be compared to the Actual Net Electrical Output

delivered to PREPA for the same time periods. If, the Net Electrical Output calculated from the Output Curve is plus or minus 5% (five percent) of the actual Net Electrical Output delivered to PREPA no adjustments will be made to the Net Electrical Output calculated in Paragraph C.

E. If the calculations described in the preceding Paragraph D show a variance in Net Electrical Output of more than 5% (five percent), the Net Electrical Output calculated from the Output Curve for the Event Hours will be adjusted by multiplying it by a ratio, ("Adjustment Ratio")

- The Adjustment Ratio will be calculated by taking the arithmetic average of the two ratios resulting of using the Net Electrical Output delivered to PREPA for the Comparable Hours as the numerator and the Net Electrical Output predicted by the Output Curve for the Comparable Hours as the denominator.

F. If any period during the Event Hours and thus the Comparable Hours are for a time period that is not exactly equal to the time period that the meters measure and record, the information data for that shorter time period not measured will be calculated by prorating it over the time period recorded. For example if the Event Hours is ten (10) minutes and pertinent data is recorded and kept for fifteen (15) minute intervals, the data for the shorter time period will be calculated as the product of the data for the fifteen (15) minute interval multiplied by the ratio of ten (10) divided by fifteen (15) (i.e., the actual Event Hours divided by the time interval for which records for these data are available).

APPENDIX F-1

OUTPUT CURVES

To be provided by SELLER and approved by PREPA, two weeks after

the Initial Synchronization Date.

Output Curves shall be revised annually.