



Distributed Energy Resources Interconnection Manual
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DISTRIBUTED ENERGY RESOURCES (DER) **INTERCONNECTION MANUAL**

1. Introduction

This CPS Energy Distributed Energy Resources Interconnection Manual (“Manual”) has been prepared for use by both CPS Energy personnel and potential distributed generation (energy resources) owners in order to connect and operate generation systems up to 10 MW on the CPS Energy electric distribution system at voltages of 35kV and below. Any generation 10 MW and over and /or directly connected to the transmission system will be dealt with on a case-by-case basis. Examples of Distributed Energy Resources (“DER”) include, but are not limited to systems that generate energy such as solar photovoltaic, wind, combined heat and power, fuel cells, micro-turbines, reciprocating engines, Stirling engines, energy storage, landfill gas, and diesel.

1.1 Goals and Perspective

CPS Energy has developed this Manual keeping three main goals in perspective:

1.1.1 Safety First: The first and most important goal for CPS Energy is safety; the safety of the general public and of the employees working on the electrical systems.

1.1.2 Reliability: The second goal is reliability; the interconnection of the DER to CPS Energy’s distribution system must not compromise the reliability and/or the service quality of any of CPS Energy’s customers.

1.1.3 Economics: The third goal is economics; the interconnection must be designed in a cost effective manner.

1.2 Business Purposes

Distributed Energy Resources are normally installed for one of two business purposes. The business purposes are known as either Net-Metering or Grid-Tied as outlined below.

1.2.1 Net-Metering

- DER System energy is provided to supply the customer’s premises and thus displaces the customer’s energy consumption from CPS Energy when installed behind the Point of Delivery (POD) on the customer side.
- The customer must also be the DER System’s owner.
- Any excess power generated will be delivered and sold to CPS Energy.
- The DER System may not serve any other electrical customer in a different location on the CPS Energy System.

1.2.2 Grid-Tied

- The DER System is designed with the sole purpose to sell all of its generated net power to CPS Energy under a power purchase agreement or tariff.
- The DER System is connected to CPS Energy’s distribution system at a location and in a manner approved by CPS Energy.
- The DER System does not directly provide power to any other entity or customer.

1.3 Application

This Manual applies to either type of arrangement. The technical and operational impacts on the CPS Energy system will vary depending on the size of DER System and in the manner of interconnection. CPS Energy may require different equipment depending on the size of the DER System, the amount of power being exported to the CPS Energy system, and the location of the DER System. In any case the potential DER System owner must ultimately conduct their own analysis to determine the economic benefit of the DER System's operation.

CPS Energy reserves the right to amend this Manual from time to time. This Manual is located on the CPS Energy website at:

http://www.cpsenergy.com/Developers_Builders/Distributed_Energy_Resources/

2. Interconnection with CPS Energy

This Manual includes the requirements for interconnecting DER Systems to the CPS Energy System. CPS Energy is dedicated and committed to working with applicants to allow interconnection. Certain steps must be followed to result in a successful, safe, and reliable interconnection of the DER System to the CPS Energy System.

2.1 Interconnection Facilities and System Modifications

The installation of DER Systems may require construction of new facilities on CPS Energy's side of the POD or modifications to existing supply facilities in order to accommodate such connections. The determination of the need for system modifications is made by CPS Energy in the context of system studies conducted during the interconnection application and review process.

There may be costs to the DER owner as a result of CPS Energy having to make necessary arrangements for interconnection of the DER System. CPS Energy may require the installation and use of more sophisticated protective devices and operating schemes, especially when the facility is exporting power directly to CPS Energy.

Although the Applicant may be responsible for the costs associated with such construction or modifications, CPS Energy will own and operate all facilities that are installed on the utility's side of the POD.

2.2 Application Review and Interconnection Evaluation

An interconnection evaluation study by CPS Energy is required to evaluate the Application (see Appendix A4) along with submitted materials and drawings. This technical perspective evaluation is needed to identify and to assist in resolution of any issues associated with the proposed DER System interconnecting to the CPS Energy distribution system.

***Note:** While CPS Energy accepts no liability related to the installation and operation of the DER System, it is required that the design and installation utilize qualified and experienced contractors and consultants, and be performed in accordance with minimum requirements of the*

National Electrical Code (NEC) and all applicable codes, and be in accordance with industry best practices.

2.3 Interconnection Provisions for DER Systems

The DER Owner or its contractor shall design and install the DER System as necessary for the interconnection to CPS Energy's System at the point of interconnection as located and approved by CPS Energy (See the definition of "Point of Interconnection" in Appendix A1). Design shall be in accordance with requirements and provisions contained in this Manual, including its attachments.

2.4 Interconnection Facilities and/or System

The owner will be responsible for the expenses associated with Interconnection Facilities required by CPS Energy and for the costs of any additional protective facilities which are required or prudent in order to protect CPS Energy's System from disruption or damage caused by the DER System (See Definitions of "Interconnection Facilities" and "Distributed Energy Resources Facilities" in Appendix A1).

2.4.1 Measuring Energy at Facilities: The Interconnection Facilities shall have provisions and equipment to measure both the energy produced by the DER Facility and any energy provided by CPS Energy for Owner's use at the DER Site.

2.4.2 Disconnection of Interconnection at Facilities: DER Owner may disconnect from CPS Energy's System by operation of its own switch, in accordance with Appendix A2 ("Interconnection Requirements for Distributed Energy Resources") in this Manual.

Note: The Owner shall have no right to operate CPS Energy's switch or any of CPS Energy's Equipment located on the CPS Energy System side of the Point of Delivery.

2.4.3 CPS Energy Right to Disconnect Interconnection at Facility: CPS Energy shall have the right to disconnect the DER Facility from the CPS Energy System where continuance of service to Customer or other Customers will, in CPS Energy's reasonable determination, endanger persons or property. CPS Energy also reserves the right to disconnect for other cases as described in Appendix A2.

3. Technical, Operational, and Maintenance Requirements

The detailed technical, operational, and maintenance requirements are found in Appendix A2, "Interconnection Requirements for Distributed Energy Resources". This section of the Manual summarizes some of those key requirements. In general the DER System and associated facilities must be designed in accordance with, but not limited to, UL Standards, the Institute of Electrical and Electronic Engineers (IEEE) Standards, the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the ERCOT Operating Guides and Protocols (ERCOT), CPS Energy Electric Service Standards and any other applicable local, state, or federal codes or standards. Particular attention should be paid to UL 1741, IEEE 519 and IEEE 1547.

3.1 DER Maximum Capability Limitations

3.1.1 Secondary Voltages: DER Facilities connected at secondary voltages cannot have a maximum capacity rating that exceeds the size of the transformer serving the secondary.

3.1.2 Radial Distribution System: DER Facilities connected to the radial distribution system at distribution voltage cannot have a combined maximum capacity rating connected on an individual feeder that exceeds 2 MW for 13 kV and 5 MW for 35kV feeders. In no case will the DER feed power back through the CPS Energy substation transformer.

3.1.3 Network Systems: DER Facilities connected to the CPS Energy system downtown underground networks cannot have maximum ratings that exceed 15% of the previous year's peak load on the specific individual circuit within the secondary network grid. Only inverter-based DER Systems are allowed on the network. In no case can a rotating synchronous machine be placed on the network grid. (See Section 4 below for additional information on the networks.)

3.2 Prevention of Interference

The DER System operating requirements are described below and in Appendix A2.

3.2.1 Voltage: The Owner will operate its DER equipment in such a manner that the voltage levels on CPS Energy are in the same range as if the DER equipment was not connected to CPS Energy's system. The Owner shall provide an automatic method of disconnecting the DER System from CPS Energy if a sustained voltage deviation in excess of +5.0 % or -10% from nominal voltage persists for more than 2 seconds, or a deviation in excess of +10% or -30% from nominal voltage persists for more than 10 cycles. The Owner may reconnect when CPS Energy voltage and frequency return to normal range and the system is stabilized.

Note: For non-inverter installations, the Owner shall use 3-phase, 4-wire wye connected PT's for monitoring voltage and the monitoring point shall be at the Point of Common Coupling (PCC).

3.2.2 Flicker: The Owner's equipment shall not cause excessive voltage flicker on CPS Energy's distribution system. This flicker shall not exceed 3.0% voltage dip, in accordance with IEEE 519 as measured at the PCC.

3.2.3 Frequency: The operating frequency of the DER equipment shall not deviate more than +0.5 Hertz (Hz) or -0.7 Hz from a 60 Hz base. The Owner shall automatically disconnect the DER System from CPS Energy within 15 cycles if this frequency tolerance cannot be maintained. The Owner may reconnect when CPS Energy voltage and frequency return to normal range and the system is stabilized.

3.2.4 Harmonics: In accordance with IEEE 519, the total harmonic distortion (THD) voltage shall not exceed 5.0% of the fundamental 60 Hz frequency nor 3.0% of the fundamental frequency for any individual harmonic, when measured at the PCC.

3.2.5 Fault and Line Clearing: The Owner shall automatically disconnect from CPS Energy within 10 cycles if the voltage on one or more phases falls below -30% of nominal voltage on CPS Energy serving the Customer premises. This disconnect timing also ensures that the DER System is disconnected from CPS Energy prior to automatic re-close of breakers. The DER System may reconnect when CPS Energy voltage and frequency return to normal range and the system is stabilized.

Note: For non-inverter installations, the Customer shall use 3-phase, 4-wire wye connected PT's for monitoring voltage and the monitoring point shall be at the PCC.

3.2.6 Direct Current Injection: The DER System should not inject direct current (DC) greater than 0.5% of rated output current into the CPS Energy System.

4. CPS Energy Application Review and Evaluation

4.1 Introduction

This section describes a structured approach by CPS Energy for the engineering review process of a typical DER interconnection study. It includes the steps that must be taken to account for site-specific concerns and address the technical and operational requirements of CPS Energy.

The goal of CPS Energy is that the interconnection analyses of the impacts of DER are conducted in a clear and consistent manner. However, certain applications may require minor deviations while they are being reviewed by CPS Energy. Such minor modifications to a pending application shall require clear communications between CPS Energy and the Applicant.

4.2 CPS Energy Processing of DER Applications

In general, any interconnection study performed by CPS Energy shall follow these guidelines:

- (1) Study scope shall be based on characteristics of the DER System at the proposed location.
- (2) Study shall consider cost incurred as a result of DER interconnection.
- (3) CPS Energy shall provide a study fee cost estimate to the DER applicant prior to initiation of study.
- (4) CPS Energy shall make written reports and study results available to the DER applicant.
- (5) CPS Energy may reject applications for demonstrable reliability or safety issues.
- (6) CPS Energy shall use reasonable efforts to meet the application processing schedule, or will notify the DER applicant in writing why it cannot meet the schedule and provide estimated dates for application processing and interconnection study completion.

4.3 Applicants Initial Requirements

4.3.1 Existing DER Systems: Anyone owning or operating a DER Facility or Facilities in parallel with CPS Energy's electric distribution system even for a short time frame, must

immediately notify CPS Energy of the existence, location and category of the DER Facility or Facilities. If the owner has not previously properly registered the DER with CPS Energy, CPS Energy personnel will assist the owner in completing the process in this Manual. If an owner refuses to work through the application process with CPS Energy, then the DER Facility or Facilities must disconnect immediately.

4.3.2 Feasibility Study Request: Should a potential Applicant desire a site feasibility study or studies from CPS Energy, the form in Appendix A3 (“Application for Feasibility Study of Distributed Energy Resources”) must be filled out and returned with the non-refundable fee. An application and fee must be submitted for each site requested. See Appendix A5 for the actual fees.

4.3.3 Interconnection Request: In advance of an interconnection, the Applicant must contact the CPS Energy Distributed Energy Resources Department and complete the “Application for Interconnection of Distributed Energy Resources” (see Appendix A4). A separate form and application fee must be submitted for each DER facility or facilities and each location. The fees are found in Appendix A5.

4.3.4 Submittal of a DER System Plan: As a part of the application, the Applicant shall submit a plan detailing the electrical design, interconnection requirements, size, and operational plans for the DER System (the “DER Plan”) in accord with this Manual, the Application in Appendix A4, and Appendix A2 (“Interconnection Requirements for Distributed Energy Resources”). For facilities $\geq 25\text{kW}$ the DER Plan shall be prepared by a Professional Engineer registered in the State of Texas.

Either at the time of submission or at any time during the review process, CPS Energy may require additional information. CPS Energy may request an additional engineering fee depending on the extent of any analysis needed. A basic fee will be charged initially in anticipation that there will be charges required for interconnection facilities and for potential system modifications to CPS Energy’s system. The fee will be adjusted accordingly depending on the extent of interconnection facilities or system modifications deemed necessary by CPS Energy.

4.3.5 Waiver of Application Fees: CPS Energy may, at its sole discretion, waive the application fee in the case of DER Facilities (i) that will not be operated in parallel with CPS Energy’s electric distribution system, (ii) with no chance to ever export power to CPS Energy, (iii) that are of standard manufacture and design and intended entirely as emergency or back-up power supply for the facility, or (iv) are part of a net-meter rebate program.

4.4 CPS Energy Review Process

4.4.1 Feasibility Study Review Process: CPS Energy will review any requests related to the feasibility of sites. CPS Energy will provide a “Letter of Availability” (LOA) to the Applicant within 30 days of the receipt of an accepted “Application for Feasibility Study of Distributed Energy Resources” (Appendix A3). This LOA will include the availability of interconnection utility services.

4.4.2 Interconnection Request and DER Plan Review Process: CPS Energy will review the application and accompanying documents, plans, specifications, and other information provided and will return an interconnection analysis to the Applicant within 30 days of receipt of final plans and specifications.

(1) Technical review will be consistent with guidelines established by the “Interconnection Requirements for Distributed Energy Resources” (Appendix A2).

(2) If corrections or changes to the plans, specifications and other information are made, or to be made, by the Applicant, the 30-day period may be reinitialized when such changes or corrections are provided to CPS Energy. In addition, any changes to the site or project requiring new analysis by CPS Energy may require additional costs and a new DER Plan. The cost will be determined by CPS Energy and shall be paid by the Applicant.

The Applicant acknowledges and agrees that any review or acceptance of such plans, specifications and other information by CPS Energy shall not impose any liability on CPS Energy and does not guarantee the adequacy of the Applicant’s DER Facility or Facilities to perform its intended function. CPS Energy disclaims any expertise or special knowledge relating to the design or performance of such generating installations and does not warrant the efficiency, cost-effectiveness, safety, durability, or reliability of such DER Facilities and installations.

(3) In the event it is necessary at the time of initial interconnection or at some future time for CPS Energy to modify its electric delivery systems in order to serve the Applicant’s DER Facilities and/or purchase or continue to purchase the output of the DER Facilities, or because the quality of the power provided by the DER Facility adversely affects CPS Energy’s delivery system, the DER Owner will be responsible to reimburse CPS Energy for all costs of modifications required. Additionally, the DER owner is expected to comply with changes to any of the technical or operational requirements as a result of such modifications.

4.5 Application for DER on CPS Energy Network System

(1) Certain aspects of secondary network systems create technical difficulties that may make interconnection more difficult to implement. Applications to connect to the CPS Energy network must be analyzed on a case-by-case basis.

(2) In a network secondary distribution system, service is redundantly provided through multiple transformers as opposed to radial systems where there is only one path for power to flow from the distribution substation to a particular load. The secondary’s of networked transformers are connected together to provide multiple potential paths for power and thus much higher reliability than an equivalent radial feeder. To keep power from inappropriately feeding from one transformer back through another transformer (e.g., feeding a fault on the primary side), devices called network protectors are used to detect such a backfeed and open very quickly (within a few cycles).

(3) If the aggregate DER output within a networked secondary exceeds the aggregate load, the excess power will activate one or more network protectors. If such a situation were allowed, the

reliability of the secondary network would be reduced. In such a circumstance, DER could compromise grid reliability.

(4) CPS Energy has nine separate network distribution systems located in the downtown area. If it is determined that the Applicant's DER Facility is planned to be on a network, the Applicant will be notified and referred to Appendix A5 for the application fees associated with CPS Energy network systems.

5. DER System Owner's Responsibilities

5.1 General

The Owner/Applicant shall provide CPS Energy's Distributed Energy Resources Department with a fully completed Application (Appendix A4) and all planning and support materials for CPS Energy to evaluate the interconnection requirements for the DER Facility.

(1) The Owner shall have the facility installed according to documented plans and shall allow CPS Energy to complete its commissioning testing and requirements as outlined in Appendix A2. The Owner shall correct any shortcomings determined by CPS Energy before the DER Facility or Facilities are released for operation.

(2) On an annual basis, CPS Energy shall have the right to review the operation of the DER Facility or Facilities at the site and conduct any tests it deems necessary to insure that the impact of the DER on the CPS Energy System results in safety and reliability for all parties involved and for all of CPS Energy Customers.

5.2 Line Extension and Modifications to CPS Energy's Facilities

(1) As a part of the interconnection analysis performed by CPS Energy, the Applicant will be provided with an estimate of any line extension or other cost to be incurred in providing electric facilities to the DER Facility.

(2) Notwithstanding CPS Energy's line extension policy, the Applicant shall pay in advance the full cost of the construction of any transmission, substation, distribution, transformation, metering, protective, communication or other facilities or equipment which, at the sole discretion of CPS Energy, is required to serve the DER Facility or Facilities.

(3) In the event it is necessary at the time of initial interconnection or at some future time for CPS Energy to modify its electric delivery systems in order to serve the DER Facilities and/or purchase or continue to purchase the output from the DER Facility or Facilities, or because the quality of the power provided by the DER Facility or Facilities adversely affects CPS Energy's delivery system, the Applicant will be responsible to reimburse CPS Energy for all costs of modifications required for the interconnection of the DER Facility or Facilities.

(4) In the event CPS Energy at any time in the future changes primary (or secondary) voltage of distribution facilities serving the DER installation or the Applicant's premises or location such that metering equipment, transformers and/or any other Applicant-owned equipment must be

changed, the full cost of the change will be borne by the Applicant.

(5) In all cases, the Applicant shall pay the full cost of the installation of a visible load break disconnect switch by and to the sole specification of CPS Energy. The switch will be readily accessible to CPS Energy personnel and of a type that can be secured in an open position by a CPS Energy padlock.

(6) Appendices A2 and A7 of this Manual includes additional detail and operational and safety requirements. The Applicant/Owner will follow all aspects of these requirements prior to and during operation of the DER Facility or Facilities.

5.3 Liability Insurance

5.3.1 For Facilities Larger Than 50 kW: Prior to interconnection, the Applicant must provide a certificate of insurance showing satisfactory liability insurance including contractual liability insurance covering indemnity obligations which insures the Owner against all claims for property damage and for personal injury or death arising out of, resulting from or in any manner connected with the installation, operation and maintenance of the Owner's DER Facility.

(1) The amount of such insurance coverage shall be not less than \$2,000,000 per occurrence and name CPS Energy as an additional insured. This amount may be increased at the sole discretion of CPS Energy if the nature of the project so requires.

(2) The certificate of insurance shall provide that the insurance policy will not be changed or canceled during its term without thirty days written notice to CPS Energy. The term of the insurance shall be coincident with the term of the interconnection contract or shall be specified to renew throughout the length of the Interconnection Contract.

(3) The Applicant shall provide proof of such insurance to CPS Energy at least annually and on request by CPS Energy.

5.3.2 50 kW and Smaller: For installations 50kW and smaller the Applicant is not required to provide a certificate of insurance coverage to CPS Energy. It is recommended, however, that the Owner carry liability insurance coverage which insures the Owner against all claims for property damage and for personal injury or death arising out of, resulting from or in any manner connected with the installation, operation and maintenance of the Owner's generating equipment.

5.4 Contracts

5.4.1 Interconnection Contract: The Applicant must sign and deliver to CPS Energy the completed and signed "Distributed Energy Resource Interconnection Agreement" (as appropriate) substantially in the form attached hereto in Appendix A6.

5.4.2 Purchase Power Contract: (where the Owner desires to deliver power and CPS

Energy agrees to purchase power)

- (1) ≤ 25 kW: As outlined in CPS Energy's tariffs if applicable.
- (2) > 25 kW and < 10 MW: The Applicant will execute a Power Purchase Agreement with CPS Energy.
- (3) ≥ 10 MW: DER Facilities of this size are not covered by this Manual and will be considered by CPS Energy on a case-by-case basis.
- (4) An exception may be in the case of a special program offered by CPS Energy any which may have its own Power Purchase Agreement.
- (5) The Applicant may not assign any of the DER related contracts with CPS Energy to another entity without the written approval of CPS Energy.

5.5 Initial Interconnection

Upon satisfactory completion of the review process and execution of required agreements as outlined in this Manual, CPS Energy will prepare the schedule for the interconnection of the DER Facilities.

- (1) The interconnection will be completed as soon as practical after completion of the review process and execution of the necessary contracts.
- (2) After completion of interconnection requirements and prior to initiation of service, CPS Energy will conduct a final inspection and commissioning of the facilities and interconnection to CPS Energy's system.
- (3) Upon satisfactory final inspection, CPS Energy will initiate service to the DER Facility or Facilities.

CPS Energy's review process and final inspection is intended as a means to safeguard CPS Energy's facilities and personnel. Any review by CPS Energy shall not impose any liability on CPS Energy and does not guarantee the adequacy of the Owner's equipment to perform its intended function. CPS Energy disclaims any expertise or special knowledge relating to the design or performance of generating installations and does not warrant the efficiency, cost-effectiveness, safety, durability, or reliability of such DER installations.

Appendix A1: Definitions

The following words, terms and acronyms, when used in this Manual and its attachments shall have the following meanings, unless the context clearly indicates otherwise.

Applicant - A customer or entity that intends to apply or has applied to CPS Energy for interconnection of a Distributed Energy Resources system. (See also Customer/Owner/Producer.)

Application for Interconnection of Distributed Energy Resources (or Application) - The standard form of application for interconnection of Distributed Energy Resources projects approved by CPS Energy as shown in Appendix A4.

Company - CPS Energy.

CPS Energy System/CPS Energy Electric Distribution System - CPS Energy's distribution system 35kV and below to which the DER equipment may be interconnected.

Customer/Owner/Producer - Any entity interconnected to the CPS Energy's system for the purpose of receiving or exporting electric power from or to the CPS Energy's system.

DER Facilities/System - All facilities installed, including the DER itself, to connect the DER to the Point of Interconnection.

Distributed Energy Resources (DER) - An electrical generating facility located within the CPS Energy service territory of less than 10 MW and connected at a voltage of 35kV and below, which may be connected in parallel operation to the CPS Energy system. The facility may include energy storage technologies as well as conventional generation technologies.

Distribution Feeder - An electric line operated at voltages 35 kV and below that serves to deliver power from a utility substation or other supply point to customers.

Electric Reliability Council of Texas (ERCOT) - The area in Texas served by electric utilities, municipally owned utilities, and electric cooperatives that is not synchronously connected with electric utilities outside the state.

Energy Development Department/GENCO/Generation Management System - The department within CPS Energy that has the daily responsibility for generating unit commitments and operational load forecasting.

Grid Tied - A DER connected to the CPS Energy System that does not offset any Customer electrical requirements (other than consumed by the generation auxiliaries). CPS Energy purchases all the net generation produced by the DER. This arrangement requires the execution of a Power Purchase Agreement (PPA) between the DER Owner and CPS Energy.

IEEE - The Institute of Electrical and Electronics Engineers.

Interconnection Agreement (IA) - The standard form of agreement, which has been approved by CPS Energy. The Interconnection Agreement sets forth the contractual conditions under which CPS Energy and a Customer/Applicant/Owner/Producer agree that one or more facilities may be interconnected with the CPS Energy distribution system. (See Appendix A6.)

Interconnection Facilities - All facilities required by CPS Energy as a result of the DER interconnection, to allow the safe and reliable interconnection and parallel operation of the DER.

Interconnection Study - A study or studies that may be undertaken by CPS Energy in response to its receipt of a completed application (see Appendix A4) for interconnection and parallel operation with the utility system. Interconnection studies may include, but are not limited to, service studies, coordination studies and utility system impact studies.

Inverter - A machine, device or system that changes direct-current power to alternating-current power.

Inverter-Based Protective Function - A function of an inverter system, carried out using hardware and software that is designed to prevent unsafe operating conditions from occurring before, during, and after the interconnection of an inverter-based static power converter unit with a utility system. For purposes of this definition, unsafe operating conditions are conditions that, if left uncorrected would result in harm to personnel, damage to equipment, unacceptable system instability or operation outside legally established parameters affecting the quality of service to other customers connected to the utility system.

kV - Kilovolt, an amount of voltage equal to one thousand volts.

kW - Kilowatt, an amount of power equal to one thousand watts.

MW - Megawatt, an amount of power equal to one million watts.

Net-Meter - Service to a Customer under which electric energy generated by that Customer's DER and delivered to the CPS Energy System may be used to offset electric energy provided by CPS Energy to the Customer during a specified billing period.

Network Service/Underground Network - Network Service consists of two or more utility primary distribution feeder sources electrically tied together on the secondary (or low voltage) side to form one power source for one or more customers. Network Service is designed to maintain service to the customers even after the loss of one of these primary distribution feeder sources.

Parallel Operation - The operation of Distributed Energy Resources while the DER is connected to the CPS Energy distribution system.

Point of Common Coupling (PCC) - From the perspective of the DER, this is the nearest point on the CPS Energy System where other customers can be connected. This is generally the point

where system voltages and harmonics are metered, as it best represents the DER's impact on other customers on the CPS Energy System.

Point of Delivery/Point of Demarcation (POD) - The point where the electric energy first leaves the conductors or devices owned by CPS Energy, and enters the service-entrance, other conductors or devices owned by the Customer/Owner/Producer. In nearly all cases this most nearly represents the point where the ownership changes between CPS Energy facilities and the Customer/Owner/Producer's facilities.

Point of Interconnection (POI) - The point where the DER itself is electrically connected, either directly to the CPS Energy System or directly to the load-side (metered) of the Customer's owned equipment for the applicable DER System.

Radial Distribution System - Radial service consisting of one primary distribution feeder source forming a single power source for one or more customers.

Site Feasibility Study - A site specific study that may be undertaken by CPS Energy in response to its receipt of a completed application from a potential DER Owner. See Appendix A3.

Stabilized - A utility system is considered stabilized when, following a disturbance, the system returns to the normal range of voltage and frequency for a duration of two minutes or a shorter time as mutually agreed to by the utility and customer.

Switchgear - An enclosed metal assembly containing components for switching, protecting, monitoring and controlling electric power systems.



Appendix A2

Interconnection Requirements for Distributed Energy Resources

CPS Energy and the Distributed Energy Resource Facility Owner (“Owner”) recognize the importance of having design, operational, and maintenance requirements to coordinate the interconnection of Owner's system with CPS Energy's system. This document addresses typical requirements for interconnecting Distributed Energy Resources (“DER”) Facilities to the CPS Energy system.

1. General Requirements.

1.1. Notice to All Owner’s Personnel. The Owner’s contractors, agents, and operating/maintenance personnel shall be informed of and follow the requirements that are applicable to the specific DER Facility as listed in the Interconnection Agreement (IA). Advanced notice of intent and verification of compliance is required before connecting to CPS Energy system.

1.2. Notifying CPS Energy. Unless otherwise stated in this document any required notification to CPS Energy shall be made to the CPS Energy DER Department.

1.3. Display of Documents. Copies of the IA along with this document shall be posted in the DER Facility and all facilities associated with the operation of the DER Facility.

1.4. Interconnect Study. Specific locations and conditions may require the installation of more sophisticated protective devices and operating schemes. CPS Energy shall make any additional requirements known to the Owner at the time the interconnection studies are completed.

1.5. Disconnect. CPS Energy may disconnect the generator from the distribution system in an emergency, or should the Owner fail to install, operate, and maintain all wiring and equipment in such condition and/or manner that endangers persons or property, or may cause impairment of CPS Energy's interconnection and service to Owner, or any of CPS Energy's distribution customers.

1.6. Definitions.

1.6.1. Point of Delivery (POD) – The point where the electric energy first leaves the conductors or devices owned by CPS Energy and enters the Customer’s installation, unless otherwise specified in a separate CPS Energy agreement, such as the IA or the Customer’s Service Agreement. In nearly all cases this most



nearly represents the point where the ownership changes between CPS Energy facilities and the Owner's facilities. POD is also known as the Point of Demarcation.

1.6.2. Point of Common Coupling (PCC) - From the perspective of the DER, this is the nearest point on the CPS Energy System where other customers can be connected. This is generally the point where system voltages and harmonics are measured, as it best represents the DER's impact on other customers connected to the CPS Energy System.

1.6.3. Point of Interconnection (POI) - The point where the DER itself is electrically connected, either directly to the CPS Energy System or directly to the load-side (metered) of Customer's owned equipment for the applicable DER System.

1.6.4. DER Facilities/System - All facilities installed, including the DER generator itself, to connect the DER to the POI.

1.6.5. Interconnection Facilities - All facilities required by CPS Energy as a result of interconnection to the DER to allow the safe and reliable interconnection and operation of the DER.

1.6.6. POTS – Land line telephone service. (Plain Old Telephone Service per Newton's Telecom Dictionary.)

1.6.7. SCADA - Supervisory Control and Data Acquisition.

1.6.8. EMC – CPS Energy's Energy Management Center.

1.6.9. Interconnection Agreement (IA) – Agreement executed between CPS Energy and Owner.

1.6.10. Electric Reliability Council of Texas (ERCOT) – The area in Texas served by electric utilities, municipally owned utilities, and electric cooperatives that is not synchronously connected with electric utilities outside the state. ERCOT manages the flow of electric power to the customers, schedules power on the grid that connects transmission lines and generation units, and manages financial settlement for the competitive wholesale bulk-power market.

2. Technical and Design Requirements. To help ensure the protection and safety of Owner's and CPS Energy's personnel and property, the continued provision of electric service to Owner, the continued maintenance of an interconnection between Owner and CPS Energy, and the reliable functioning of CPS Energy's overall system operations, the following requirements relevant to the type of DER Facility shall be observed.



2.1. Design Considerations.

2.1.1. Standards. The Owner's equipment shall be designed in accordance with but not limited to UL Standards, Institute of Electrical and Electronics Engineers (IEEE) Standards, the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the ERCOT Operating Guides, CPS Energy Electric Service Standards and any other applicable local, state or federal codes or standards.

2.1.2. Safety.

2.1.2.1. Visual Disconnect. Owner shall furnish and install a manual disconnect device that has a visual break that is appropriate to the voltage level (a disconnect switch, a draw-out breaker, or fuse block), and is accessible to CPS Energy personnel, and capable of being locked in the open position. The Owner shall follow CPS Energy's switching, clearance, tagging, and locking procedures, which CPS Energy shall provide for the Owner.

2.1.2.2. Reconnect Protection. The Owner's DER shall be equipped with protective hardware and software designed to prevent the DER from being connected to CPS Energy's distribution system unless the CPS Energy voltage and frequency is within the accepted range on all phases.

2.1.3. Listed or Certified Equipment. For DER Systems up to 50 kW, certified equipment and equipment listed with an approved test label up to may be installed on CPS Energy's distribution system in accordance with CPS Energy approved interconnection control and protection scheme without further review of the Owner's design by CPS Energy. When the Owner is exporting to CPS Energy using certified equipment, the protective settings and operations shall be those specified by CPS Energy. For a list of the certified equipments see one of the following web sites:

<http://www.gosolarcalifornia.ca.gov/equipment/inverters.php>

http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php

2.1.4. Protection of Owner's Equipment. The Owner shall be responsible for protecting its DER equipment in such a manner that CPS Energy system outages, short circuits or other disturbances including zero sequence currents and ferro-resonant over-voltages do not damage the Owner's DER equipment. The Owner's protective equipment shall also prevent unnecessary tripping of CPS Energy breakers that would affect CPS Energy's capability of providing reliable service to other Customers.



2.1.5. Remote Disconnect Control. If the DER is 2 MW or larger or CPS Energy determines (based on studies or reviewing test results) that a DER may not trip properly when isolated from CPS Energy's system, CPS Energy shall provide (at the Owner's expense) a communication channel to support communication between CPS Energy and the Owner's facility. The channel may be a leased data circuit or other mutually agreed upon medium.

2.1.6. Bi-directional Disconnect Breaker. Circuit breakers or other interrupting devices at the Point of Interconnection must be capable of interrupting maximum available fault current from either direction. Facilities larger than 2 MW and exporting to CPS Energy shall have a redundant circuit breaker unless a listed device suitable for the rated application is used.

2.1.7. Exporting Power to CPS Energy. Exporting to CPS Energy may require additional operational or protection devices and will require coordination of operations with CPS Energy.

2.2. Prevention of Interference.

2.2.1. Automatic Disconnect. The Owner shall provide an automatic method of disconnecting the DER equipment from CPS Energy if any of the parameters in the Interference Table below are violated. The Owner may reconnect with CPS Energy after all parameters return to an acceptable range and the system is stabilized for 2 continuous minutes.

2.2.2. Interference Monitor. Interference is most often measured at the POI. The monitor may be placed at a practical location and best practices calculations may be utilized to determine expected level of interference for compliance. CPS Energy reserves the right to measure these parameters at the most practical point of connection, either the POI, PCC, or POD.

2.2.3. Test Current Injection. Test method shall conform to current IEEE anti-islanding standards. Direct current (DC) must be no greater than 0.5% of rated output current.

2.2.4. Interference Table. The following table lists the key electrical parameters and their acceptable limits in order to prevent interference on the CPS Energy System.



Interference Table		
CPS Energy DER Operating Variable	Trigger Point for Disconnect	Maximum Time to Disconnect (Reference)
1. Voltage @ Point of Interconnection (POI)		
Over Voltage Set point #1	+5% of nominal voltage	2 sec (PUCT)
Under Voltage Set point #1	-10% of nominal voltage	2 sec
Over Voltage Set point #2	+10 % of nominal voltage	0.167 sec
Under Voltage Set point #2	-30% of nominal voltage	0.167 sec
2. Flicker	Voltage at the POI must be less than 3% voltage dip (as defined by the “Maximum Borderline of Irritation Curve” in IEEE 519)	
3. Frequency		
Over Frequency Set point	+0.5 Hz from base frequency	0.25 sec
Under Frequency Set point	-0.7 Hz from base frequency	0.25 sec
4. Harmonics		(IEEE 519)
Total Harmonic Distortion	<5.0% of fundamental frequency	
Individual Harmonics	<3.0% of fundamental frequency	
5. Fault and Line Clearing for Loss of Voltage on any phase of CPS Energy circuit	-30% of nominal voltage	0.167 sec
6. Direct Current Injection	< 0.5% of DER Facility rated output current. (IEEE 1547-2003)	

Note: “Over Voltage Regulation Set point #1” should not be greater than +5% because CPS Energy cannot subject other customers to voltage of +5 - +10% for more than 30 seconds at PCC according to Texas PUC. If greater than +5% is desired, CPS Energy will require voltage calculations prior to approval of installation.

2.3. Single Phase DER--Control, Protection and Safety Equipment. Equipment required for control, protection and safety specific to single phase DER, typically of 50 kilowatts (kW) or less.

- interconnect disconnect device at the POD and at the DER Facility when required
- an over/under voltage trip
- an over/under frequency trip
- synchronizing check for switching



2.4. Three-Phase DER--Control, Protection and Safety Equipment. This section specifies the control, protection, and safety equipment requirements specific to various generation systems. Exporting to CPS Energy may require additional operational or protection devices and will require coordination of operations with CPS Energy.

2.4.1. Three-phase Synchronous Generators.

- Breakers shall be 3-phase devices with electronic or electromechanical control.
- The Owner is solely responsible for properly synchronizing its generator with CPS Energy.
- The excitation system response ratio shall not be less than 0.5.
- The generator's excitation system(s) shall conform, as near as reasonably achievable, to the field voltage versus time criteria specified in the appropriate American National Standards Institute Standard in order to permit adequate field forcing during transient conditions.
- For generating systems greater than 2 MW the Owner shall maintain the Automatic Voltage Regulator (AVR) of each generating unit in service and operable at all times. If the AVR is removed from service for maintenance or repair, CPS Energy's System Operator shall be notified at 210-353-4362.

2.4.2. Three-Phase 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 on CPS Energy side at the PCC is within the visible flicker stated in Section 2.2 of this document. Otherwise, the Owner may be required to install hardware or employ other techniques to bring voltage fluctuations to acceptable levels.

2.4.3. Line-Commutated Inverters do not require synchronizing equipment.

2.4.4. Self-Commutated Inverters whether of interactive or stand-alone type shall be used in parallel with CPS Energy only with synchronizing equipment.

2.4.5. Protective Function Requirements. The protective function requirements for 3- phase facilities of different size and technology are listed below.

2.4.5.1. All DER installations shall have:

- Interconnect disconnect device
- DER disconnect device
- Over-voltage trip
- Under-voltage trip
- Over/under frequency trip



- Manual or automatic synchronizing check (for facilities with stand alone capability).

2.4.5.2. For 25 kW but not more than 500 kW, the installation shall also have, in addition to the above requirements:

- Either a ground over-voltage trip or a ground over-current trip depending on the grounding system if required by CPS Energy,
- Reverse/under power sensing if the facility is not exporting (the DER is less than the minimum load of the Owner's facilities).

2.4.5.3. For 500 kW but not more than 2,000 kW, the installation shall also have in addition to the above requirements:

- Automatic synchronizing check (for facilities with stand alone capability)
- If the facility is exporting power, the power direction protective function may be used to block or delay the under frequency trip with the agreement of CPS Energy.

2.4.5.4. For 2,000 kW up to 10,000 kW, the installation shall also have, in addition to the above requirements:

- Telemetry/transfer trip may also be required by CPS Energy as part of a transfer tripping or blocking protective scheme.

2.4.6. Exporting Power - If the three phase generator is greater than 50 kW and is exporting power to CPS Energy, the generator power factor must be remotely adjustable from +/- 0.95 and conform to SCADA RTU communication requirements. (Note the VAR output must be +/- 0.31 per unit.)

2.5. System Acceptance and Commissioning.

2.5.1. Inspection and Start-up Testing.

2.5.1.1. Startup Notice -The Owner shall provide CPS Energy with notice at least two weeks before the initial energizing and start-up testing of the Owner's DER equipment and CPS Energy may witness the testing of any equipment and protective systems associated with the interconnection.

2.5.1.2. For 500 kW and Greater, Before Initial Parallel Operation;

- Operability test of the isolation devices
- Unintentional-islanding functionality test (IEEE 5.4.1) and cease to energize functionality (IEEE 5.4.2) must be passed; open each



phase at the POI and system should shut down.

- For design modifications that may affect the safe and reliable operation of the CPS Energy distribution system, the Owner shall revise and re-submit the Interconnection Application with information reflecting the modifications.

2.5.1.3. For 500 kW and Greater, During Start-up Tests on All DERs - Set AC Power Quality monitoring at the POI to verify conformance with the interference table.

2.5.1.4. For 500 kW and Greater, Provide a Commissioning Report - Owner shall submit a summary report containing the test procedures used and the results of the tests within thirty (30) days of testing. The report shall be submitted to the CPS Energy DER Department. Thereafter, Owner may be required to retest the system protection elements upon any reasonable request by CPS Energy.

2.5.2. Site Testing and Commissioning.

- Testing of protection systems shall include procedures to functionally test all protective elements of the system up to and including tripping of the DER and interconnection point disconnects.
- Visual inspection shall be made to ensure grounding coordination requirement of IEEE 1547-2000 section 4.1.2 has been implemented.
- Testing will verify all protective and power quality set points and relay/breaker trip timing. CPS Energy may witness the testing of installed switchgear, protection systems, and DER controls.

2.5.3. Final Setup Information. For DER 500 kW and over, the Owner shall provide a list of set points for all protection equipment and regulation equipment to CPS Energy DER Department at the time of acceptance. This may be a picture, screen shot, printout or other form of verification acceptable to the CPS Energy DER Department.

2.6. Metering.

2.6.1. General. Metering design shall be based on CPS Energy Tariff(s), ERCOT Protocol Section 10 (Metering), and any special requirements identified during project review. CPS Energy shall design, supply, own, and maintain all necessary meters and associated equipment. Metering design, equipment, and installation will be at the DER Owner's expense. ERCOT metered installations will require Owner registration as a Resource Entity with ERCOT, and will utilize CPS Energy as the "Qualifying Scheduling Entity" for scheduling the market resource. In general the metering requirements are as



follows:

- For DER Facilities up to a 50 kW designed output, a CPS Energy revenue meter shall be installed at the inverter output, in addition to any premises metering. This is not an ERCOT meter point.
- For DER Facilities greater than 50kW and up to the registration threshold, which is presently 1MW output (as per ERCOT Protocol Section 10.2.2), metering is required to capture the power delivered to the bulk CPS Energy distribution system for ERCOT reporting as described in ERCOT Protocol 10.2.2. Meter data for settlement is not required to be submitted to ERCOT.
- DER Facilities greater than 1MW (the current registration threshold) and less than 10MW output, will require a Transmission and/or Distribution Service Provider (TDSP) ERCOT meter to provide settlement meter data. DER's must be registered with ERCOT and CPS Energy must read, validate, edit, and submit meter data to ERCOT. This data must be validated and edited in accordance with the Texas Standard Electronic Transaction (SET) Protocols found on the ERCOT website. At CPS Energy's discretion, this meter point may be made an ERCOT Polled Settlement (EPS) meter point and ERCOT will directly poll the meter.
- All DER Facilities 10MW and greater will be EPS metered. Multiple DER Facilities connected at one meter point with a combined capability of 10 MW or greater may require gross real-time MW and MVAR telemetry from each DER Facility.

2.6.2. Meter Location. The DER Owner shall provide CPS Energy a suitable location on its premises for the installation of CPS Energy's meters and associated equipment. Metering shall be located at the POD or as determined in the Interconnection Agreement. Typical meter locations are as follows:

- Meter enclosure(s) or meter sockets shall be located adjacent to respective DER switchgear and not attached to or inside switchgear.
- CPS Energy metering instrument transformers located in the DER switchgear shall meet the requirements outlined in the CPS Energy Electric Service Standards. Instrument transformers shall meet CPS Energy requirements for potential and current transformers.
- Meter enclosures associated with Utility pole mounted instrument transformers



shall be located adjacent to the Utility pole. Utility pole mounted instrument transformers will be provided and installed by CPS Energy.

2.6.3. Installation. CPS Energy shall supply, specify, own, and maintain all meters and associated equipment to measure energy flow of the DER. The DER Owner shall provide for material, installation and maintenance in accordance with NESC and CPS Energy specification as follows:

- The DER Owner shall install, own, and maintain all conduit raceway(s) required for site installation metering, relaying, and communications.
- The DER Owner shall provide support structure for meter socket or meter enclosure(s), and meter enclosure foundations. Details for these requirements will be on a project by project basis, and will be provided to the DER Owner during the design phase of the project.

2.6.4. Meter Capability and Telemetry Requirements. In general all CPS Energy/Owner agreements, CPS Energy Tariff(s), and ERCOT Protocol Section 10 shall govern the minimum meter requirements. Specific communication and telemetry requirements are as follows:

- Telemetry to the CPS Energy Generation Management System must be provided for DER Facilities greater than 1 MW. The DER must be registered with ERCOT as a Resource Entity.
- DER Facilities delivering 250 kW or more shall have a meter capable of monitoring, real power output, reactive power output and voltage at the POI, POD, or other reasonable location (see IEEE 1547 4.1.6).

2.6.5. Metering Auxiliary Power and Communication Requirements. The DER Owner shall provide for communications and auxiliary power requirements identified during the design and review phase of the project. Meter points for DER Facilities 1MW and greater will require the following:

- Meter communications will be required at the meter point for remote meter access. An internet connection and dial up telephone service shall be provided at the DER Owner's expense with termination at the metering equipment metering enclosure. Please note internet access and telephone dial up may be available as part of CPS Energy communications system.



- A single 120 VAC, 15 Amp circuit shall be provided for meter equipment from an uninterruptable power supply by the DER. Typical 120 VAC circuit load is 2 Amps maximum.

2.7. SCADA. CPS Energy shall supply, own, and maintain all RTU (remote terminal unit) and associated equipment to remotely control and/or monitor status and analog data deemed necessary by CPS Energy. All serially connected devices providing these reads to the RTU must be capable of communicating DNP 3.0 protocol or provide a 4-20ma input to the RTU.

The DER Owner shall supply at no cost to CPS Energy the following:

- A mutually agreed upon location on its premises for the installation of CPS Energy's SCADA equipment.
- As mentioned in 2.6.2. above, Owner to provide adequate general space for the metering, RTU, SCADA, and communications equipment. This space is 6ft. x 6ft. x 7ft. high to allow for the equipment rack structure and NESC working clearance.
- A 120 VAC 15 Amp circuit shall be provided for SCADA equipment from an uninterruptable power supply by the Owner. Typical 120 VAC circuit is 2 Amps maximum.
- All communication connections to meters, relays, and other Intelligent Electronic Devices (IEDs) interfacing with CPS Energy SCADA equipment. Any communication connections to SCADA in excess of 50 feet shall be of multi-mode fiber.
- Unrestricted access to all CPS Energy SCADA equipment.

2.8. Monitoring Power Quality. CPS Energy may supply, own, and maintain a permanent power quality monitor on site if deemed necessary. Purpose of the monitor is to ensure compliance with interconnection parameters and to prevent interference with CPS Energy as described in Section 2.2.

- Permanent monitors are integral to the metering and communications are provided by the CPS Energy Metering Department at the site.
- Temporary monitors may be installed at the time of commissioning and at any time by CPS Energy.

CPS Energy shall have the right to disconnect its system from the Owner system. CPS Energy will determine the timing and duration of the interruption. CPS Energy will consider reconnecting its system to the Owner when CPS Energy has evidence that the electric energy of the Owner meets the Standards and Requirements of the agreement with the Owner. CPS Energy will determine the timing, conditions and details of the reconnection on a case by case basis.



2.9. Communication. CPS Energy shall supply, own, and maintain all necessary communication equipment and associated equipment for use of providing communication path to SCADA, Metering, System protection and Power Quality. Communication equipment will reside with the SCADA equipment and Power Quality equipment in the Cabinet provided by CPS Energy Communication Services. Cabinet size is 74” high by 66” wide and 36” deep. CPS Energy Communication Services department will provide the specification of the fiber optics cable and copper cable.

The DER Owner shall supply at no cost to CPS Energy the following:

- A conduit raceway, fiber optics and/or copper cable from the Data circuit Demarc to the SCADA Cabinet.
- A conduit raceway, fiber optics cable and/or copper cable for communication from the communication equipment to each metering enclosure (this includes CPS Energy meter and DER owned meter), relays, and other IED.
- A duplex 120 VAC circuit rated no less than 15 Amps for CPS Energy Communication equipment (Typical circuit load < 5 Amp).
- An uninterruptible power source.
- A leased Data circuit or other mutually agreed upon medium from DER site to a determined CPS Energy Substation.
- Foundation/Concrete slab 66” X 36”.
- Unrestricted access to all CPS Energy Communication equipment and path. If unrestricted access is not available, DER Owner shall provide contact information and escalation list for 24 hours a day, 7 days a week.

2.10. Phase Over Voltages Additional Design Review.

If the DER is single-phase connected line-to-neutral, it is incapable of contributing to phase-to-neutral over voltages given the over-voltage trip requirements.

If a DER is located on a three-phase four-wire feeder, the DER interconnection should be reviewed to confirm that it will not cause phase over voltages in the event that the feeder is disconnected from the rest of the distribution system. (A DER of sufficient size could provide brief phase-to-neutral over voltages that could damage customer’s equipment on the local distribution system in the event of a system outage.) There are several ways that a DER can be integrated with such a feeder without the potential for causing harmful voltages:

- If the DER is small enough relative to the feeder size (e.g., 10% or less of the feeder peak load), it may not contribute enough voltage support to raise the voltage to hazardous levels.



- If the DER has a way of regulating phase-to-neutral voltage, it can ensure that this will not happen.
- If the DER installation does not comply with one of the options above for limiting voltage overloads, it may require additional study to determine what can be done to mitigate this issue.

3. Operation and Maintenance. To help ensure the protection and safety of Owner's and CPS Energy's personnel and property, the continued provision of electric service to Owner, the continued maintenance of an interconnection between Owner and CPS Energy, and the reliable functioning of CPS Energy's overall system operations, the following operational and maintenance procedures shall be observed.

3.1. Operating Authority and Personnel.

- CPS Energy System Operator (SO) will have the ultimate responsibility for carrying out the operating procedures described herein.
- CPS Energy maintains the Energy Management Center (EMC) on a 24-hour basis for the purpose of coordinating the operation of all Transmission, Distribution, and Generation facilities connected to CPS Energy.
- The Owner may be required to have an on-site or on-call person that will take operating instructions from the CPS Energy SO any time the DER is on line and generating energy or reactive power on the CPS Energy system.

3.2. Voice Communication. Owner will provide telephone numbers for normal and emergency situations. These should be listed on an Exhibit of the IA and CPS Energy shall be notified immediately of changes. Owner shall provide and maintain a telephone in its facility connected to an outside telephone line independent from Owner's internal telephone system (if there is one). This ensures telephone communications should Owner's internal switchboard become inoperable.

3.3. Energizing the Connections Between CPS Energy and the DER Facility. Only authorized employees of CPS Energy are permitted to make and energize the connections between CPS Energy's system and the Owners facilities.

3.4. Emergency Conditions.

3.4.1. CPS Energy Emergency. If in CPS Energy's sole judgment, an emergency poses a threat to the area power supply and service interruption and/or generation disconnect may prevent or alleviate the emergency condition, Owner may be called upon by CPS Energy's System Operator to operate necessary switches, breakers, reduce generation, change reactive output, etc. in order to prevent or alleviate an emergency condition.

3.4.2. ERCOT Emergency. CPS Energy is a member of ERCOT and operates its



system in accordance with the operating criteria, guidelines, and protocols of ERCOT. As a result, CPS Energy may interrupt service to the DER in the event of an ERCOT declared emergency or as directed by ERCOT Operations.

3.5. DER Owner Operating and Maintenance Responsibility.

3.5.1. Equipment Responsibility. Owner assumes all responsibility for the electrical system on the Owner's side of the Point of Delivery (POD).

- Owner will operate and maintain all wiring and apparatus in such condition and/or manner as not to endanger persons or property, or to cause impairment of CPS Energy's interconnection and service to Owner, or any of CPS Energy's customers.
- Owner shall inspect and maintain all facility structures and equipment provided by Owner on an industry or manufacturer's recommended basis.

3.5.2. Control and Protective Equipment. The Owner is responsible for routine maintenance of any DER control and protective equipment at the POI not owned by CPS Energy. If CPS Energy does not do the periodic breaker trip testing by mutual agreement with the Owner, Owner will conduct periodic breaker trip testing and notify CPS Energy in advance of such testing so that CPS Energy may witness such tests.

3.5.3. Maintenance and Operation Records. The Owner will maintain interconnection and service equipment records as follows:

- Log of maintenance activities for interconnect equipment.
- Protection functionality and associated battery maintenance logs must be maintained (IEEE 1547 5.5).
- Operation log for DER systems greater than 500 kW. As a minimum the log shall include the date, DER time on, and DER time off, and MW and MVAR output.
- Facility one-line must be maintained and a correct one-line diagram of Owner's facility must be provided to the CPS Energy EMC SO after any change. CPS Energy may review such documents at reasonable times.

3.5.4. Owner Switching Request. The Owner shall;

- Make a reasonable attempt to notify CPS Energy System operations at least 48 hours in advance of any scheduled switching the Owner wishes CPS Energy to execute.
- Follow all switching instructions provided by CPS Energy's System Operator.
- Coordinate operation of its system with CPS Energy to ensure that the overall CPS Energy system operation will be consistent with ERCOT operating criteria and guidelines to the extent applicable to this transaction.



3.5.5. Five Megawatt Power Availability Notice. For a Grid-Tied DER Systems of 5 MW and greater, Owner shall notify CPS Energy's Energy Development Department by email at gencoenergycontrol@cpsenergy.com by 12:00 noon Central Time on Friday of the on-line availability and, if available, the hourly projected generation for the next week. If planned availability or projected generation changes during the week, Owner shall immediately notify CPS Energy's Energy Development Department.

3.5.6. Notification of Disruption. Owner shall promptly notify CPS Energy's System Operator of all internal system conditions that could affect CPS Energy's distribution system. All communications with the CPS Energy's SO shall reference the Owner's facility two character mnemonic name (if applicable) and applicable equipment numbers as designated by CPS Energy on the approved one-line diagram.

3.5.7. Reasonable Access.

- Owner shall provide CPS Energy's authorized representative access to Owner's premises at all reasonable hours for the purpose of inspecting CPS Energy's wiring and apparatus, erecting, removing or replacing CPS Energy's facilities at the POI, reading CPS Energy's meters and for all other purposes connected herewith.
- For ERCOT meter equipment failure, CPS Energy authorized representatives shall have access 24 hrs a day, 365 days a year.

3.5.8. Correction of Interference. Owner shall, repair, replace or disconnect equipment which violates the Prevention of Interference Section 2.2 in a reasonable time.

3.5.8.1. Owner Disclosure. If the Owner becomes aware of interference, Owner will notify CPS Energy as soon as practical and propose a schedule for correcting the interference.

3.5.8.2. CPS Energy Response. CPS Energy will investigate the interference effect on supply of electric service to other customers. Should the equipment interfere with CPS Energy's service to other customers, CPS Energy will notify the Owner of disconnect, unless an acceptable agreement is negotiated.

3.5.9. Equipment Compatibility. Owner is responsible for providing all facility equipment in accordance with CPS Energy's applicable specifications, both initially and from time to time thereafter, whenever changes in the CPS Energy's distribution system (including the distribution system's monitoring and protection devices) requires such changes in the facility in order to maintain its compatibility with the CPS Energy's distribution system. Prior to the replacement or modification of any equipment, Owner shall first notify CPS Energy of the replacement or modification, submit specifications to



CPS Energy and obtain CPS Energy's approval of compatibility with CPS Energy's distribution system.

3.5.10. Batteries. Owner will visually inspect and conduct periodic maintenance on any facility batteries as recommended by manufacturer. Owner will provide CPS Energy copies of test reports and any corrective action taken.

3.6. CPS Energy Operating and Maintenance Responsibility.

3.6.1. CPS Energy SCADA. CPS Energy will operate and maintain any CPS Energy SCADA (Supervisory Control and Data Acquisition) equipment installed at the Owner's facility to communicate with the CPS Energy's EMC and GENCO (Energy Development Department).

3.6.2. CPS Energy Disconnect Notice. CPS Energy will use reasonable efforts to provide Owner with seven calendar days advanced notice of any scheduled switching for distribution lines connecting the DER. CPS Energy shall have the right and authority to disconnect DER at CPS Energy's reasonable discretion if CPS Energy believes (in each case, as determined in a non-discriminatory manner) that:

- Continued interconnection of the DER Facility with CPS Energy's electric system creates or contributes (or will create or contribute) to a system emergency on CPS Energy's electric system.
- The DER Facility is not in compliance with the requirements herein, and the non-compliance adversely affects the safety, reliability or power quality of CPS Energy's electric system.
- The Owner is in violation any of the DER agreement(s) with CPS Energy.

In non-emergency situations, CPS Energy shall give Owner notice of noncompliance including a description of the specific noncompliance condition and allow Owner a 45 day cure period to correct the noncompliance prior to disconnecting the DER Facility.

3.6.3. CPS Energy Disconnect due to Interference. CPS Energy shall have the right to disconnect its system from the Owners system. CPS Energy will determine the timing and duration of the interruption. CPS Energy will consider reconnecting its power system to the Owner when CPS Energy has evidence that the electric energy of the Owner meets the Standards and Requirements of the agreement (Section 2.2) with the Owner. CPS Energy will determine the timing, conditions and details of the reconnection on a case by case basis.

3.6.4. Annual Maintenance Outage. CPS Energy performs periodic maintenance on its equipment. Such maintenance on CPS Energy equipment at the POD or any of the Interconnection Facilities may require scheduling approximately an eight hour outage



annually during normal working hours. Such outage of Owner's equipment will typically be coordinated to coincide with Owner's annual maintenance schedule. The Owner's maintenance schedule shall be on file in the CPS Energy System Operator's office and must be updated at least annually. Any changes to such schedule shall be reviewed and approved by CPS Energy.

CPS Energy shall inspect the following devices, instruments, and systems (if installed):

- Revenue metering equipment owned by CPS Energy--This equipment shall be inspected on a reasonable basis, but not more often than every two months. CPS Energy will maintain and replace this equipment as necessary.
- CPS Energy owned metering instrument transformers and associated equipment-- A power outage to Owner's equipment is required for the maintenance of the revenue metering or control instrument transformers at the POI.
- All SCADA equipment at the POI--CPS Energy will maintain this equipment as necessary and must have access to this equipment 24 hours a day 7 days a week.
- Protective relays as specified on CPS Energy's relay test sheets--CPS Energy will set and maintain these relays as necessary. This will include out-of-case testing. Breaker trip testing will be performed at the same time if CPS Energy and the Owner agree. CPS Energy will provide Owner copies of the results of the annual relay tests upon request and notify Owner of any protective relay equipment requiring repair or replacement.
- All communication equipment used with distribution line protective relaying including periodic performance testing--Owner will be notified of any problems or irregularities found.

3.7. Switching Guidelines. Switching of CPS Energy equipment is required at times for equipment outages to allow both CPS Energy and Owner to perform maintenance and construction. CPS Energy and Owner activities should be coordinated whenever possible to reduce switching requirements. Owner and CPS Energy shall abide by each other's isolation procedures, including but not limited to abiding by the intent of isolation tags, locks or written notices of both parties. To facilitate this process, the following requirements have been included for guidance:

- **Planned Outages.** When switching CPS Energy equipment is desired for maintenance or operation of Owner's system, Owner shall contact CPS Energy's System Operator at (210) 353-4962 and selecting option 4 during CPS Energy's regular business hours at least 48 hours in advance, but not later than 2:00 P.M. Central Time on the day preceding such planned switching and explain the nature of the request. If CPS Energy's System Operator approves the switching, Owner must notify CPS Energy's System Operator at the scheduled time immediately prior to proceeding with the planned switching.
- **Equipment Failure.** In addition to outages for scheduled maintenance by Owner or CPS



Energy, switching may be required at the POI or POD as a result of defective equipment being found, failed equipment and emergency situations. In these situations, both CPS Energy and Owner agree to provide any required switching as promptly as reasonably possible.

- To remove a transformer from service, all loads should be removed first.
- To remove line equipment from service, switching at remote CPS Energy or other customer facilities is required. Owner must request an outage as previously described. CPS Energy will provide all switching on the CPS Energy side of the POD.

3.8. Equipment Identification. CPS Energy may display and mount signs, stickers, drawings, telephone numbers, and instructions pertaining to the scheduled maintenance or emergency operation of Owner's system on outside equipment and inside.

3.9. Clearance Procedures.

It is CPS Energy's practice that Owner must obtain clearance from CPS Energy SO for any maintenance activities requiring the outage of CPS Energy's distribution lines at the POI or POD in accordance with Section 3.7. When an outage of distribution line apparatus is desired, the following procedure for securing a clearance will apply:

- A clearance request is made to CPS Energy's System Operator in accordance with Section 3.7. CPS Energy's SO shall give switching instructions to CPS Energy personnel to accomplish switching at Owner's facility and contact any other CPS Energy operators or crews necessary to accomplish switching at remote terminals.
- Owner and/or CPS Energy personnel shall place safety or "hold" tag on switches when they are opened. Tagging of equipment remote from Owner's system shall be done by CPS Energy personnel.
- CPS Energy's SO shall give the clearance in the name of the party requesting it. CPS Energy will use designated CPS Energy personnel to check that the procedures of the clearance are completed by the Owner prior to final approval. In the event more than one crew is working on a line, each crew shall secure clearance. CPS Energy is responsible for placing grounds on CPS Energy's equipment.
- When a switch in Owner's system is tagged mutually by Owner and CPS Energy personnel, the first operator desiring to remove his tag shall notify CPS Energy's SO that he is removing his tag and that there is still a tag on the switch. Neither CPS Energy nor Owner shall operate the switch until the operator whose tag is still on the switch has notified CPS Energy's SO that he is removing his tag.
- Release of all clearances and removal of all grounds are required before "hold" tags are removed and any switches closed. "Hold" tags are removed only after the clearance is released by the individual who secured the clearance and switching instructions are received from CPS Energy's SO.



3.10. Grounding Procedures.

- CPS Energy shall place safety grounds on CPS Energy equipment when required for maintenance procedures.
- All grounding on the Owner's side will be performed by the Owner's personnel.
- The operator providing maintenance is responsible for placing safety grounds around the equipment to be maintained.
- No safety grounds should be placed where a switching device could be opened, removing the protection of a safety ground(s).
- The number and locations of all grounds should be provided to CPS Energy's SO.
- All grounds must be removed before "hold" tags are removed from switches.

3.11. Fault Initiated Outages. After automatic tripping of the Owner due to an interruption of CPS Energy service at the POI or POD (due to a fault or other system disturbance);

- Owner shall notify CPS Energy's SO.
- Important to report as soon as possible;
 - Present position of circuit breakers or switches (open or closed)
 - Time of outage
 - Any information which might be helpful in determining the cause of the outage
- Report as soon as the information is available;
 - Indication flags of any relays which initiate trips to the CPS Energy circuit breaker at the POI or POD (if applicable). Owner shall make a notation of the relay flags and will not reset flags without permission from CPS Energy's SO. CPS Energy reserves the right to reset relay flags.
 - Circuit breaker operations counter reading on CPS Energy circuit breaker at the POI or POD (if applicable).

3.12. Owner Operations.

3.12.1. Forced Outages. As soon as practical, Owner shall notify CPS Energy of any potential problems or of any forced outages and the expected duration thereof.

3.12.2. Owner Reconnect Notice. In the event Owner's system is isolated from the CPS Energy's system, Owner shall notify CPS Energy's SO before attempting to resynchronize with CPS Energy's system.

3.12.3. Operations Log Request Timing. Any records maintained or accessible to the Owner concerning an operating log with records of real and reactive power production, changes in operating status, scheduled and forced outages, and any unusual conditions found during any inspections shall be provided to CPS Energy upon request within thirty (30) days of CPS Energy's request.



3.12.4. Voltage Regulator Failure. In the event a generating unit's voltage regulator is out of service, Owner shall immediately notify CPS Energy's SO.

3.13. Owner's Operational Reactive Support Responsibility.

If CPS Energy studies determine Owner should be operated to support the distribution system voltage by regulating volt-amps reactive output, this regulation shall be accomplished in accordance with the following:

- CPS Energy's SO shall be responsible for monitoring overall system conditions and Owner shall take such corrective action as CPS Energy's SO may require.
- Owner shall maintain the distribution voltage level provided by CPS Energy's SO up to the reactive levels stated by the CPS Energy.
- If the Owner is categorized by ERCOT as subject to ERCOT reactive supply requirements, CPS Energy shall require the Owner to meet the minimum requirements for reactive VAR support as outlined in the ERCOT reactive support requirements for all connected generators.
- Owner must submit all reactive support tests as required by the ERCOT compliance templates to the CPS Energy EMC for submission to ERCOT.

The Owner's voltage regulators must have characteristics acceptable to CPS Energy and must be in service at all times.

3.14. Speed Governor Maintenance and Notification (if applicable).

- Owner shall maintain its speed governor settings as required by CPS Energy.
- Yearly testing must be done and the test results submitted to the CPS Energy DER Department.
- Owner shall maintain its speed governor in service (if applicable) when operating synchronous to CPS Energy unless blocked due to a temporary operating problem.
- Owner shall immediately notify CPS Energy's System Operator when blocked.

3.15. Amendments.

These Interconnection Requirements may be amended from time to time by CPS Energy to account for significant modifications in the manner in which Owner is connected to CPS Energy's system or to reflect subsequent changes in CPS Energy's Rate Structure for Electric Service approved by the San Antonio City Council. Notice of such amendment(s) will be communicated to Owner.



Appendix A3
APPLICATION FOR FEASIBILITY STUDY OF DISTRIBUTED ENERGY RESOURCE
(One application per site)

PRODUCER:

Name of Project: _____ Date: _____

DER Site Address (include zip code): _____

Contact Name: _____

Contact Address: _____

Contact Phone Number(s): _____

Contact Email: _____

Contact Signature: _____

GENERATION RESOURCE

Size of proposed system: _____

Type (Synchronous, Induction, Inverter): _____

Do you plan to export power: Yes No

If yes, maximum amount expected (in AC power): _____

Expected Energizing and Start-up Date: _____

Submit the following in PDF format only:

- Site Plan (with nearest adjacent intersecting streets) to DistGen@cpsenergy.com.

If additional information would be beneficial for this study, please attach on separate sheet(s).

Please note there will be a **Non-Refundable** charge for each application based on the size of the system as follows:

50kW to 999kW - \$360

1MW to 4.99MW - \$595

5MW to 9.99MW - \$1,545

*If the project proceeds to our Interconnection Study, this fee will be deducted from Study Fee charge.

Make checks payable to **CPS Energy** and send to:

CPS Energy

Distributed Energy Resource Dept.

10th Floor - Navarro MD#111007

145 Navarro St.

San Antonio, TX 78205

1 Nov 2011

Appendix A3



Appendix A4
**APPLICATION FOR INTERCONNECTION OF DISTRIBUTED ENERGY
RESOURCES**

CUSTOMER/PRODUCER:

Name: _____

DER Site Address: _____

Account No.: _____

Telephone: (normal) _____ (emergency): _____

Information Prepared and Submitted By: _____

Name: _____

Address: _____

Email: _____

Signature: _____

Name of Customer or Customer's designated representative who can be contacted throughout ownership of DER system in case CPS Energy needs to contact this person at any time in case of emergency or important issues concerning the DER System.

Customer or Customer's designated representative: _____

Contact Number (24hrs. / 7days a wk.): _____

Email: _____

Installer/Contractor (if not same as above): _____

Contact Number (24hrs. / 7days a wk.): _____

Email: _____

The following information shall be supplied by the Customer or Customer's designated representative and/or contractor. All applicable items must be accurately completed in order that the Customer's generating facilities may be effectively evaluated by CPS ENERGY for interconnection.



GENERATION RESOURCE

Number of units/Configuration of modules: _____

Manufacturer: _____

Type (Synchronous, Induction, or Inverter): _____

Fuel Source Type (Solar, Natural Gas, Wind, etc.): _____

Kilowatt Rating (95° F at location): _____

Kilovolt-Ampere Rating (95° F at location): _____

Power Factor: _____

Voltage Rating: _____ Ampere Rating: _____

Frequency: _____ No. of Phases: _____

If the type is not an Inverter, provide RMS Symmetrical Short Circuit Current and X/R Ratio at Rated Voltage at point of common coupling for:

Line-to Ground Fault: _____ X/R _____

3-Phase Fault: _____ X/R _____



Supplemental Information

For installations that connect through an inverter, please provide the following information:

Inverter Manufacturer (Name) _____
Inverter Model (Name/Number) _____
Inverter Software Version (Number) _____

If this System's control and or protective functions are dependent on a "software" program supplied by the manufacturer of the equipment, please provide the version or release number for the software that will be used.

For non-inverter installations that plan to parallel continuously, please provide the following information for each generator:

Manufacturer: _____	Field Amps: _____
Type: _____	Field Volts: _____
Kilowatt Rating: _____	Motoring Power: _____
Kilovolt-Ampere Rating: _____	Serial Number: _____
Power Factor: _____	Gross Nameplate Rating: _____ kVA
R.P.M.: _____	Gross Nameplate Rating: _____ kW
Operating Voltage: _____	Net Nameplate Rating: _____ kW
Output Amperes: _____	Power Factor Rating: _____ %
Frequency: _____	PF Adjustment Range: _____ %
Number of Phases: _____	

Wiring Configuration

Single or 3-Phase Winding Configuration
(Choose One)

- 3 Wire Delta
- 3 Wire Wye
- 4 Wire Wye
- Single Phase 2 wire
- Single Phase 3 wire

Neutral Grounding System Used: (Choose One)

- Ungrounded
- Solidly Grounded
- Ground Resistor = _____ Ohms
Provide Grounding Transformer Data as well if applicable

For Synchronous Generators Only:

Synchronous Reactance: _____ % on _____ base
 Transient Reactance: _____ % on _____ base
 Sub-transient Reactance: _____ % on _____ base
 Negative Sequence Reactance: _____ % on _____ base
 Zero Sequence Reactance: _____ % on _____ base



For Induction Generators Only:

Locked Rotor Current: _____ Amps

-OR-

Stator Resistance: _____ Amps

Stator Leakage Reactance: _____ %

Rotor Resistance: _____ %

Rotor Leakage Reactance: _____ %

Short Circuit Current Produced by Generator: _____ Amps

For Generators that are Started as a “Motor” Only:

1. In-Rush Current: _____ Amps

2. Host Customer’s Service Entrance Panel (Main Panel) Continuous Current Rating: _____ Amps

For customers supplying an interconnecting transformer, please provide the following:

Transformer Connection and Grounding Information

Load Loss: _____ W

Percent Impedance: _____ %

Base kVA: _____ kVA

Voltage Ratings: _____ V

Tap Ratings: _____



CPS Energy DER Interconnection Settings Form

Instructions to Applicant: A list of CPS Energy interconnection protection requirements for voltage and frequency are given below. Please fill in the project name and requested information in Columns A and B, and the anti-islanding features in Section 3. **This form needs to be signed by the Applicant.** Note: If the DER system cannot be set to meet the listed requirement, fill in the closest available value (or fixed value) so that CPS Energy can evaluate the settings.

DER Project Name: _____

Prevention of Interference:

1. Voltage

CPS Energy Requirement Descriptor	CPS Energy Requirement	Column A: Setting Name	Column B: Setting Value
Over Voltage Regulation Set point #1	$\leq +5\%$		____%
Over Voltage Time Delay #1	$\leq 2 \text{ sec}$		____ sec
Under Voltage Regulation Set point #1	$\leq -10\%$		____%
Under Voltage Time Delay #1	$\leq 2 \text{ sec}$		____ sec
Over Voltage Regulation Set point #2	$\leq +10\%$		____%
Over Voltage Time Delay #2	$\leq 0.167 \text{ sec}$		____ sec
Under Voltage Regulation Set point #2	$\leq -30\%$		____%
Under Voltage Time Delay #2	$\leq 0.167 \text{ sec}$		____ sec

Note: “Over Voltage Regulation Set point #1” should not be greater than +5% because CPS Energy cannot subject other customers to voltage of +5-+10% for more than 30 seconds at PCC according to Texas PUC. If greater than +5% is desired, CPS Energy will require voltage calculations prior to approval of installation.

2. Frequency

CPS Energy Requirement Descriptor	CPS Energy Requirement	Column A: Setting Name	Column B: Setting Value
Over Frequency Set point	$\leq +0.5 \text{ Hz}$		____ Hz
Over Frequency Time Delay	$\leq 0.25 \text{ sec}$		____ sec
Under Frequency Set point	$\leq -0.7 \text{ Hz}$		____ Hz
Under Frequency Time Delay	$\leq 0.25 \text{ sec}$		____ sec

Note: Above set points are based on a nominal frequency of 60 Hz.



3. Anti-Islanding Protection

CPS Energy Instructions: Please describe the anti-islanding protection scheme, as well as, the worst-case time delay for shutting down the DER system. Indicate how long it takes the DER system to disconnect from the grid. Anti-islanding sensing must meet the NEC, IEEE 929 and UL 1741.

Customer Response:

By signing, the applicant certifies that the above information is true and accurate.

Signed by (Printed Name, Title/Position): _____

Signature: _____

Date: _____

CPS Energy Reviewer Comments:

CPS Energy Reviewer Name: _____

CPS Energy Reviewer Signature: _____

Date: _____

Appendix A5

Feasibility Study and Interconnection Application Fees

1) Feasibility Study Request

Should a potential Owner desire a site feasibility study or studies from CPS Energy, the form in Appendix A3 (“Application for Feasibility Study for Distributed Energy Resources”) must be filled out and returned with the non-refundable fee. An application and fee must be submitted for each site requested. (If the project progresses to the Interconnection Request below, this fee will be deducted from the fees below.) The fees are as follows:

1kW to < 50kW - \$0
50kW to < 1MW - \$360
1MW to < 5MW - \$595
5MW to < 10MW - \$1,545

2) Interconnection Request-Radial Distribution System

In advance of an interconnection, the Owner must contact CPS Energy and complete the “Application for Interconnection of Distributed Energy Resources” (see Appendix A4). A separate form and application fee must be submitted for each DER facility and each location. The fees are as follows for a DER planned to be connected to the CPS Energy radial distribution system:

1kW to < 50kW - \$0
50kW to < 500kW - \$5,000
500kW to < 1MW - \$15,000
1MW to < 5MW - \$30,000
5MW to < 10MW - \$50,000

3) Interconnection Request-Network Distribution System

In advance of an interconnection, the Owner must contact CPS Energy and complete the “Application for Interconnection of Distributed Energy Resources” (see Appendix A4 C). A separate form and application fee must be submitted for each DER facility and each location. The fees are as follows for a DER planned to be connected to the CPS Energy network distribution system:

1kW to < 50kW - \$500
50kW to < 500kW - \$6,000
500kW to < 1MW - \$16,000
1MW to < 5MW - \$33,000
5MW to < 10MW - \$55,000



Appendix A6
**DISTRIBUTED ENERGY RESOURCE INTERCONNECTION
AGREEMENT**

This Interconnection Agreement (“Agreement”) is made and entered into to be effective the ____ day of _____, ____ by City Public Service of San Antonio ("CPS Energy"), and _____ (“Producer”), a generator of distributed energy resource, each hereinafter sometimes referred to individually as “Party” or both referred to collectively as the “Parties.”

Recitals

WHEREAS, Producer either plans to construct or has already constructed a distributed energy resource facility (“DER Facility”) at a site located within CPS Energy’s retail electric service area (“DER Site”), which will generate electric energy for Producer’s needs and may produce surplus energy which Producer wishes to deliver to the CPS Energy electric power distribution system by way of electrical metering facilities owned and operated by CPS Energy (collectively called “CPS Energy’s System”).

WHEREAS, Producer has completed and submitted the Application for Interconnection of Distributed Energy Resource (“DER Application”) to CPS Energy’s System, which is incorporated herein as Exhibit A, and CPS Energy has conducted its pre-interconnection studies to determine whether CPS Energy can make available and Producer is qualified to enter into such an arrangement for such distributed energy resource interconnection with CPS Energy's System.

WHEREAS, in consideration of the mutual covenants set forth herein, the Parties agree as follows with regard to CPS Energy’s interconnection to the distributed energy resource of Producer.

1. **Scope of Agreement**

This Agreement sets out conditions under which the Producer and CPS Energy agree that a DER Facility, eligible for interconnection to CPS Energy's System, may be interconnected to CPS Energy’s System, in accordance with the Interconnection Requirements for Distributed Energy Resource (“Interconnection Requirements”) found on the www.cpsenergy.com website and incorporated into this Agreement by reference.

Any energy supplied by CPS Energy and purchased by Producer under this Agreement shall be in accordance with the terms of CPS Energy’s Rules and Regulations for Electric and Gas Service (“Rules and Regulations”), CPS Energy's applicable Rate Schedules (“Rates”), the Interconnection Requirements and the terms and conditions of this Agreement. The Rules and Regulations, Rates, the Interconnection Requirements, and this Distributed Energy Resource Interconnection Agreement together form the total agreement between the Parties.



2. **Interconnection of DER Facility**

Producer or its contractor shall design and install the DER Facility, as necessary for the interconnection of Producer's DER Facility to CPS Energy's System at the Point of Interconnection as located and described in the Interconnection Requirements for Distributed Energy Resource. The Point of Interconnection (POI) is defined as the point where the DER Facility is electrically connected, either directly to the CPS Energy System or directly to the load-side (metered) of Customer-owned equipment, for the applicable DER Facility. Producer will own, operate, maintain and be responsible for the DER Facility, and for the costs of any other protective facilities which, in CPS Energy's commercially reasonable opinion, are required or prudent in order to protect CPS Energy's System from disruption or damage caused by the DER Facility. The Interconnection Facilities shall measure both the energy produced by the DER Facility and any energy provided by CPS Energy for Producer's use at the DER Site. The "Interconnection Facilities" are defined as all facilities required by CPS Energy as a result of interconnection to the DER to allow the safe, reliable interconnection and operation of the DER. CPS Energy will design the Interconnection Facilities such that the Interconnection Facilities are sufficient to enable Producer to supply electric energy across the Point of Interconnection and Point of Delivery to CPS Energy's System. The Point of Delivery/Point of Demarcation (POD) is defined as the point where the electric energy first leaves the conductors or devices owned by CPS Energy, and enters the service-entrance, other conductors or devices owned by the Producer. Producer agrees to promptly provide information and engineering drawings requested by CPS Energy to assist in the design and installation of the Interconnection Facilities. Any electrical energy to be supplied by CPS Energy under this Agreement shall be delivered to Producer at the Point of Delivery in the manner described within the Interconnection Requirements.

3. **Inspection of DER Facility**

Prior to connection of the DER Facility to the Interconnection Facilities, CPS Energy may send a representative to the DER Site to inspect and perform acceptance tests on the DER Facility to determine if the DER Facility complies with the Interconnection Requirements and that all metering, telemetry, communications equipment, etc., associated with the Point of Interconnection is properly functioning and receiving and transmitting accurate information. Producer shall not commence operation of the DER Facility until written approval has been given by CPS Energy. CPS Energy shall notify Producer as to whether or not approval is granted within ten (10) working days from CPS Energy's inspection of the DER Facility. In the event the DER Facility does not comply, CPS Energy shall promptly notify Producer in writing, specifying with reasonable specificity the reason(s) for rejection of approval, and shall provide Producer a reasonable period of time to bring the DER Facility into compliance. CPS Energy shall have reasonable access to the DER Site at all times and shall provide advance notice to Producer of the need for CPS Energy presence at the DER Site, except that no advance notice is necessary in the case of an emergency, or if necessary to meet CPS Energy's legal obligation to provide service to CPS Energy's Customers.



4. **Charges for Interconnection Facilities**

Following execution of this Agreement and prior to commencement of construction of the Interconnection Facilities, CPS Energy shall invoice Producer for the estimated cost, if any, for the work which is required to interconnect the DER Facility to CPS Energy's System in accordance with the Interconnection Requirements ("Interconnection Costs"), in the manner set forth in Exhibit B. DER Producer shall pay CPS Energy the Interconnection Costs within thirty (30) days from the date of the postmark or electronic mail (e-mail) of such invoice, consistent with the Exhibit B - Interconnection Costs. Any amount not paid within such time shall bear interest at the legal rate calculated from the due date. CPS Energy shall have the right to terminate this Agreement pursuant to Section 9 upon Notice to Producer if the Interconnections Costs remain unpaid by Producer 60 days from the date of the invoice postmark or email. In the event the actual cost of the work exceeds the initial estimated Interconnection Cost, invoiced by CPS Energy and paid by Producer, through no fault of CPS ENERGY, CPS Energy shall invoice Producer for the additional cost and Producer shall pay such additional cost to CPS Energy within thirty (30) days from the date of the postmark or email of the invoice. Within thirty (60) days following completion of the make-ready work, if the amount paid by Producer to CPS Energy exceeds the final actual cost of the construction, CPS Energy shall promptly reimburse Producer for the amount by which the amount that was paid by Producer exceeds the final actual cost of the construction.

5. **Charges/Payment for Energy**

If Producer is a net metered Customer, Producer's monthly energy bill, and Net Electric Generation (NEG) credits to which Customer is entitled, will be calculated in accordance with the corresponding CPS Energy applicable Rate(s) under which the Producer is served less any NEG credit computed under CPS Energy applicable Rate(s). NEG, in terms of kWh, is deemed to exist only if an amount equal to the difference between the current month's CPS Energy meter read less the previous month's CPS Energy meter read is negative. Producer agrees to pay its energy bill on or before the due date set forth on the bill in accordance with applicable provisions in the Rules and Regulations.

A Producer who is not a net metered Customer shall pay for energy provided by CPS Energy and be paid by CPS Energy for energy produced by the DER Facility in accordance with the provisions found in the Power Purchase Agreement negotiated between the Producer and CPS Energy.

6. **Operation of Interconnection**

During the term of this Agreement, Producer will maintain and operate the DER Facility in accordance with the Interconnection Requirements. CPS Energy's operation and maintenance of the Interconnection Facilities shall be excused for the duration of any outage which materially prevents or impairs CPS Energy's ability to operate and control the provision of energy through the Point of Interconnection. CPS Energy shall resume operation and maintenance as soon as possible after the outage.



Unless otherwise provided for in the Interconnection Requirements, each Party shall install, operate and maintain all apparatus and necessary protective devices on the Party's respective side of the Point of Delivery which are reasonably necessary, or reasonably required by CPS Energy, to comply with good operating practices and applicable ERCOT Protocols and Operating Guides, at its own cost and expense. In nearly all cases this most nearly represents the point where the ownership changes between CPS Energy facilities and the Producer's facilities.

CPS Energy and Producer shall each be responsible for the safe installation, maintenance, repair and condition of their respective lines and appurtenances on the Party's respective side of the Point of Interconnection. For the mutual protection of Producer and CPS Energy, only with CPS Energy's prior authorization and approval are the connections between the CPS Energy's distribution service wires and Producer's service entrance conductors to be energized.

7. **Construction, Operation and Maintenance of DER Facility**

Producer shall be responsible for the design, installation, operation, and maintenance of the DER Facility and shall obtain and maintain any required governmental authorizations and/or permits. Producer shall conduct operations of its DER Facility in compliance with all aspects of such authorizations or permits and shall construct the DER Facility in accordance with specifications equal to or greater than those provided by the National Electrical Safety Code, approved by the American National Standards Institute, and other applicable standards in effect at the time of construction. Producer shall perform maintenance of the DER Facility in accordance with the applicable manufacturer's recommended maintenance schedule and shall provide CPS Energy with a copy upon request. Producer has provided CPS Energy with two phone numbers for contact during "normal" business hours and for emergency events. These contact numbers are found on Exhibit C and Producer is responsible for promptly monitoring and updating the contact information as necessary over the term of this Agreement.

8. **Disconnection at the Point of Interconnection**

Producer shall be required to install their own switch on their side of the Point of Interconnection for their use in disconnecting the DER Facility. Producer may, at their option, disconnect from the Point of Interconnection by operation of their switch. No notice is required for DER Facility's less than 500 kW. **For DER systems 500kW and larger, notice to CPS Energy is required as outlined in the Interconnection Requirements.** Producer shall have no right to operate any of CPS Energy's facilities. Producer's disconnection shall not constitute a termination of this Agreement unless Producer exercises its rights under Section 9. Should CPS Energy schedule planned maintenance and repairs on CPS Energy's System requiring disconnection or other service interruption, CPS Energy will use reasonable efforts to provide Producer with seven calendar days advance notice of such disconnection.

CPS Energy shall have the right to disconnect its System from the DER Facility in cases where continuance of connection will, in CPS Energy's reasonable



determination, i) endanger persons or the public with physical harm or pose potential damage to property of CPS Energy, its customers or members of the public or ii) if there is evidence that the DER Facility operation causes disruption or deterioration of service to other Producers or other customers served from the same grid; or (iii) where CPS Energy reasonably determines that Producer has failed to meet its obligations as provided for in this Agreement; or (iv) where CPS Energy has reasonable cause to believe that Producer is not in compliance with the requirements of this Agreement. During the forced outage of any portion of CPS Energy's System serving and/or receiving energy from Producer, CPS Energy shall have the right to suspend service to effect immediate repairs on CPS Energy's System, but CPS Energy shall use its reasonable efforts to provide Producer with prior notice.

9. **Term and Termination Rights**

This Agreement becomes effective when executed by both Parties, and shall continue in effect until terminated by either Party providing sixty (60) days prior written notice to the other Party. CPS Energy may terminate (i) upon CPS Energy's determination that the DER Facility does not comply with the conditions of this Agreement provided CPS Energy provides notice of default to the Producer and Producer is given a forty-five (45) day period in which to bring the DER Facility into compliance, which may be extended upon mutual agreement, and the DER Facility continues to be noncompliant after such cure period; (ii) upon failure by Producer to generate energy from the DER Facility within twelve months after completion of the Interconnection Facilities; (iii) if any representation made by Producer in this Agreement proves to be false or deliberately misleading in any material respect; or (iv) if CPS Energy costs of constructing the Interconnection Facilities, as set out in Exhibit B of this Agreement are not paid by Producer as provided for Section 4 of this Agreement, after notice and a reasonable opportunity for Producer to remedy such nonpayment. The Parties shall disconnect the DER Facility from the Point of Interconnection upon the effective date of any termination under this Section.

The Initial Term of this Agreement shall be for one (1) year from the date of execution of the Agreement, and thereafter for successive terms of one year unless terminated in accordance with this Section. The last day of the Initial Term and of each successive one-year term of this Agreement is referred to in this Agreement as an "Anniversary Date".

10. **Limitation of Liability and Indemnification**

Notwithstanding any other provision in this Agreement, with respect to CPS Energy's provision of service to Producer, CPS Energy's liability to Producer shall be limited as set forth in the Rules and Regulations.

In no event shall CPS Energy be liable for consequential, special, or incidental damages, including, without limitation, loss of profits, loss of revenue or disruption of business, or loss of production by or on behalf of Producer. CPS Energy does not assume liability for any costs or damages arising from the disruption of the business or for Producer's costs and expenses of prosecuting or



defending an action or claim against CPS Energy. The limitations of liability provided in this paragraph do not apply in actionable cases of gross negligence or intentional wrongdoing on the part of CPS Energy, if any.

11. **Insurance**

For facilities larger than 50 kW and prior to interconnection, the Producer must provide a certificate of insurance showing satisfactory liability insurance including contractual liability insurance covering indemnity obligations which insures the Producer against all claims for property damage and for personal injury or death arising out of, resulting from or in any manner connected with the installation, operation and maintenance of the Producer's DER Facility. The amount of such insurance coverage shall be not less than \$2,000,000 per occurrence and name CPS Energy as an additional insured. This amount may be increased at the sole discretion of CPS Energy if the nature of the project so requires. Insurance as specified hereunder shall be in conjunction with insurance obligations stipulated within the executed Power Purchase Agreement (PPA), if applicable. The certificate of insurance shall provide that the insurance policy will not be changed or canceled during its term without thirty days written notice to CPS Energy. The term of the insurance shall be coincident with the term of this Agreement or shall be specified to renew throughout the length of this Agreement.

The Producer shall provide proof of such insurance to CPS Energy at least annually and upon request by CPS Energy.

For installations 50kW and smaller the Producer is not required to provide a certificate of insurance coverage to CPS Energy. It is recommended, however, that the Producer carry liability insurance coverage which insures the Producer against all claims for property damage and for personal injury or death arising out of, resulting from or in any manner connected with the installation, operation and maintenance of the Producer's generating equipment.

12. **Easements**

The Producer shall execute and deliver to CPS Energy one or more grants of easement or rights-of-way over, on, under and adjacent to the DER Facility Site, in form and content reasonably acceptable to CPS Energy, containing such commercially reasonable terms and conditions for the construction, operation, maintenance and/or relocation of CPS Energy's gas and electric facilities and the Interconnection Facilities. CPS Energy may locate its equipment or facilities within such easement or right-of-way in the location of its choosing, after obtaining the prior written consent for such location from Producer, which may not be unreasonably withheld, conditioned or delayed. The agreement, execution and delivery of such easements shall be a prerequisite to issuance of the approval provided for in Section 3. Producer agrees that CPS Energy's representatives, employees and assignee are hereby granted rights of ingress and egress to the DER Facility Site at all reasonable times for the purpose of inspection of



equipment and facilities providing service and in order to carry out the provisions of this Agreement.

13. **Dispute Resolution**

The Parties agree to make a good faith effort to resolve any disputes arising between them under this Agreement by non-binding mediation. The Parties hereby agree that, in the event that any dispute between them has not been resolved by non-binding mediation, a Party will have any and all remedies in any court of competent jurisdiction.

14. **Governing Law and Regulatory Authority**

This Agreement was executed in the State of Texas and will in all respects be governed by, interpreted, construed, and enforced in accordance with the laws of the State of Texas.

15. **Amendment and Changes**

This Agreement may be amended only upon mutual agreement of the Parties, which amendment will not be effective until reduced to writing and executed by the Parties. Producer agrees that the Rates and the Rules and Regulations are expressly subject to change by the Board of Trustees of CPS Energy or any governmental body having jurisdiction over the provision of gas and electric service by CPS Energy. Producer agrees to be bound by the Rates and the Rules and Regulations as they may change from time to time. Any such change shall affect only that portion of this Agreement specifically changed and all other portions shall remain in full force and effect.

16. **Entirety of Agreement and Prior Agreements Superseded**

This Agreement, including all attached Exhibits, which are expressly made a part hereof for all purposes, constitutes the entire agreement and understanding between the Parties with regard to the interconnection of the facilities of the Parties at the Point of Interconnection expressly provided for in this Agreement. The Parties are not bound by or liable for any statement, representation, promise, inducement, understanding, or undertaking of any kind or nature (whether written or oral) with regard to the subject matter hereof not set forth or provided for in this agreement. This Agreement replaces all prior agreements and undertakings, oral or written, between the Parties with regard to the subject matter of this agreement, and all such agreements and undertakings are agreed by the Parties to no longer be of any force or effect. It is expressly acknowledged that the Parties may have other agreements covering other services not expressly provided for herein, which agreements are unaffected by this Agreement.



17. **Notices.**

Notices given under this Agreement are deemed to have been duly delivered if hand delivered or sent by United States certified mail, return receipt requested, postage prepaid, to

If to CPS Energy:

CPS Energy President and CEO
P.O. Box 1771
San Antonio, TX 78296-1771

Cc:

Distributed Energy Resource Dept.
PO Box 1771
San Antonio, Texas 78296-1771

If to Producer:

Producer: _____
Title or Attn: _____
Mailing Address: _____

The above-listed names, titles, and addresses of either Party may be changed by written notification to the other, notwithstanding Section 17.

18. **Assignment**

Any successor, representative or assignee which shall succeed by purchase, merger or consolidation to all or substantially all the properties of CPS Energy or of Producer, as the case may be, shall be entitled to the rights and shall be subject to the obligations of its predecessor in title under this Agreement. CPS Energy or Producer may assign the rights and obligations of this agreement to an affiliated entity, or to a successor entity of either party that is owned, directly or indirectly, by a company or entity that is in the direct chain of corporate ownership of such Party. Either Party may assign or pledge this Agreement under the provisions of any mortgage, deed of trust, indenture or similar instrument which it has executed or may execute hereafter. Provider shall not assign this Agreement or any of its rights, duties or obligations unless and until Provider obtains CPS Energy's consent in writing of the other Party to this Agreement. On any grid-tied DER Facility 500kW or greater, CPS Energy shall have the first right of refusal to purchase the DER Facility should Producer decide to sell.

19. **No Third-Party Beneficiaries**

This Agreement is not intended to and does not create rights, remedies, or benefits of any character whatsoever in favor of any persons, corporations, associations, or entities other than the Parties, and the obligations assumed in this agreement are solely for the use and benefit of the Parties, their successors in interest and, where permitted, their assigns.



20. **Confidentiality Agreement**

Should Producer request ERCOT Polled Settlement (EPS) meter information or the ability to retrieve meter data from the EPS, Producer shall be required to execute a Confidentiality Agreement in the form attached as Exhibit D.

21. **No Waiver**

The failure of a Party to this Agreement to insist, on any occasion, upon strict performance of any provision of this Agreement will not be considered to waive the obligations, rights, or duties imposed upon the Parties.

22. **Headings**

The descriptive headings of the various articles and sections of this Agreement have been inserted for convenience of reference only and are to be afforded no significance in the interpretation or construction of this Agreement.

23. **Multiple Counterparts and Duplicate Originals**

This Agreement may be executed in two or more counterparts, each of which is deemed an original but all constitute one and the same instrument. The Agreement may also be executed in duplicate originals.

24. **Revisions to Exhibits and Requirements**

The Exhibits and the Requirements to this Agreement are part of the Agreement. CPS Energy may revise any of the Exhibits and Requirements to this Agreement at any time, with the prior written acceptance of Producer. Upon acceptance by the Producer, the revised Exhibits and Requirements will become a part of this Agreement. If Producer has not accepted the revised Exhibits and Requirements within thirty (30) calendar days after the revised Exhibits and Requirements have been received by Producer, then Producer shall have been deemed to have rejected the Exhibits and Requirements. If CPS Energy receives a written rejection within the thirty (30) calendar day period, and Producer and CPS Energy are unable to reach a compromise, this Agreement shall terminate upon written notice by either CPS Energy or Producer to the other Party.

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

CPS Energy

Producer

NAME: _____

NAME: _____

SIGNATURE: _____

SIGNATURE: _____

TITLE: _____

TITLE: _____

DATE: _____

DATE: _____

Appendix A7: Additional Safety and Performance References

The following standards may be useful in the specification, design, and evaluation of a DER system. Many of these documents are the standards used by utilities to design and operate the distribution system. While most are not necessary for designing the typical DER interconnection, any of them may be relevant for a particular application. One or more of these documents will likely provide the basis of a utility's application rejection or claim for additional requirements. In such cases, specific sections of applicable documents should be referenced. Many of these documents have been updated and the updated version should be used.

Secondary Safety and Performance standards for DER:

- ANSI/IEEE Std. 100-1996, IEEE Standard Dictionary of Electrical and Electronic Terms
- ANSI/IEEE Std. 493-1900 IEEE Recommended Practice for Design of Reliable Industrial and Commercial Power Systems (IEEE Gold Book).
- ANSI/IEEE Std. 1100-1992 IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book).
- ANSI/IEEE Std. 1159-1995 IEEE Recommended Practice for Monitoring Electric Power Quality.
- ANSI/IEEE Std. 1250-1995 IEEE Guide for Service to Equipment Sensitive to Momentary Voltage Disturbances. .
- ANSI/IEEE Std. C37.04 ANSI/IEEE Standard Rating Structure for AC High-voltage Circuit Breakers Rated on a Symmetrical Current Basis
- ANSI/IEEE Std. C37.06 ANSI/IEEE Standard for AC High-voltage Circuit Breakers Rated on Symmetrical Current Basis – Preferred Ratings and Related Required Capabilities
- ANSI/IEEE Std. C37.108-1989 IEEE Guide for the Protection of Network Transformers.
- ANSI/IEEE Std. C37.13 ANSI/IEEE Standard for Low-voltage AC Power Circuit Breakers Used in Enclosures
- ANSI/IEEE Std. C37.14 ANSI/IEEE Standard for Low-voltage DC Power Circuit Breakers Used in Enclosures
- ANSI/IEEE Std. C37.16 ANSI/IEEE Standard for Low-voltage Power Circuit Breakers and AC Power Circuit Protectors – Preferred Ratings, Related Requirements, and Application
- ANSI/IEEE Std. C37.18 ANSI/IEEE Standard Enclosed Field Discharge Circuit Breakers for Rotating Electric Machinery
- ANSI/IEEE Std. C37.2 IEEE Standard Electrical Power System Device Function Numbers
- ANSI/IEEE Std. C37.27 ANSI/IEEE Standard Application Guide for Low-voltage AC Nonintegrally Fused Power Circuit Breakers (Using Separately Mounted Current-Limiting Fuses)
- ANSI/IEEE Std. C37.29 ANSI/IEEE Standard for Low-voltage AC Power Circuit Protectors Used in Enclosures
- ANSI/IEEE Std. C37.50 ANSI Standard Test Procedures for Low-voltage AC Circuit Breakers Use In Enclosures

- ANSI/IEEE Std. C37.51 ANSI Standard Conformance Test Procedure for Metal Enclosed Low-voltage AC Power Circuit-Breaker Switchgear Assemblies
- ANSI/IEEE Std. C37.52 ANSI Standard Test Procedures for Low-voltage AC Power Circuit Protectors Used in Enclosures
- ANSI/IEEE Std. C37.95 IEEE Guide for Protective Relaying of Utility Consumer Interconnections
- ANSI/IEEE Std. C57.12 IEEE Standard General Requirements for Liquid Immersed Distribution, Power and Regulating Transformers
- ANSI/IEEE Std. C57.12.13 Conformance Requirements for Liquid Filled Transformers Used in Unit Installations including Unit Substations.
- ANSI/IEEE Std. C57.12.40-1994 American National Standard for Secondary Network Transformers - Subway and Vault Types (Liquid Immersed) - Requirements.
- ANSI/IEEE Std. C57.12.44-1994 IEEE Standard Requirements for Secondary Network Protectors.
- ANSI/IEEE Std. C84.1-1995, Electric Power Systems and Equipment - Voltage Ratings (60Hertz)
- IEC 1000-3-3 Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current less than 16A
- IEC1000-3-5 Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current greater than 16A
- UL 1008 Transfer Switch Equipment

Other UL standards apply to distributed generation systems but do not directly address interconnection safety. UL 2200 is the Standard For Safety for Stationary Engine Generator Assemblies. These requirements cover stationary engine generator assemblies rated 600 volts or less that are intended for installation and use in non-hazardous locations in accordance with NEC. These requirements do not cover generators for use in hazardous locations, which is covered by the Standard for Electric Motors and Generators for Hazardous (Classified) Locations, UL 674. These requirements also do not cover uninterruptible power system (UPS) equipment, which are covered by the Standard for Uninterruptible Power Supply Equipment, UL 1778.

Standards Organizations:

<p>National Fire Protection Association (NFPA)</p>	<p>1 Batterymarch Park Quincy, MA 02269-9101 Phone (617) 770-3000, Fax: (617) 770-0700 Web: http://www.nfpa.org</p>
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Underwriters Laboratories (UL)	333 Pfingsten Road Northbrook, IL 60062-2096 Phone: (847) 272-8800, Fax: (847) 272-8129 Web: http://www.ul.com/
Wyle Laboratories, Inc.	7800 Highway 20 West Huntsville, AL 35806 Phone: (256) 837-4411, Fax: (256) 721-0144 Web: http://www.wylelabs.com
Institute of Electrical and Electronics Engineers (IEEE)	445 Hoes Lane, PO Box 459 Piscataway, NJ 08855-0459 Phone: (800) 678-4333 Web: http://www.ieee.org
National Renewable Energy Laboratory	1617 Cole Boulevard Golden, CO 80401 Phone: (303) 275-3000, Fax: (303) 275-4053 Web: http://www.nrel.gov
Sandia National Laboratories, Photovoltaic Systems Assistance Center	P.O. Box 5800, Division 6218 Albuquerque, NM 87185 Phone: (505) 844-8161, Fax: (505) 844-6541 Web: http://www.sandia.gov/Renewable_Energy/photovoltaic/pv.html