# Revision History

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AUSTIN ENERGY
DISTRIBUTION SYSTEM INTERCONNECTION GUIDE
FOR CUSTOMER-OWNED POWER PRODUCTION FACILITIES
LESS THAN 10 MW

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INTRODUCTION

The primary purpose of this guide is to outline the process for connecting a Distributed Generation (DG) or Distributed Energy Resources (DER) facility and to define the minimum technical and financial requirements for safe integration of customer-owned power production facilities with the Austin Energy (AE) Distribution System (Note: The typical AE Distribution System voltage is 12.47 kV). This information is provided in an effort to maintain safe and reliable service to generating facilities and customers.

This guide covers most types of Distributed Generation/Distributed Energy Resources in the AE service area:

i. Inverter Based Systems - Predominantly Solar PV to date and also includes Energy Storage.
ii. Synchronous or Induction Motor Systems - Wind generation, standard fossil-fuel based motor generators.
iii. Other Types - Will be reviewed as encountered.

This guide is intended to be consistent with the requirements of the current version of IEEE Standard 1547, “IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces”, Federal, State, and Local regulations, and accepted industry practices and standards. It is intended as a supplement to the PUC and the IEEE for installation/interconnection of DG/DER systems on Austin Energy’s electrical distribution system.

In general, the DG/DER System and associated facilities must be designed in accordance with, but not limited to, UL (Underwriters Laboratories) Standards, IEEE (Institute of Electrical and Electronics Engineers) Standards, NEC (National Electrical Code), NESC (National Electrical Safety Code), PUC (Public Utility Commission of Texas), ERCOT (Electric Reliability Council of Texas) Operating Guides and Protocols, Austin Energy Electric Service Standards and Design Criteria Manual, and any other applicable Local, State, or Federal codes or standards. Particular attention should be paid to UL 1741, IEEE 519, and IEEE 1547.

Sections A and B review the application process. Sections C and D review the technical requirements for the installations. Section E outlines customer responsibilities, and Sections F and G cover definitions and applicable codes and standards.

Appendices A thru E provide additional reference material most commonly requested.

Appendix F was added for the purpose of supporting ERCOT’s Emergency Response Service (ERS) Program and includes the process as well as the application form.

Appendix G was added for the purpose of providing guidelines and configurations for connecting plug-in electric vehicles (PEVs) to a residential Time-of-Use (TOU) metering system.
Since these standards change regularly as a result of the latest practices, it is the user’s responsibility to verify that the most recent version of this document is being used.

The latest released version of this guide can be found on the AE website at:

http://www.austinenergy.com
  • Select the “Contractors” tab.
  • Select the “Electric Service Design & Planning" tab.
A. **INTERCONNECTION CLASSIFICATIONS**

There are five classifications of interconnections on the AE Distribution System that are defined by the following categories, and the first task is to refer to Appendix A of this guide (or section 1.12 of the AE Design Criteria Manual) to determine whether or not the proposed system will be sited in the Downtown Network.

**Note:** The size of a system will be an aggregate of all systems combined, both existing and proposed, and all values used in this guide are noted in alternating current (AC), not direct current (DC).

1. **Systems (not on the Downtown Network) which are less than 50 kW**

   Systems less than 50 kW and **NOT** on the Downtown Network account for close to 90% of the Distributed Generation (DG)/Distributed Energy Resources (DER) systems installed in the Austin Energy service area, and the process is covered in Section B.1 of this Interconnection Guide.

2. **Systems (not on the Downtown Network) which are 50 kW to less than 500 kW**

   Systems from 50 kW to less than 500 kW and **NOT** on the Downtown Network account for close to 10% of the DG/DER systems installed in the AE service area, and the process is covered in Section B.2 of this Interconnection Guide.

3. **Medium Systems (not on the Downtown Network) 500 kW to less than 10 MW**

   There are very few systems of this size and complexity in the AE service area. Detailed procedures for interconnecting systems 500 kW to less than 10 MW are covered in Section B.3 of this Interconnection Guide.

4. **Large Systems (not on the Downtown Network) 10 MW or greater**

   Standards for a facility this large (10 MW and up) are not set out in this document and are typically interconnected at the transmission level which is handled by the Director of Transmission and Distribution Planning. Austin Energy and the customer may interconnect a facility using mutually agreed upon technical standards.

   **Contact:** reza.ebrahimian@austinenergy.com

   a. Any entity proposing a total generation unit 10 MW or greater needs to follow the Generation Interconnection or Change Request Procedure. Details are available on the ERCOT website at: [http://www.ercot.com/gridinfo/generation](http://www.ercot.com/gridinfo/generation).

   b. The “Austin Energy Facility Connection Requirements” document may also be referenced and is available on AE’s website at: [http://www.austinenergy.com](http://www.austinenergy.com)
   - Select the “Contractors” tab.
• Select the “Electric Service Design & Planning” tab.

5. **Any Commercial or Residential System on the Downtown Network**

   Detailed procedures for interconnecting systems of any size that are on the AE Downtown Network are covered in Section B.3 of this Interconnection Guide.
B. APPLICATION PROCESS FOR DISTRIBUTED GENERATION/DISTRIBUTED ENERGY RESOURCES FACILITIES

The customer/contractor is required to obtain an electrical permit for construction of any generation facility interfaced to the AE system per Austin Electrical Code Section §25-12-111. This applies to all entities served by Austin Energy: residential, commercial, and government agencies.

All procedures for obtaining a City of Austin (COA) electrical permit apply, regardless if the system is installed within Austin or a separate Extraterritorial Jurisdiction (ETJ).

AE offers many rebates and incentives for customers to install Solar PV.

Refer to the AE website for more information:
http://www.austinenergy.com/go/solar

For commercial applications, please see the following link to Permit Application:
1. **Process for Systems Rated <50 kW and NOT on the Downtown Network**

Systems less than 50 kW and **NOT** on the Downtown Network account for approximately 90% of the DG/DER systems installed in the Austin Energy service area, and the process has been streamlined. (See steps a thru f below and the process flow diagram on p. 15.)

Systems in this category are typically handled through the City of Austin Development Office at One Texas Center.

**Please call Customer Energy Solutions (CES) at 512-482-5346 if you have questions or need help getting started.**

a. The customer is required to fill out a [DGPA (Distributed Generation Planning Application)](http://www.austinenergy.com) for any interconnection to the AE system, which can be found on the AE website at:

http://www.austinenergy.com

- Select the “Contractors” tab.
- Select the “Electric Service Design & Planning” tab.
- Note that although the DGPA form is necessary, AE approval is **NOT** required for systems less than 50 kW.

b. The customer is then required to obtain an **electrical permit** from the City of Austin and should provide the following data for obtaining the electrical permit:

i. Physical layout drawing(s) clearly indicating the interconnection equipment shown in **Section C**.
ii. Electrical one-line diagram, up to, and including, the interface to the AE system.
iii. List of major equipment: manufacturer’s name, model number and information for inverter, overcurrent device, solar modules (if Solar PV).
iv. Copy of the inverter manufacturer’s string sizing calculations from their website to verify that the system is sized appropriately (if Solar PV).
v. Completed DGPA.
vi. **Energy Storage Systems >30 kWh may require approval by Austin Fire Department.**

c. The customer is recommended to have a pre-construction review of their plans by contacting the City Electrical Inspector via [AMANDA](see **Section F: Definitions**). **This review is entirely optional.** Note that the Installer has to verify NEC compliance of the modified system, from the point of connection all the way back to the Point of Common Coupling, with the focus on proper size of feeder cables and panel buses.

d. Contractor builds system per plans submitted. **Note:** Any significant change in the design must be approved by the City Inspector’s office.
e. After the system is installed, the customer/contractor shall request the final electrical inspection from the COA Electrical Inspection department via AMANDA.
   i. The customer shall not start up, test, or operate electrical generating equipment in parallel with the AE electrical system until all inspections have been passed.

f. The customer's system and all equipment associated with the parallel operation of power production equipment will be inspected to verify that all work has been correctly performed and the system installation complies with all applicable codes and standards.
   i. Refer to Appendix C for the current inspection checklist.
   ii. The customer shall provide, at their expense, their contractor to demonstrate all protective functions for the inspector.
1. Distributed Generation/DER Application Approval Process for Systems <50 kW and NOT on the Downtown Network

1. Complete Austin Energy DGPA

2. Provide schematic drawings and DGPA to City of Austin for an Electrical Permit

3. Contractor requests pre-construction meeting to review with COA using AMANDA (optional)

4. Contractor builds system per design

5. Schedule final inspection using COA’s AMANDA system

6. Final inspection by Electrical Inspector

End
2. Process for Systems Rated 50 kW to <500 kW and NOT on the Downtown Network

Systems from 50 kW to less than 500 kW and NOT on the Downtown Network account for approximately 10% of the DG/DER systems installed in the Austin Energy service area, and the process for obtaining a permit is slightly more complex. (See steps a thru g below and the process flow diagram on p. 19. Also see Section D on p. 37 for any additional requirements.)

Systems in this category are typically handled through the City of Austin Development Office at One Texas Center.

Please call Customer Energy Solutions (CES) at 512-482-5346 if you have questions or need help getting started.

a. The customer is required to submit a completed DGPA (Distributed Generation Planning Application) to Austin Energy for review for any interconnection to the AE system, which can be found on the AE website at:

   http://www.austinenergy.com
   • Select the “Contractors” tab.
   • Select the “Electric Service Design & Planning” tab.

b. The DGPA must be accompanied with a full set of drawings and specifications that have been sealed by a Professional Engineer licensed in the state of Texas. All drawings shall be in electronic files in either pdf or AutoCad .dwg formats. Files larger than 3 MB should be sent in a zipped or compressed format. Upon request, the customer shall submit to AE all technical data or additional information required to evaluate the proposed customer electrical generating facility including, but not limited to, the following as required:

   i. Physical layout drawings, including dimensions and interconnection distance.
   ii. Schematic drawings up to, and including, the interface to the AE system indicating the interconnection equipment shown in Section C.
   iii. Electrical one-line and three-line diagrams, and schematic diagrams identifying continuous and fault current ratings of all equipment to verify compliance to NEC Article 110.10.
   iv. System protection details.
   v. Integration of DG/DER grounding system with AE distribution system per IEEE 1547, NEC Article 250, and AE Design Criteria Manual.
   vi. Detailed list of equipment: manufacturer’s name, model number, and rating information.
      a) Note: All equipment shall be listed and certified to either UL or NRTL (a Nationally Recognized Testing Laboratory).
   vii. Lightning protection and grounding details indicating conformance to NFPA 780 (if required).
   viii. Coordination data such as: (for Primary fed customers only – this is not common)
      a) Functional and logic diagrams.
b) Control and meter diagrams.

c. The customer is also **required to go to the Development Services Department of the City of Austin for plan review for obtaining an electrical permit**, and the DGPA must be accompanied with a full set of drawings. Upon successful completion of the plan review, the contractor will receive an electrical permit. Note that the Installer has to verify NEC compliance of the modified system, from the point of connection all the way back to the Point of Common Coupling, with the focus on proper size of feeder cables and panel buses.

d. The customer is recommended to have a pre-construction review of their plans by contacting the City Electrical Inspector via **AMANDA** (see **Section F: Definitions**). This **review is entirely optional**.

e. Contractor builds system per plans submitted. Note: Any significant change in the design must go back through the plan review process.

f. After the system is installed, the customer/contractor shall request the final electrical inspection from the COA Electrical Inspection department via **AMANDA**.
   i. The customer shall not start up, test, or operate electrical generating equipment in parallel with the AE electrical system until all inspections have been passed.

g. The customer's system and all equipment associated with the parallel operation of power production equipment will be inspected to verify that all work has been correctly performed and the system installation complies with all applicable codes and standards.
   i. Refer to **Appendix C** for the current inspection checklist.
   ii. The customer shall provide, at their expense, their contractor to demonstrate all protective functions for the inspector.
2. Distributed Generation/DER Application Approval Process for Systems 50 kW to <500 kW and NOT on the Downtown Network

Contact AE for information on Solar Rebates and Incentives (optional)

1. Submit completed DGPA to Austin Energy CES for review

2. Provide schematic drawings and approved DGPA to City of Austin for Plan Review

3. Contractor receives electrical permit

4. Contractor requests pre-construction meeting to review with COA using AMANDA (optional)

5. Contractor builds system per design

6. Schedule final inspection using COA’s AMANDA system

7. Final inspection by Electrical Inspector

End
3. **Process for Systems Rated 500 kW to less than 10 MW OR on the Downtown Network**

Due to the size and complexity of these systems, AE’s **System Engineering group** is the single point of contact for processing these types of interconnection requests. (See steps a thru g below and the process flow diagram on p. 24. Also see **Section D** on p. 37 for any additional requirements.)

System Engineering will be responsible for coordinating with Complex Metering, Distribution Design, Distribution Planning, Key Accounts, Network Design, Regulatory Analysis, System Operations, and Transmission Planning regarding all technical issues associated with interconnecting to the AE distribution system and can be reached by email at: systemengineeringadm@austinenergy.com

a. The customer is required to submit a **DGPA (Distributed Generation Planning Application)** along with the **completed application** for any interconnection to the AE system, which can be found on the AE website at: http://www.austinenergy.com
   - Select the “Contractors” tab.
   - Select the “Electric Service Design & Planning” tab.

b. The customer will submit the completed application (**Appendix D**) to AE System Engineering containing all **required Customer Data**. Any installation 500 kW and up, or **of any size on the Downtown Network**, must be accompanied with a full set of drawings and specifications that have been sealed by a Professional Engineer licensed in the state of Texas. All drawings shall be in electronic files in either pdf or AutoCad .dwg formats. Files larger than 3 MB should be sent in a zipped or compressed format. Upon request, the customer shall submit to AE all technical data or additional information required to evaluate the proposed customer electrical generating facility including, but not limited to, the following as required:

   i. Physical layout drawings, including dimensions and interconnection distance.
   ii. Conductor sizes and length and technical parameters for circuit impedances.
   iii. Schematic drawings up to, and including, the interface to the AE system indicating the interconnection equipment shown in **Section C**.
   iv. Electrical main one-line and three-line diagrams and schematic diagrams identifying continuous and fault current ratings of all equipment to verify compliance to NEC Article 110.10.
   v. System protection details.
   vi. Integration of DG/DER grounding system with AE distribution system per IEEE 1547, NEC Article 250, and AE Design Criteria Manual.
   vii. Detailed list of equipment: manufacturer’s name, model number, and rating information.
viii. Manufacturer's test data or certification indicating compliance with national codes concerned with radio noise, harmonic generation, and telephone interference factor.

ix. Lightning protection and grounding details indicating conformance to NFPA 780 (if required).

x. Coordination data such as:
   a) Functional and logic diagrams.
   b) Control and meter diagrams.
   c) Any other data relevant to coordination of the customer system with the AE system.
   d) Systems over 500 kW or on the Downtown Network must also have a written sequence of operation including documented switching procedure(s).
   e) Synchronizing methods (if any).

xi. Load Data (Downtown Network only):
   Electrical load analysis based on previous 12 months customer data (where possible) to verify maximum sizing of array for minimum import relay requirements. Refer to Appendix E for an example of how to calculate system size from load.

c. AE System Engineering will review and provide feedback on the proposed facility. An interconnection study may also be required to determine any mitigation procedures that may be required. Once the final design has been determined, AE System Engineering will issue a letter releasing the DGPA.

d. The customer is also required to go through plan review for obtaining an electrical permit, and the DGPA must be accompanied with a full set of drawings. Upon successful completion of the plan review, the contractor will receive an electrical permit. Note that the Installer has to verify NEC compliance of the modified system, from the point of connection all the way back to the Point of Common Coupling, with the focus on proper size of feeder cables and panel buses.

e. The system shall be installed per the final design in the permit application. Any deviations from the final design (including field changes) shall be communicated to AE/City of Austin for further review. A more detailed commissioning test (if required by AE) shall be mutually agreed on as well that verifies all protective functions per IEEE 1547.

f. After the system is installed, the customer shall request the final electrical inspection from the COA Electrical Inspection department using the AMANDA (see Section F: Definitions) system.
   i. The customer shall not start up, test, or operate electrical generating equipment in parallel with the AE electrical system until final meter installation or written consent of AE has been done.

g. The customer's facility and all equipment associated with the parallel operation of power production equipment will be inspected to verify that all work has been correctly performed and the system installation complies with all applicable codes and standards.
   i. Refer to Appendix C for the current inspection checklist.
ii. The customer shall provide, at their expense, their contractor and any additional equipment (current sources, etc.) required to demonstrate all protective functions for AE and to perform any additional commissioning tests that may be required.
Distributed Generation Interconnection Application Process (Systems 500 kW to <10 MW or on Downtown Network)

**Start**
- System Engineering receives Interconnection Application from Customer or is forwarded Application from within Austin Energy.

**Impact Studies**
- System Engineering forwards Application to Complex Metering, Distribution Design, Distribution Planning, Key Accounts (if applicable).

**Distribution Planning Studies**
- System Engineering studies Preliminary Design Studies
  - Outline of customer’s equipment
  - Impact on EPS equipment loading under all steady state conditions
  - Impacts on system protection, fault conditions, and arc flash rating
  - Impacts on voltage regulation within the EPS under steady state conditions
  - Impacts on EPS power quality

- Distribution Planning Studies
  - Connectional Design Studies
  - System protection studies
  - Operational characteristics — loading, load shedding, etc.
  - Special System Studies
    - Short-circuit simulation
    - Dynamic simulation
    - Electromagnetic Transient simulation
    - Harmonics and flicker

**System Engineering**
- Coordinates Impact Studies with Distribution Planning.

**Impact Study Draft Issued**
- System Engineering completes or receives Draft and issues to Metering, Distribution Design, and Distribution Planning.

**DR Impact Mitigation Analysis**
- Distribution Planning analyzes DR Impact to system and recommends changes to distribution system to mitigate impact.

**Interconnection Cost Estimate**
- Distribution Planning prepares: Opinion of Probable Costs for DR Interconnection and mitigation (if required) is determined and included in Impact Study Report.

**System Engineering**

**Operations**
- Finalizes Interconnection Agreement and Operating Guide with Customer.

**Customer**
- Signs Interconnection Agreement (see Appendix D).

**PM**
- Confirms and coordinates method of payment with Customer, notifies Distribution Design of contract execution, and provides copies of executed Agreement.

**Plan of Service Meeting**
- Distribution Design identifies Project Manager (PM).
- System Engineering and Distribution Design create Plan for Interconnection.
- Control Group — Designs plans for facility controls.
- Metering — Designs plan for metering cabinet.
- Substation — Designs plan for substation modifications. Material and Labor costs are generated.
- Director of Distribution Design and PM reviews and approves Plan of Service, Cost Estimate, and CIP Project Request form by signature.

**PM**
- Prepares quote as part of the final Interconnection Study and reviews proposal with Customer.

**System Engineering**
- Participates in commissioning DG or DER and final inspections performed by CON.

**End**
C. GENERAL SYSTEM LAYOUTS AND REQUIREMENTS

This section reviews general system layouts and components for simple DG/DER Systems <10 kW and **NOT** on the Network. It also provides technical descriptions of the requirements that are also applicable for **ALL other DG/DER** systems. Figures 1 thru 5 represent simplified diagrams illustrating the key requirements for Solar PV and/or Energy Storage Systems. They are showing "typical" 10 kW systems only and are not all-inclusive of other systems (such as those 10 kW to <50 kW, 50 kW to less than 500 kW, or 500 kW to less than 10 MW). For these systems, Figures 1-5 can be referenced, but certain, particular equipment might have to be replaced, resized, etc. (utility transformer, billing meter, service disconnect, overcurrent protection, etc.).

Other DG/DER systems may require review by AE and are **not specifically shown in these layouts**. Other DG/DER systems will include systems 10 kW to <50 kW, 50 kW to <500 kW, 500 kW to less than 10 MW, or on the Downtown Network. Notes 1 thru 14 in this section **DO** apply to all DG/DER systems <10 MW **even though other general system layouts are not illustrated in this guide**.

Larger DG/DER systems contain similar overall requirements, and detailed requirements are shown in **Section D** for each system classification. AE shall review all customer-selected interconnection equipment and the proposed configuration to verify it meets all requirements.

Shared Solar systems are included in this guide as part of a general review process. They contain similar overall interconnection requirements, and typical configurations are shown in **Appendix B**. AE shall review all customer-selected interconnection equipment and the proposed configuration to verify it meets all requirements.

The technical and operational impacts on the Austin Energy system will vary depending on the size of DG/DER system and in the manner of installation/interconnection. AE may require different equipment depending on the size of the DG/DER system, the amount of power being exported to the AE system, and the location of the DG/DER system. The DG/DER system owner must conduct their own analysis and conform to Austin Energy interconnection requirements as directed in this guide.
Figure 1: Simplified Diagram for Solar PV Only Systems <10 kW and NOT on the Network (Typically Residential)
Figure 2: Simplified Diagram for DC Coupled Solar PV plus Energy Storage Systems <10 kW and NOT on the Network (Typically Residential)
Figure 3: Simplified Diagram for AC Coupled Solar PV plus Energy Storage Systems <10 kW and NOT on the Network (Option 1) (Typically Residential)
Figure 4: Simplified Diagram for AC Coupled Solar PV plus Energy Storage Systems <10 kW and NOT on the Network (Option 2) (Typically Residential)
Figure 5: Simplified Diagram for **Energy Storage Only**
Systems <10 kW and NOT on the Network (Typically Residential)
Notes for Figures 1 thru 5 (p. 26 thru 30):

These notes are also applicable for ALL other customer-owned or Shared Solar DG/DER systems and for configuration drawings shown in Appendix B).

1. **Facility Identification:**
   A directory/plaque of all DG/DER sources including contact information shall be provided as per NEC Articles 690 and/or 705. Reference also AE Design Criteria Manual 1.9.1.7.
   
a. The directory or plaque must be permanent - simple stick on labels are not allowed.

b. A rapid shutdown label shall be installed in accordance with NEC Article 690.

c. The plaque must also include information on any standby systems or energy storage system.

2. **Manual Disconnect:**
   A manual load break disconnect switch with visible blades shall be provided at the customer's distributed generation service point to provide a separation point between the customer's electrical generation system and the AE electrical utility system. Note that the Solar PV system disconnect may also be integrated with the Rapid Shutdown system. AE will coordinate and approve the location and type of the disconnect switch(es) as shown in Appendix B. For "old" service improvements, reference AE Design Criteria Manual 1.9.1.8.C. For the main disconnect, reference AE Design Criteria Manual 1.8.4.
   
a. The disconnect switch(es) shall be mounted (and grouped) in proximity to the metering equipment, as well as other switches, per NEC Article 690 and connected per NEC Article 404.6.

b. The switch shall be readily accessible to AE personnel at all times and be capable of being locked in the open position with an AE padlock and should not be locked by the owner.

c. AE reserves the right to open the disconnect switch isolating the customer's electrical generating system (which may or may not include the customer's load) from the AE system for the following reasons:
   i. To facilitate maintenance or repair of the AE electrical system or of the distributed generation system.
   ii. During AE electrical system emergency conditions.
   iii. When the customer's electrical generating system is determined to be operating in a hazardous or unsafe manner or adversely affecting AE's system.
   iv. Failure of the customer to comply with applicable codes, regulations, and standards in effect at that time.
   v. Failure to abide by any contractual arrangement or operating agreement with AE.
3. **Surge Protective Device (Solar PV only):**
The device (Type 1 or 2) shall be appropriately sized for the service entrance per NEC.
Note on UL 1449 3rd Edition Type 1 and Type 2 Surge Protection: Type 1 Surge Protective Device (SPD) - Permanently connected Type 1 SPD's are intended for installation between the secondary of the service transformer and the line side of the service equipment overcurrent device. Type 2 Surge Protective Device - Permanently connected Type 2 SPD's are intended for installation on the load side of the service equipment overcurrent device.

4. **Overcurrent Protection:**
The type and size of the device shall be reviewed by AE depending upon the installation. Adequate test data or technical proof that the device meets the criteria specified in IEEE 1547 and the NEC must be supplied by the customer to AE. Overcurrent protection for line-side taps must meet the requirements of NEC Article 705.31.

5. **Metering:**
   a. **Installations <1 MW:**
      i. Contact **AE Complex Metering: (512) 505-7045.**
      ii. AE will provide the additional metering equipment necessary to measure capacity and energy delivered to, or received from, the customer's PV facility.
      iii. Refer to Figure 1 for an example of a simplified Solar PV installation and **Appendix B** for standard configurations. Contact AE Complex Metering for any clarification.
         a) Note: The PV meter shall be grouped with billing meter and disconnects.
      iv. Contact AE Complex Metering when installing systems shown in Figures 2 thru 5.
         a) For Figures 2 thru 5 involving energy storage, meters will be set once billing rates have been approved by AE. AE shall provide a meter bypass once inspection has been passed.
      v. Refer to the AE website for detailed meter socket, meter hub, and CT specifications.
      vi. **http://www.austinenergy.com**
          - Select the “Contractors” tab.
          - Select the “Electric Service Design & Planning” tab.
            a) Facilities with <200 amps current would typically use a self-contained meter.
            b) Facilities with >200 amps current would typically use an instrument rated meter.
            c) Final determination of meter type and configuration shall be made by the AE Metering group.
      vii. In case of Opt-out with metering issue, please call Complex Metering Operations department for further instructions. **Note: No (new) DG interconnections will be allowed with smart meter opt-out.**

   b. **Installations 1 MW to <10 MW:**
      i. Contact **AE Complex Metering: (512) 505-7045.**
      ii. The distributed generation facility owner will need to register the resource with ERCOT. Refer to ERCOT website for more information: **http://www.ercot.com/services/rg/re/dgresource.**
      iii. AE shall provide at AE’s expense the necessary EPS metering equipment for interconnection to the AE system.
iv. In case of Opt-out with metering issue, please call Complex Metering Operations department for further instructions. Note: No (new) DG interconnections will be allowed with smart meter opt-out.

6. **Inverters (for inverter based systems):**
   
a. Solar PV inverters shall be certified to UL 1699B, UL 1741, and IEEE 1547 and must be on the approved list published by the California Energy Commission (CEC) on its website [http://www.gosolarcalifornia.org](http://www.gosolarcalifornia.org).

b. Inverters in non-Solar PV distributed generation systems must meet the requirements of IEEE 1547 and be certified to UL 1741, and UL 2200, if applicable, and may not be self-commutating while paralleled with the AE system.
   
i. Inverters shall be set per the default settings as defined in IEEE 1547-2018 (or 300 seconds).
   
ii. Inverters in areas with high levels of DG/DER penetration may require alternate settings.

c. Inverters used with energy storage systems shall be certified by the Energy Storage System battery manufacturer for use with their system.

d. Inverters used to provide backup power (such as for energy storage systems) shall include a transfer switch to disconnect from the AE system while operating in island mode using self-commutation.

e. Three phase systems must either use a three phase inverter or single phase inverters arranged in a wye configuration. Single phase inverters may not be connected in a delta configuration due to grounding concerns.

7. **Grounding:**
   
a. Grounding shall be done in accordance with UL 1741 and NEC Articles 250 and 690. DC Grounding Conductor to meet #8 AWG minimum per NEC 250.166.

b. All inverters shall be effectively grounded and shall have Ground Fault protection per NEC Article 690.11.

8. **Protective Devices and Functions:**
   
All DG/DER installations shall have protective devices that provide an automatic method of disconnecting its generation equipment from the AE system along with electronic programmable relays to meet the requirements of IEEE 1547, Section 4 - "General Interconnection Technical Specifications and Performance Requirements". The automatic disconnecting device may be of the manual or automatic reclose type and shall not be capable of reclosing until the AE System voltage and frequency return to normal range and the system is stabilized for the duration specified in (f) below. Note that inverters certified to UL 1741 provide many of these functions.
a. Voltage and Flicker: The customer equipment shall provide under/overvoltage trip capability. AE shall endeavor to maintain the voltages on the AE system but shall not be responsible for factors or circumstances beyond its control. If the customer's electrical generation equipment has automatic voltage control capability, it shall be operated in the manual mode with power factor control consistent with the power factor requirement set out below and in IEEE 1547.
   i. The customer owned equipment will not cause AE system voltage to go outside of the limits set by ANSI C84.1.
   ii. In accordance with IEEE 519, the flicker shall not exceed 3.0% voltage change, measured at the point of common coupling. If high or low voltage complaints or flicker complaints result from the operation of the customer's electrical generation, the customer's generating system shall be disconnected until the problem is resolved.

b. Frequency: The customer equipment shall provide under/overfrequency trip capability. AE will endeavor to maintain a 60-hertz nominal frequency on the AE system. If the customer's electrical generation equipment has speed or frequency control, it shall be operated in the manual droop mode.

c. Harmonics: The customer's electrical generation system shall not cause voltage harmonic content or total harmonic distortion (THD) in excess of the limits of IEEE 519 and IEEE 1547 when measured at the point of common coupling with the AE system.

d. Fault and Loss of Source: In accordance with IEEE 1547, in the event of a fault on the customer's system or a fault or loss of source on the AE system, the customer shall provide an automatic method of disconnecting its generation equipment from the AE system within 10 cycles should the voltage on one or more phases fall below 50% of nominal voltage on the AE system serving the customer premises at the point of common coupling.
   i. In the event of an outage, the DG/DER system shall contain anti-islanding protection to de-energize the system and prevent inadvertent backfeed during this outage into AE’s electrical system.
   ii. Installations over 2 MW shall provide for transfer trip of the DG/DER facility.

e. Power Factor: The customer's electrical generation system shall be designed, operated, and controlled at all times to provide reactive power requirements at the point of interconnection per IEEE 1547, but in no case exceeding from 0.95 lagging to 0.95 leading power factor unless approved in writing by AE.

f. Reconnection to AE Service: After any disturbance resulting in a service interruption or feeder breaker actuation, no Distributed Generation/DER source may reconnect until the AE System voltage and frequency return to normal range and the system is stabilized for a period of 300 seconds, or as approved in writing by AE. This disconnect timing ensures that the generator is disconnected from the AE System prior to automatic re-close of feeder breakers.
g. Relay Settings (if applicable): The settings for all distribution interconnections shall be approved by System Engineering in conjunction with IEEE 1547 and AE Transmission and Substation Engineering and Construction as necessary.

To enhance system reliability and safety and with AE’s approval, the customer may employ a modified relay scheme with delayed frequency or voltage tripping using communications equipment between the customer and AE.

9. **Main Service Disconnect:**
   All customers must have a code-compliant service disconnecting means. Refer to the AE Design Criteria Manual for specifics.

10. **Rapid Shutdown Feature (Solar PV only):**
    All installations submitted for approval shall incorporate a rapid shutdown feature if required by the AHJ per Article 690.12 of the NEC.

11. **Additional Disconnects:**
    The location of all disconnects shall be clearly indicated on the informational directory/plaque (see item 1 above).

   a. **Solar PV:** DC Disconnects are required and typically internal to inverters for system maintenance. Additional DC disconnects may be required to meet Rapid Shutdown requirements.

   b. **Energy Storage Systems:** At least one lockable, visible blade DC disconnect is required for first responders on external DC conductors between the battery and the inverter (not required for self-contained systems). Additional disconnects may be required in accordance with 2017 NEC 706.7(E), readily accessible and within sight of the ESS.

   c. **Self-Contained Energy Storage Systems (Back Up Application):** A lockable, visible blade AC disconnect is required for first responders on self-contained systems when used in a backup application. The disconnect shall be located within sight of the battery, and before the backup panel. Additional disconnects may be required in accordance with 2017 NEC 706.7(E).

   d. **Isolation Switch:** An isolation switch shall be required to automatically disconnect AE from any distributed generation sources upon loss of primary power, and shall not be reconnected until the primary source is restored in accordance with NEC 705.40.

12. **Solar Panel Access and Spacing Requirements (Solar PV only):**
    Solar panels shall be installed with perimeter access per the most recent revision of IFC 605.11.3. The IFC along with many other codes can be found at: https://codes.iccsafe.org/public/
13. **Energy Storage System Equipment:**
   Provisions shall be made: All Energy Storage System equipment shall be certified to UL 1973, and installation shall comply with manufacturer’s instructions. Lithium Ion systems shall be certified to UL 1642. Lead-Acid systems shall be certified to UL 1989. Refer to **Section D.4** for additional information.

   **NOTE:** Installations larger than 30kWh may require Fire Department Review per IFC 608.

14. **AC & DC Wiring:**
    Provisions shall be made: Conductors run in attic required to be in conduit both AC and DC (reference NEC 690.31(G) for DC wiring).
D. DETAILED REQUIREMENTS FOR PARALLEL SYSTEMS

1. Additional Technical Requirements by System Classification

a. Systems (not on the Downtown Network) less than 50 kW (typically residential):
   i. No additional requirements.

b. Systems (not on the Downtown Network) rated at least 50 kW to less than 1 MW must also have:
   i. An automatic sync-check relay (if generator is synchronous or self-commutated) or open transition transfer switch.
   ii. 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 AE (not common).
   iii. The system must have the ability to provide power factor support from 0.9 lagging to 0.9 leading. Exact settings will be determined with AE.
   iv. Refer to simplified diagrams in Section C, Figures 1 thru 5, for "typical" layouts. Figures 1 thru 5 represent simplified diagrams illustrating the key requirements for Solar PV and/or Energy Storage Systems. They are showing "typical" 10 kW systems only and are not all-inclusive of other systems (such as those <50 kW, 50 kW to less than 500 kW, or 500 kW to less than 10 MW).
   v. Other DG/DER systems may require review by AE and are not specifically shown in these layouts. Other DG/DER systems will include systems 10 kW to <50 kW, 50 kW to <500 kW, 500 kW to less than 10 MW, or on the Downtown Network. Notes 1 thru 14 in Section C DO apply to all DG/DER systems <10 MW even though other (additional) general system layouts are not illustrated in this guide.

c. Systems (not on the Downtown Network) rated 1 MW to less than 10 MW must have:
   i. If the facility is capable of exporting to the AE system, there shall be a redundant circuit breaker interfaced to the AE relay system (required for 2 MW and up for DG/DER inverter based systems and for 1 MW and up for synchronous or induction motor systems).
   ii. EPS metering is required for systems 1 MW and up. Refer to Metering, Section C.5, for additional requirements.
   iii. Utility grade relays approved by AE and compatible with AE relay communication. The relay shall be compatible with Mirrored Bits protocol. The relay shall provide the following functions at a minimum:
      a) An undervoltage/overvoltage trip with sensing/readout by phase.
      b) An under/over frequency trip with sensing/readout by phase.
      c) An automatic synchronism check relay (for facilities with stand-alone capability).
      d) Telemetry/transfer trip to be done in accordance with IEEE 1547 and PUC Substantive Rule §25.212 (transfer trip for DG/DER inverter based systems rated more than 2 MW but less than 10 MW). For 1 MW and up synchronous or induction motor systems, install transfer trip function per AE requirements.
e) Either a ground overvoltage or a ground overcurrent trip depending on the grounding system.

f) 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 AE.

g) On-board data acquisition and event log to record actual readings for all events.

h) All required fault-detection relays shall coordinate with AE’s devices, as necessary.

i) All interconnection relays shall be set to provide overlapping or coordinated protection to prevent extensive damage should an interrupting device fail to clear when required. The line-protection schemes shall be able to distinguish between generation, inrush, and fault current.

j) Where the existing relay schemes have to be reset, replaced, or augmented with additional relays to coordinate with the customer’s new facility, all work shall be done at the customer’s expense.

iv. Systems greater than 2 MW must have two-way fiber optic communications channel between AE and the customer’s facility for monitoring and relay communication and shall comply with the requirements of IEEE 1547.3. The customer will pay for all installation charges and communications equipment.

v. DG/DER facilities of 4 MW or larger defined as intermittent sources will either require a dedicated feeder, or have the facility load split between multiple feeders to minimize/reduce voltage fluctuations that would affect other customers.

vi. DG/DER facilities of 5 MW or larger shall be provided electrical service at primary voltage (12.47 kV) and will be responsible for providing their own step-up transformers which shall be a grounded-WYE configuration on the utility side.

vii. The system must have the ability to ramp output up or down either by use of dynamically controlled inverters or staged ramping sequences. Ramping sequences shall be for minimizing adverse voltage effects and shall be approved by AE.

viii. The system must have the ability to provide power factor support from 0.9 lagging to 0.9 leading. Exact settings will be determined with AE.

d. Facilities on the Downtown Network:
   Refer to Appendix E for interconnecting DG/DER in the Downtown Network.

2. Dedicated Service
   AE will determine the need and feasibility for dedicated service on a case-by-case assessment of each customer-owned power production facility. The customer is responsible for all connection charges above standard service.

   Dedicated Feeder - Proposed Distributed Generation/DER facilities may not represent greater than 25% of the existing feeder load or 15% of the maximum available fault available on the circuit without written approval from AE.

3. Additional Requirements for Non-Inverter Based Generation

   a. All generating units must comply with all of the applicable standards of ANSI and IEEE as well as be certified to UL 2200 “Stationary Engine Generator Assemblies”.

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b. The customer should contact Austin Energy to determine the phase rotation at their proposed site.

c. Fault current of the system must be recalculated to include the proposed generation, and all equipment must be rated to handle the increased fault current.

d. Machine rating will be determined from faceplate rating of the generator at 100% power factor.

e. Synchronous machines
   i. The distributed generation facility’s circuit breakers shall be three-phase devices with electronic control.
   ii. The customer is solely responsible for proper synchronization of its generator with the AE system.
   iii. The generator’s excitation system shall conform to the field voltage versus time criteria specified in the most recent version of IEEE Standard C50.13.
   iv. For generating systems greater than 2 (two) megawatts (MW) the customer shall maintain the automatic voltage regulator (AVR) of each generating unit in service and operable at all times. AE shall be notified if the AVR is removed from service for maintenance or repair.

f. Induction machines
   i. The induction machines used for generation may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop at the point of interconnection is within the flicker limits specified in this document.
   ii. Induction generators shall have static capacitors that provide at least 95% of the magnetizing current requirements of the induction generator field. AE may, in the interest of safety, authorize the omission of capacitors. However, where capacitors are used for power factor correction, additional protective devices may be required to guard against self-excitation of the customer’s generator field.

4. Additional Requirements for Electric Energy Storage Systems

   a. All Energy Storage Systems (ESS) shall be installed per manufacturer’s instructions.

   b. A second AC disconnect means shall be installed in proximity to the Energy Storage System if the AE required disconnect is not within sight.

   c. A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. The disconnecting means shall be readily accessible and located within sight of the ESS.

   d. Energy Storage Systems installed in parallel with other DG, such as Solar PV (as shown in Figures 3 & 4, p. 28 & 29), may not both simultaneously discharge to the AE distribution system, unless the capacity of the transformer serving the customer has been reviewed by AE to ensure safe operation.
5. **Other Protective Devices**
   The foregoing provides a statement of the minimum requirements for parallel operation on the AE system. In addition, AE will have the right to specify certain protective devices including relays and circuit breakers that must be installed at the customer's expense to operate in parallel with AE's system, to protect the safety of its employees and equipment, maintain the reliability of the system, or improve the accuracy of its metering equipment.

6. **Technical Exceptions**
   a. AE will review and consider exceptions that customers may have to the "Requirements for Parallel Systems" provided, however, that legal requirements such as compliance with fire safety, electrical, or construction codes may not be waived unless such law, code, or ordinance provides for waiver or approval of alternate requirements and then only under the conditions set out therein for the grant of such waiver or written approval of alternate requirements.

   b. Customers desiring to present exceptions for consideration should submit in writing a completed description of the nature of each such exception to AE.

   c. Customers submitting exceptions should also include recommendations for an alternative approach to this particular requirement.
E. **COMPLIANCE WITH APPLICABLE LAWS AND INSTALLATION RULES**

1. **Compliance with Laws:** All customer-owned power production facilities located in the AE service area shall comply with the latest version of the Austin Electrical Utility Service regulations, City of Austin Electrical Code (§25-12-111), ERCOT Distributed Generation Requirements, NFPA 70 (National Electrical Code), and NESC (National Electrical Safety Code), as well as the most current version of all other applicable federal, state, or local laws or ordinances as of date of installation. Refer to Section G for a listing of additional codes and standards. AE customers in areas outside of the City of Austin may be required to have an additional permit depending on any local authority having jurisdiction (AHJ).

2. **Compliance with Installation Rules:** All customer-owned power production facilities shall also comply with the Installation Rules and Standards for Electric Service established for the AE service area. All equipment rated for use at 1000V or below shall be UL listed and shall comply with NEC Article 490.

   a. Note that per City and State Law, Solar PV systems may only be installed by a licensed contractor. Homeowner exemptions do not apply for working on electrical services.

3. **Applicability for Emergency or Standby Systems:** Emergency and/or standby systems as defined in Articles 700 through 702 of the NEC not in parallel with the AE electrical distribution system, other than brief transition switching periods, are not required to follow this interconnection procedure. However, if the design of the system involves parallel operation with the AE distribution system for periods typically longer than 15 seconds, then the customer is required to follow the procedure outlined in this guide. Note: Any closed transition switching requires synchronizing controls.

4. **Interconnection Studies:** Detailed interconnection studies may be required if the generation is connected to AE’s distribution system and AE determines it to be necessary for safety and reliability purposes:

   a. Facilities rated <500 kW (not on the network)
      i. Interconnection study typically not required for equipment pre-certified to UL 1741.

   b. Facilities rated 500 kW to 1 MW
      i. Interconnection study typically not required for equipment pre-certified to UL 1741.
      ii. If an interconnection study is desired, AE to bear all costs for studies performed.

   c. Facilities rated >1 MW but less than 10 MW, or on the Downtown Network
      i. Interconnection study typically required at customer’s expense.
      ii. Austin Energy shall determine the cost and timeline for performing a detailed interconnection study.
5. **Installation Safety:** Due to the arc flash hazards present in larger commercial systems, all work on the customer electrical system shall be performed under the direct supervision of a Master Electrician.
   
a. All energized meter sockets shall be covered with a UL listed plastic meter cover blank-off plate until the meter has been installed to prevent inadvertent electrical contact.

6. **Inspection:** All customer-owned power production facilities shall be inspected for compliance with minimum safety code requirements and installation rules by a licensed electrical inspector. Isolated systems will also be inspected to ensure that the customer's load and power production equipment are not connected to an electrical circuit in common with the AE system. Inspection approval shall mean only that as of the date of the inspection, the customer's system met minimum code requirements at the time of such inspection and shall not be construed as endorsement, approval, or recommendation of a particular system design for the customer's needs nor a representation that the facility continues to comply with such codes following the inspection.

7. **Enforcement:** AE reserves the right to discontinue electric service to customers who have interconnected without AE authorization, fail or refuse to comply with minimum requirements or applicable law, or who, as determined by AE, are operating their power production equipment in a hazardous or unsafe manner. AE may also pursue such other and further rights or remedies as are available to enforce these requirements.

8. **Operating Safety:** Adequate protection and documented operational procedures must be jointly developed and followed by the customer and AE for each customer power production facility operating in parallel with the AE system. These operating procedures must be approved by both the customer and AE. The customer shall be required to furnish, install, operate, and maintain in good order and repair and be solely responsible for, without cost to AE, all facilities required for the safe operation of a customer generation system in parallel with the AE system.

9. **Maintenance of Protective Equipment:** All interconnection equipment on the customer's facility shall be installed and maintained by the customer at their sole expense and in accordance with minimum guidelines established by AE.
   
a. The customer shall provide a maintenance schedule and perform maintenance of protective equipment at their sole expense at least every two (2) years, or as mandated by current standards, equipment manufacturer recommendations, or as required by AE to provide a safe, reliable system while operating in parallel with the AE system. Circuit breakers must be trip-tested by the customer at least once each year.

b. A periodic test report log shall be maintained. Testing shall include, but is not limited to, for example, the tripping of the circuit breakers by the protective relays. The customer shall provide appropriate access to all facilities for the purpose of such inspections. AE reserves the right to periodically re-inspect the system with prior notification to the customer.
c. Maintenance records for parallel systems must be provided to AE upon request.

10. **Self-Protection:** The minimum protection requirements are designed and intended to protect the Austin Energy electrical distribution system only. The customer shall provide, at their sole expense, all devices necessary to protect the customer’s electrical generating system by conditions that may occur on the AE system resulting in interruptions and restorations of electrical service. The equipment so installed must protect the customer's electric generating system from overvoltage, undervoltage, overload, short circuits, including ground fault conditions, open circuits, phase imbalance and reversal, over and under frequency conditions, and other injurious electrical conditions that may arise during the operation of the AE system.

11. **Capital Cost Responsibility:** The customer is required to bear all initial and subsequent costs associated with the change-out, upgrading, or addition of protective devices, transformers, poles, line, services, meters, switches, and associated equipment and devices beyond that which would be required to provide normal service to the customer if no generation was involved. The customer shall be invoiced for all material and labor that are required in excess of those covered by other applicable installation charges or fees (see appropriate schedules). Upon written request, AE shall supply the customer a cost estimate prior to any work being done.

12. **Liability:** The customer assumes all responsibility for damage or loss that may occur from improper coordination and synchronization of its generator with the AE system.

   a. The customer shall provide proof of insurance of at least $500,000 for systems over 500 kW and at least $1M for systems over 1 MW.

   b. The customer shall be responsible for coordination and synchronization of the customer's electrical generating system with all aspects of AE's electrical system.

13. **Confidentiality:** Due to the nature of the rapidly evolving regulations for DG/DER, non-specific information might be shared among working groups to better understand and optimize the process for interconnection. Detailed or specific information provided, such as customer identification, one-line or site diagrams, or specific component information, shall not be shared without customer approval.

14. **Third Party Leases:** Austin Energy is the exclusive provider of electric service within its service territory. State law prohibits other owners of electric equipment from furnishing electricity for compensation. Therefore, leases related to solar generation must be equipment leases for flat payments and may not be based on volumetric charges or multipliers for the kWh output of the photovoltaic equipment, nor may leases be based on the customer’s consumption from the equipment. As such, a customer may generate electricity to meet its own needs but cannot buy electricity from anyone else. A customer may lease the equipment on a cost basis but may not have lease payments based on the energy produced, which would be construed as the sale of electricity. It is up to each customer lessee and solar equipment lessor to ensure that a lease does not violate state law.
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F. DEFINITIONS

1. **AE System**: The Electric Utility System of Austin Energy (AE). A detailed map of the service area is available on the Austin Energy Storm Center Website: [https://my.austinenergy.com/outages/](https://my.austinenergy.com/outages/)

2. **AMANDA**: AMANDA is "Application Management & Data Automation", a software application system for development review, permitting, and inspection. AMANDA™ is a Case Management & Process Automation Platform that empowers government agencies with enterprise permitting solutions that automate all the steps involved in permits, including application, review, approval, issuance and inspections.

3. **Anti-islanding**: Detection circuitry required for DG systems that sense when a power outage has occurred on the utility lines and shuts itself off so there is no possibility of backfeeding into the utility system.

4. **Backfeed**: A situation whereby the normal power flow is reversed and current flows from the customer system into the AE distribution system.

5. **Customer**: Refers to both co-generators and small power producers within the AE service area who use conventional fossil fuels or alternative sources such as solar, wind, or biomass to produce power. The customer must have legal ownership rights of the proposed distributed generation facility and property.

6. **Dedicated Service**: A feeder or transformer, or both, in the AE Distribution system that only serves a single customer.

7. **DGPA**: **Distributed Generation Planning Application form(s)** which are required to be filled out for any Distributed Generation or DER interconnection to Austin Energy: [http://www.austinenergy.com](http://www.austinenergy.com)
   - Select the “Contractors” tab.
   - Select the “Electric Service Design & Planning" tab.

8. **Distributed Energy Resources (DER)**: Systems that are small-scale power generation or storage technologies (typically in the range of 1 kW to 10,000 kW) used to provide an alternative to or an enhancement of the traditional electric power system.

9. **Distributed Generation (DG)**: An electrical generating facility located within the Austin 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 Austin Energy system. The facility may include energy storage technologies as well as conventional generation technologies.

10. **Downtown Network**: The network refers to an area of the AE distribution system in downtown Austin where multiple feeders are "networked" together. Areas of downtown Austin are on the Downtown Network, and due to safety and power quality concerns, additional protection is required so that no distributed generation facility will be allowed to
export power to the AE grid. These requirements are documented in IEEE Standard 1547.6 and an analysis of the issues was documented by the National Renewable Energy Labs at: 

https://www.nrel.gov/docs/fy09osti/45061.pdf

11. Electric Energy Storage (or Energy Storage Systems): Electric Energy Storage Systems connected in parallel to the AE distribution system are considered to be distributed generation assets.


13. EPS Metering: ERCOT Polled Settlement Metering. May be required for DG/DER greater than 1 MW. Refer to: http://www.ercot.com/mktinfo/metering/eps

14. ERCOT (Electric Reliability Council of Texas): The area in Texas served by electric utilities, municipally owned utilities, and electric cooperatives that are 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.


16. ESPA: Electric Service Planning Application form(s) which are required to be filled out for any change in the service connection to Austin Energy: http://www.austinenergy.com
   • Select the “Contractors” tab.
   • Select the “Electric Service Design & Planning” tab.

17. Generating Facility Capacity: The net capacity of the generating facility connecting at a single point of common coupling and the aggregate net capacity of the facility where multiple generators connect at the same point of common coupling.

18. High-Leg Service: Refers to a 4-wire 3-phase open delta system where the midpoint of one phase winding is grounded. See NEC Article 110.15, and the AE Design Criteria Manual section. A licensed electrician should verify each phase relative to ground using suitable equipment to determine the exact circuits powered by the high leg.

19. IEEE: Institute of Electrical and Electronics Engineers.

20. Interconnection: The physical means by which electric energy is received from a generating source. The principal elements of an electric interconnection include transmission and distribution circuits, transformers, and switching devices such as circuit breakers, fuses, and isolating disconnect switches. Supplemental elements may include sensing devices and protective relay equipment.
21. **Interconnection Study**: A study or studies that may be undertaken by AE in response to the receipt of a completed Interconnection Application and parallel operation with the AE system. Interconnection studies may include, but are not limited to, Interconnection Feasibility Studies (the standard Interconnection Application process, a "screening" process, or "Preliminary Studies" per IEEE 1547.7), System Impact Studies (more detailed studies "required" by the potential for adverse impacts to the distribution system and that carefully review the potential effect of a DR unit on the area EPS, or "Conventional Studies" per IEEE 1547.7), and Facilities Studies (studies to determine whether any modifications, upgrades, or additional facilities will be required to the AE system, or "Special Studies" per IEEE 1547.7).

22. **Islanding**: A condition in which a portion of a utility electric power system is energized solely by one or more local electric power systems throughout the associated Point of Interconnection while that portion of the utility electric power system is electrically separated from the rest of the utility electric power system.

23. **Isolated System**: A system in which there is no interconnection of the customer's power source or load served by the customer's power source to an electrical circuit common with the AE electric utility system. Customers dedicating their power production equipment to a particular load without standby electric service from AE would be considered as having a totally isolated system.

24. **Maintenance Electric Service**: Electrical power which is required to serve the customer's load during specific prearranged periods of scheduled outage of the customer's power source for maintenance or repair.

25. **Microgrid**: A local energy network offering integration of DG/DER with local electric loads, which can operate in parallel with the AE System or in an intentional island mode. This is a new type of system being developed and includes the use of DG paired with smart load shed/load management techniques to enable it to run in an islanded configuration. Although IEEE Standard 1547.4 is available for review, AE procedures to handle this type of system have not been developed.

26. **Network Protector**: An assembly comprising a circuit breaker and its complete control equipment for automatically disconnecting a transformer from a secondary network in response to predetermined electrical conditions on the primary feeder or transformer and for connecting a transformer to a secondary network, either through manual control or automatic control responsive to predetermined electrical conditions on the feeder and the secondary network.

27. **Parallel System**: A system in which the customer's electrical generation system can be connected to an electrical circuit common with the AE electric utility system. Customers who receive supplementary electric service from AE will be considered as having a parallel system. This system allows for the flow of power from AE to the customer and from the customer to AE. Typical distributed generation falls into this category.
28. **Point of Common Coupling (PCC) or Interconnection Point:** The point at which energy first enters or leaves the line or apparatus owned by the customer and leaves or enters the line or apparatus owned by AE and is the point of common coupling as defined in IEEE 1547. Typically, this is defined as the load side of the revenue meter (see NEC Article 705.2). The Point of Interconnection (POI) is the point where the DG/DER itself is electrically connected, either directly to the Austin Energy System or directly to the load-side (metered) of the DG owner’s owned equipment for the applicable DG/DER System.

29. **PUC (The Public Utility Commission of Texas):** The PUCT regulates the state's electric, telecommunication, and water and sewer utilities, implements respective legislation, and offers customer assistance in resolving consumer complaints.

30. **Separate System:** A system in which there is no intended interconnection of the customer’s electrical generation system in parallel with the AE electric utility system but whose load receives standby service from AE. Customers dedicating their power production equipment to a particular load and who receive standby electric service for the load from AE must be capable of transferring the load between the two electrical systems in an open transition in order to be considered as having a separate system; that is, the customer's power production equipment is not connected to the AE electric utility system directly or indirectly through the load. Typical emergency backup generation systems with an automatic transfer switch fall into this category. However, power production equipment intended to operate with a closed transition must be reviewed by AE as well.

31. **Shared Solar:** A solar-electric system that provides power and/or financial benefit to multiple community members.

32. **Supplementary Electric Service:** Electric power required on a regular basis to serve a portion of the customer's load in addition to that served by the customer's power source.

33. **UPS:** An Uninterruptible Power Supply (UPS) system that is not normally capable of backfeed into the AE system, other than brief transition periods, will be classified as a separate system. If the UPS system is capable of backfeed into the AE system for periods exceeding 15 seconds, it will be classified as a parallel system.
G. **CERTIFICATION CODES and STANDARDS**

*(Refer to the most recent version of the following documents)*

Note: Many codes are available from the City of Austin Planning and Zoning website.

http://www.austintexas.gov/department/planning-and-zoning/codes-and-regulations

City of Austin Electrical Codes

http://www.austintexas.gov/department/building-technical-codes

Austin Energy Design Criteria Manual

http://www.austinenergy.com
- See the “Contractors” tab.
- See the “Electric Service Design & Planning” tab.
- See the “Austin Energy Design Criteria Manual”.

ANSI C84.1 - Electric Power Systems and Equipment – Voltage Ratings (60 Hz)

California Energy Commission (CEC) Solar Energy Resource

http://www.gosolarcalifornia.org/

IEEE Std 519 - IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems

IEEE Std 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces (including IEEE 1547.1, 1547.2, 1547.3, 1547.4, 1547.6, and 1547.7)


IEEE Std C37.90.2 - IEEE Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers


IEEE Std C50.13 - IEEE Standard for Cylindrical-Rotor Synchronous Generators

IEEE Std C57.12.44 - IEEE Standard Requirements for Secondary Network Protectors

IEEE Std C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000V and Less) AC Power Circuits

IEEE Std C62.45 - IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits

International Fire Code (IFC)

NFPA 70 - National Electrical Code, version as approved by City of Austin Electrical Code

NFPA 780 - Standard for the Installation of Lightning Protection Systems

NEMA MG 1 - Motors and Generators

NESC - National Electrical Safety Code

SAE J1772 - SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler

UL 1449 - Standard for Surge Protective Devices

UL 1642 - Standard for Lithium Batteries

UL 1699B - Photovoltaic (PV) DC Arc-Fault Circuit Protection

UL 1741 - Inverters, Converters, and Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 1973 - Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications

UL 1989 - Standard for Standby Batteries

UL 2200 - Standard for Stationary Engine Generator Assemblies

UL 9540 - Standard for Energy Storage Systems and Equipment
Appendix A - Map of the Downtown Network
Appendix B - **Standard Complex Meter Configurations**

Figure B-1: 1P 3W 120/240V PV Meter Tap on Load Side
Figure B-2: 1P 3W 120/240V PV Meter Tap on Line Side
Figure B-3: 3P 4W 208/120V PV Meter Tap on Load Side
Figure B-4: 3P 4W 208/120V PV Meter Tap on Line Side
Figure B-5: 3P 4W 480/277V PV Meter Tap on Load Side
Figure B-6: 3P 4W 480/277V PV Meter Tap on Line Side
Figure B-7: 3P 4W 120/240V "High Leg" PV Meter Tap on Load Side
Figure B-8: 3P 4W 208/120V "Shared Solar Only" Tap on Line Side
Figure B-9: 3P 4W 480/277V "Shared Solar Only" Tap on Line Side
NOTES:
1. PV METER MUST BE GROUPED WITH EXISTING UTILITY BILLING METER.
2. AC DISCONNECT MUST BE INSTALLED WITHIN SIGHT OF PV METER.
3. OVERCURRENT PROTECTIVE DEVICE AND PANEL RATING SHALL MEET REQUIREMENTS OF NEC ARTICLE 690 AND 705.
4. REFER TO AE WEBSITE FOR METER CAN SPECIFICATIONS.
5. CONTACT AE COMPLEX METERING AT (512) 505-7045 FOR INSTRUMENT-RATED INSTALLATION PRIOR TO PURCHASING EQUIPMENT.
6. FOR INSTRUMENT-RATED INSTALLATION, ALL CT AND PT WIRING SHALL BE DONE BY AE PERSONNEL.

CONDUCTORS FROM TAP TO FIRST DG EQUIPMENT PAST DISCONNECT SHALL BE SIZED PER REQUIREMENTS OF NEC AND AE DESIGN CRITERIA MANUAL (FULL-SIZED NEUTRAL).

DRAWINGS ARE PROVIDED TO ASSIST CONTRACTOR WITH THE DESIGN OF THE SYSTEM AND SHOULD NOT BE A SUBSTITUTE FOR THE CONTRACTORS DESIGN.

3P 4W 208V/120V
PV METER TAP ON LOAD SIDE OF SERVICE DISCONNECT

LOCKABLE AC FUSED DISCONNECT SEE NOTE 2

PV METER SEE NOTES 1, 4, 5 & 6

POWER FLOW

TO INVERTER
NOTES:

1. PV METER MUST BE GROUPED WITH EXISTING UTILITY BILLING METER.
2. AC DISCONNECT MUST BE INSTALLED WITHIN 10 FT. OF LINE SIDE TAP AND WITHIN SIGHT OF THE PV METER.
3. LINE TAP MUST BE ON THE LOAD SIDE OF THE BILLING METER.
4. REFER TO AE WEBSITE FOR METER CAND SPECIFICATIONS.
5. CONTACT AE COMPLEX METERING AT (912) 505-7045 FOR INSTRUMENT RATE INSTALLATION PRIOR TO PURCHASING EQUIPMENT.
6. FOR INSTRUMENT RATE INSTALLATION, ALL CT AND PT WIRING SHALL BE DONE BY AE PERSONNEL.
7. FOR LINE SIDE TAP THE MINIMUM HANDLE RATING OF FUSELESS DISCONNECT SHALL BE 60A. THE PULL SIZE OF THE DISCONNECT SHALL BE CALCULATED PER NATIONAL ELECTRICAL CODE (NEC).

Conductors from tap to first DC equipment panel disconnect shall be sized per requirements of NEC and AE design criteria manual (Full-Sized Neutral).

Drawings are provided to assist contractor with the design of the system and should not be a substitute for the contractor's design.

3P 4W 208/120V
PV METER TAP ON LINE SIDE OF SERVICE DISCONNECT
NOTES:

1. PV METER MUST BE GROUPED WITH EXISTING UTILITY BILLING METER.

2. AC DISCONNECT MUST BE INSTALLED WITHIN SIGHT OF PV METER.

3. LOAD SIDE TAP, OVERCURRENT PROTECTIVE DEVICE AND PANEL RATING SHALL MEET REQUIREMENTS OF NEC ARTICLES 680 AND 705.

4. ADDITIONAL DISCONNECT REQUIRED IF UPSTREAM INTERRUPTING DEVICE IS NOT READILY ACCESSIBLE. THE DISCONNECT SHALL BE GROUPED WITH THE PV METER.

5. REFER TO AE WEBSITE FOR METER CAN SPECIFICATIONS.

6. CONTACT AE COMPLEX METERING AT (512) 605-7048 FOR INSTRUMENT RATIO INSTALLATION BEFORE PURCHASING EQUIPMENT.

7. FOR INSTRUMENT RATED INSTALLATIONS, ALL CT AND PT WIRING SHALL BE DONE BY AE PERSONNEL.

CONDUCTORS FROM TAP TO FIRST DC EQUIPMENT PAST ALL DISCONNECTS SHALL BE SIZED PER REQUIREMENTS OF NEC AND AE DESIGN CRITERIA MANUAL (FULL-SIZED NEUTRAL).

DRAWINGS ARE PROVIDED TO ASSIST CONTRACTOR WITH THE DESIGN OF THE SYSTEM AND SHOULD NOT BE A SUBSTITUTE FOR THE CONTRACTOR'S DESIGN.

3P 4W 480/277V
PV METER TAP ON LOAD SIDE OF SERVICE DISCONNECT
NOTES:
1. PV METER MUST BE GROUPED WITH EXISTING
   UTILITY BILLING METER.
2. FUSED DISCONNECT MUST BE INSTALLED WITHIN 10 FT OF LINE
   SIDE TAP. IN EXISTING LOCATIONS WHERE THIS FUSIBLE
   DISCONNECT CANNOT BE LOCATED IN A READILY ACCESSIBLE
   LOCATION, AN ADDITIONAL LOCKABLE AC DISCONNECT IS
   REQUIRED IN PROXIMITY TO THE PV METER.
3. LINE TAP MUST BE ON THE LOAD SIDE OF THE BILLING METER.
4. ADDITIONAL DISCONNECT REQUIRED TO ISOLATE 480V METER
   WHERE SYSTEM IS A LINE SIDE TAP.
5. REFER TO AE WEBSITE FOR METER CANN SPECIFICATIONS.
6. CONTACT AE COMPLEX METERING AT (512) 505-7045 FOR
   INSTRUMENT RATED INSTALLATION PRIOR TO PURCHASING
   EQUIPMENT.
7. FOR INSTRUMENT RATED INSTALLATIONS, ALL CT AND PT WIRING
   SHALL BE DONE BY AE PERSONNEL.
8. FOR LINE SIDE TAP THE MINIMUM HANDLE RATING OF THE FUSEBLE
   DISCONNECT SHALL BE 60A. THE Fuse SIZE OF THE DISCONNECT
   SHALL BE CALCULATED PER NATIONAL ELECTRICAL CODE (NEC).
9. THE HANDLE RATING OF NON-FUSIBLE DISCONNECT SHALL BE 60A.

TO INVERTER

LOCKABLE AC
DISCONNECT
SEE NOTES 4 & 9

PV METER
SEE NOTES
1, 5, 6 & 7

LOCKABLE AC
FUSED DISCONNECT
SEE NOTES 2 & 8

CONDUCTORS FROM TAP TO
FIRST DG EQUIPMENT PAST ALL
DISCONNECTS SHALL BE SIZED
PER REQUIREMENTS OF NEC AND
AE DESIGN CRITERIA MANUAL
(FULL-SIZED NEUTRAL).

DRAWINGS ARE PROVIDED TO
ASSIST CONTRACTOR WITH THE
DESIGN OF THE SYSTEM AND
SHOULD NOT BE A SUBSTITUTE
FOR THE CONTRACTORS DESIGN.

3P 4W 480/277V
PV METER TAP ON LINE SIDE
OF SERVICE DISCONNECT
NOTES:

1. PV METER MUST BE GROUPED WITH EXISTING
   UTILITY BILLING METER.
2. AC DISCONNECT MUST BE INSTALLED WITHIN SIGHT OF
   PV METER.
3. OVERCURRENT PROTECTIVE DEVICE AND PANEL RATING
   SHALL MEET REQUIREMENTS OF NEC ARTICLE 690 AND
   705.
4. REFER TO AE WEBSITE FOR METER CAN SPECIFICATIONS.
5. HIGH-LEG SHALL NOT BE USED FOR PV APPLICATIONS
   WITHOUT WRITTEN APPROVAL FROM AE.

DRAWINGS ARE PROVIDED TO
ASSIST CONTRACTOR WITH THE
DESIGN OF THE SYSTEM AND
SHOULD NOT BE A SUBSTITUTE
FOR THE CONTRACTOR'S DESIGN

"HIGH-LEG" PV METER TAP ON
LOAD SIDE OF SERVICE DISCONNECT
NOTES:
1. PV METER MUST BE GROUPED WITH EXISTING UTILITY BILLING METER.
2. AC DISCONNECT MUST BE INSTALLED WITHIN 10 FT OF LINE SIDE TAP AND WITHIN SIGHT OF THE PV METER.
3. LINE TAP ON THE LINE SIDE OF THE BILLING METER ALLOWED ONLY FOR SHARED SOLAR INSTALLATIONS.
4. REFER TO AE WEBSITE FOR METER CAN SPECIFICATIONS.
5. CONTACT AE COMPLEX METERING AT (512) 505-7045 FOR INSTRUMENT RATED INSTALLATION PRIOR TO PURCHASING EQUIPMENT.
6. FOR INSTRUMENT RATED INSTALLATION, ALL CT AND PT WIRING SHALL BE DONE BY AE PERSONNEL.

TO INVERTER

LOCKABLE AC FUSED DISCONNECT
SEE NOTES 2 & 7

PV METER
SEE NOTES 1, 4, 5 & 6

DRAWINGS ARE PROVIDED TO ASSIST CONTRACTOR WITH THE DESIGN OF THE SYSTEM AND SHOULD NOT BE A SUBSTITUTE FOR THE CONTRACTOR'S DESIGN

3P 4W 208/120V SHARED SOLAR ONLY TAP ON LINE SIDE OF METER
NOTES:
1. PV METER MUST BE GROUPED WITH EXISTING UTILITY BILLING METER.
2. FUSED DISCONNECT MUST BE INSTALLED WITHIN 10 FT OF LINE SIDE TAP. IN EXISTING LOCATIONS WHERE THIS FUSIBLE DISCONNECT CANNOT BE LOCATED IN A READILY ACCESSIBLE LOCATION, AN ADDITIONAL LOCKABLE AC DISCONNECT IS REQUIRED IN PROXIMITY TO THE PV METER.
3. LINE TAP ON THE LINE SIDE OF THE BILLING METER ALLOWED ONLY FOR SHARED SOLAR INSTALLATIONS.
4. ADDITIONAL DISCONNECT REQUIRED TO ISOLATE 480V METER WHERE SYSTEM IS A LINE SIDE TAP.
5. REFER TO AE WEBSITE FOR METER CAN SPECIFICATIONS.
6. CONTACT AE COMPLEX METERING AT (512) 505-7045 FOR INSTRUMENT RATED INSTALLATION PRIOR TO PURCHASING EQUIPMENT.
7. FOR INSTRUMENT RATED INSTALLATIONS, ALL CT AND PT WIRING SHALL BE DONE BY AE PERSONNEL.
9. THE HANDLE RATING OF NON-FUSIBLE DISCONNECT SHALL BE 60A.

*Figure B-9*

- **Electric Service Delivery**

- **Austin Energy**

- **3P 4W 480/277V**
  - **Shared Solar Only**
  - **Tap on Line Side of Meter**

- **Note 3**
  - **Billing Meter**
  - **Service Disconnect**
  - **Building Loads**
  - **Conductors from Tap to First DC Equipment Past All Disconnects Shall Be Sized Per Requirements of NEC and AE Design Criteria Manual (Full-Sized Neutral).**

- **Power Flow**
  - **Lockable AC Disconnect**
  - **PV Meter**
  - **Lockable AC Fused Disconnect**

- **Drawings Are Provided to Assist Contractor With the Design of the System and Should Not Be a Substitute for the Contractor’s Design**
Appendix C - AE DG/DER Inspection Checklist

Customer:_____________________________________________________  
Contractor:_____________________________________________________  
Address:_______________________________________________________  
Meter Number:___________________________________________________  
Tilt:___________________________________________________________  
Azimuth:________________________________________________________  
Electrical Permit Number:_______________________________________  
Building Permit Number:________________________________________

General
☐ Design drawings are present.
☐ Installation is consistent with drawings.
☐ All equipment UL listed.
☐ Inverter certified to UL1741. (inverter based generation only)
☐ All equipment new. (rebate customers only)
☐ All electrical components are listed for voltage and current ratings necessary for application and installed per mfg specifications.
☐ Line side tap or interconnection at panel.
  o Verify a main building disconnect.
  o For interconnection at panel, verify OCPD sized correctly for panel main busbar per NEC Articles 690 and 705.
  o Dedicated and labeled subpanels per NEC 705.12.D.2 can meet busbar only; non-dedicated subpanels must meet bus and conductor.
☐ All building penetrations are sealed and fire resistance is maintained.
☐ Dissimilar metals that have galvanic action are isolated.
☐ All components mounted securely.
☐ Modules and Inverter/s meets requirements of respective program guidelines? (rebate customers only)
☐ Workmanship warranty duration per program guidelines. (rebate customers only)
☐ Entire system properly grounded-
  o Grounding electrode system for inverter.
  o Grounding conductor is 8AWG or sized according to code and continuous or irreversibly spliced.
  o Neutral is full-size per AE Design Criteria Manual.
☐ Permanent Labels are applied to system components as required by local and national codes.(Locations of disconnects, modules, inverters, standby systems, etc).
**Inspection of Interconnection Equipment:**
- OCPD sized correctly in DC disconnect.
- Lightning Arrester is installed. *(Solar PV only)*
- If multiple inverter, with potential exception of micro-inverter, an aggregation panel is used before meter.
  - If customer has three phase delta system (not common):
    - Single phase inverters may not be used for three phase use.
    - Inverters must be certified for use in delta systems.
  - AC disconnect is on load side of the DG meter so the meter can remain energized while the DG system is disconnected (except 480V).
    - Proper meter can is installed. *(Single-phase, three-phase, CT Can)*
    - DG Meter has isolated neutral block type distribution block.
    - Meters and disconnects grouped with billing meter.
    - OCPD sized correctly in AC disconnect.
- The handle rating of disconnect on line side tap:
  - For line side tap the minimum handle rating of fusible disconnect shall be 60A. The fuse size of the disconnect shall be calculated per National Electrical Code (NEC).
  - See the line side tap schematic for your reference.
- Wire management:
  - Check that all conduit is properly connected (wrench tight), no loose fittings, no cross threading.
  - All work performed in neat and workmanlike manner.
  - All conductors properly color coded.
  - Conductors run inside or outside of building or any structure shall be in steel conduit both AC and DC.
- Only positive portion of DC fused in uni-polar system? *(If bi-polar, fuse both sides.)*
- **Maintain 3 foot clearance from the gas meter.** *(measured horizontally)*

**Inspection of Array (Solar PV only):**
- System Size matches plans and specs.
- Module string configuration designed per inverter manufacturer string sizing calculations from their website.
- Solar Radiation access meets the requirements of respective program guidelines. *(rebate customers only)*
- Roof perimeter access meets IFC 605.11.3. *(3 feet minimum typical)*
- Stainless steel fasteners are used on modules and racking.
- Modules are not modified such that it voids the listing or warranty.
- Fuses in combiner box properly sized (if applicable).
- Expansion fittings over expansion joints.
- All conductors properly secured above the roof surface.
- Local AC disconnect required at the roof (if applicable).
- Roof penetrations are performed according to respective program guidelines. *(must provide roof boots or flashings)*
- Mounting system meets structural requirements.
  - Roof is capable of sustaining extra weight.
  - Array is capable of sustaining wind requirements.
- If module array is not visible at DC disconnect, add DC disconnect near array at grade.
- If DC goes through building, there is a disconnect on roof before entering building with visible blade disconnect.
**Validation of System Performance:**

- Inverter generating correct power?
- Inverter de-energize when disconnected from AC source?
- Inverter does not re-connect for 300 sec after AC source turned back on.

Contractor Name (printed)_________________________________

Contractor Signature     _________________________________

Current version of the AE Interconnection Guide can be found on the web at: http://www.austinenergy.com

- Select the “Contractors” tab.
- Select the “Electric Service Design & Planning” tab.
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Appendix D

Interconnection Application and Forms
For Systems 500 kW to <10 MW or on the Downtown Network
Application Checklist

1) Copy enclosed of approved DGPA Application indicating whether or not proposed facility is in the Downtown Network.

2) Copy enclosed of completed Distributed Generation Application.
   a) Application form.
   b) Customer information.
   c) DG application--either PV or rotating machine sheets.
   d) Interconnecting facilities information.
   e) Interconnection Agreement (refer to in Appendix D).

3) Copy enclosed of site electrical one-line diagram and schematic drawings showing the configuration of all Distributed Generation equipment, current and potential circuits, and protection and control schemes, signed and stamped by a professional engineer licensed in the state of Texas.

4) Copy enclosed of any site documentation that indicates the precise physical location of the proposed distributed generation facility (e.g., USGS topographic map or other diagram or documentation).

5) Copy enclosed of proposed location of Disconnect Switch (es) in relation to meter, generator, and main service meter.

6) Copy enclosed of any site documentation that describes and details the operation of the protection and control schemes, as well as proposed directory/plaque location.

7) Copy enclosed of schematic drawings for all protection and control circuits, relay current circuits, relay potential circuits, and alarm/monitoring circuits (if applicable).

8) Enclosed certificate of insurance and initial payment per fee schedule (if applicable). (Refer to Section E.11 and E.12).

9) Enclosed Signed Interconnection Agreement.

10) Upon completion of construction, schedule COA inspection at least 7 business days prior to energizing DG system.

Applicant Signature

I hereby certify that, to the best of my knowledge, all of the information provided in this Interconnection Request is true and correct.

Interconnection Customer: ____________________________ Date:_________
**Austin Energy Distributed Generation Application**  
**For facilities from 500 kW to <10 MW or on the Downtown Network**

Designated Contact Person: _____________________________________________

Address: _____________________________________________________________

Telephone Number: ___________________________________________________

Fax: __________________________________________________________________

E-Mail Address: ________________________________________________________

Requested In-Service Date: _____________________________________________

An Interconnection Request is considered complete when it provides all applicable and correct information as required on the following pages.

**Preamble and Instructions**

An Interconnection Customer who requests an Austin Energy jurisdictional interconnection must submit this Interconnection Request by hand delivery, mail, e-mail, or fax.

**Processing Fee or Deposit**

The Interconnection Customer shall submit to Austin Energy a deposit towards the cost of the feasibility study as detailed on the Austin Energy Fee Schedule.

http://www.austinenergy.com
See "Rates" tab, "Approved Rates Schedule" tab, "Fee Schedules".
Interconnection Customer Information

Legal Name of the Interconnection Customer (or, if an individual, individual's name)

Name: ________________________________________________________________

Contact Person: __________________________________________________________

Mailing Address: __________________________________________________________

City: __________________________ State: ___________ Zip: _______________

Facility Location (if different from above): ____________________________

Telephone (Day): ______________________ Telephone (Evening): _______________________

Fax: ___________________________ E-Mail Address: ________________________________

Application is for:

_____New Small Generating Facility _____Capacity addition to Existing Facility

A) If capacity addition to existing facility, please describe: ________________________________

B) Provide existing Account Number _______________________

Will the Small Generating Facility use Net Metering? Yes ______ No _______

Is customer site in the AE Downtown Network? Yes_______ No_______

Interconnection Customer or Customer-Site Load: _____________kW (if none, so state)

Maximum Physical Export Capability Requested: _____________ kW

Distributed Generation Facility Information

(Data apply only to the Generating Facility, not the Interconnection Facilities.)

Technology Type: ___ Renewable ___ Non-renewable

Fuel Type: ___ Solar ___ Wind ___ Diesel ___ Natural Gas ___ Fuel Oil ___ Other (state type) ________________________________

Type of Generator: ___ Synchronous ___ Induction ___ Inverter
# Distributed Generation Application for Solar PV

Generator (or solar collector)
Manufacturer, Model Name & Number: _____ Version Number: _____

Nameplate Output Power Rating in kW: (Summer) _____________ (Winter) ______________
Nameplate Output Power Rating in kVA: (Summer) _____________ (Winter) ______________

Inverter Manufacturer, Model Name & Number (if used): __________________________

Is the inverter on the CEC list of approved equipment? ____Yes ____No

List components of the Small Generating Facility equipment package that are currently certified:

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Certifying Entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>4.</td>
<td></td>
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<tr>
<td>5.</td>
<td></td>
</tr>
</tbody>
</table>

Is the generation equipment compatible with the certified protective relay package? ____Yes ____No

List of adjustable set points for the protective equipment or software: __________________________

---

**Distribution Facility Characteristic Data for inverter-based machines**

Max design fault contribution current: _______ Instantaneous ___ or RMS? ____
Harmonics Characteristics: __________________________
Start-up requirements: __________________________

---

Note: An approved ESPA must be supplied with the Interconnection Request.

For installations less than 1 MW, City permits should be obtained using the Quick-turn process.
Interconnection Facilities Information

Part A - Transformer

Will a transformer be used between the generator and the point of common coupling? ___Yes ___No

Will the transformer be provided by the ___Interconnection Customer or ___AE?

If transformer is provided by AE, the rest of part A (below) is left blank

Transformer Data (for Customer-Owned Transformer only):

Size: ___________kVA  Transformer Impedance: _______% on __________kVA Base

Transformer Primary: _____ Volts _____ Delta _____ Wye _____ Wye Grounded  
Transformer Secondary: _____ Volts _____ Delta _____ Wye _____ Wye Grounded  
Transformer Tertiary: _____ Volts _____ Delta _____ Wye _____ Wye Grounded  

Transformer Fuse Data (if applicable):
Manufacturer: __________________ Type: _______________ Size: ________ Speed: ______________

Interconnecting Circuit Breaker (if applicable):

Manufacturer: ____________________________ Type: __________ 
Load Rating (Amps): _______ Interrupting Rating (Amps): _______ Trip Speed (Cycles): __________

Interconnection Protective Relays (If Applicable):

List of Functions and Adjustable Setpoints for the protective equipment or software:

<table>
<thead>
<tr>
<th>Setpoint Function</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>2.</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>3.</td>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
</table>

Part B - Reconnection Time

Programmed Time Delay for Reconnection after Interruption:

___300 Seconds (default)  ___Other (specify)________
Distributed Generation Application for Rotating Machines
(not required for Solar PV systems)

RPM Frequency: _______________
(*) Neutral Grounding Resistor (If Applicable): _______________

Synchronous Generators:

Direct Axis Synchronous Reactance, Xd: _______ P.U.
Direct Axis Transient Reactance, X'd: _____________ P.U.
Direct Axis Subtransient Reactance, X''d: _____________ P.U.
Negative Sequence Reactance, X2: ___________ P.U.
Zero Sequence Reactance, X0: ____________ P.U.
KVA Base: __________________________
Field Volts: _______________
Field Amperes: _______________

Induction Generators:

Motoring Power (kW): _______________
Locked Rotor current: _______________
I2t or K (Heating Time Constant): _______________
Rotor Resistance, Rr: _______________ P.U.
Stator Resistance, Rs: ______________ P.U.
Stator Reactance, Xs: ____________ P.U.
Rotor Reactance, Xr: ______________ P.U.
Magnetizing Reactance, Xm: ______________ P.U.
Short Circuit Reactance, Xd': _____________ P.U.
Exciting Current: _______________
Temperature Rise: _______________
Frame Size: _______________
Design Letter: _______________
Reactive Power Required In KVars (No Load): _______________
Reactive Power Required In KVars (Full Load): _______________
Total Rotating Inertia, H: _____________ Per Unit on kVA Base

Excitation and Governor System Data for Synchronous Generators Only

Individual Generator Power Factor
Rated Power Factor: Leading: _______________ Lagging: _______________
If Discrete Components:

(Enclose Copy of any Proposed Time-Overcurrent Coordination Curves)

Manufacturer: _________ Type: ______ Style/Catalog No.: _______ Proposed Setting: _________
Manufacturer: _________ Type: ______ Style/Catalog No.: _______ Proposed Setting: _________
Manufacturer: _________ Type: ______ Style/Catalog No.: _______ Proposed Setting: _________
Manufacturer: _________ Type: ______ Style/Catalog No.: _______ Proposed Setting: _________
Manufacturer: _________ Type: ______ Style/Catalog No.: _______ Proposed Setting: _________

Current Transformer Data (If Applicable):

(Enclose Copy of Manufacturer's Excitation and Ratio Correction Curves)

Manufacturer: ____________________________
Type: ________________ Accuracy Class: ___ Proposed Ratio Connection: ___

Manufacturer: ____________________________
Type: ________________ Accuracy Class: ___ Proposed Ratio Connection: ___

Potential Transformer Data (If Applicable):

Manufacturer: ____________________________
Type: ________________ Accuracy Class: ___ Proposed Ratio Connection: ___

Manufacturer: ____________________________
Type: ________________ Accuracy Class: ___ Proposed Ratio Connection: ___
Interconnection Agreement

This Interconnection Agreement ("Agreement") is made and entered into this ___ day of ___________, 20__, by Austin Energy and ________________ [specify whether corporation, and if so name state, municipal corporation, cooperative corporation, or other], each hereinafter sometimes referred to individually as “Party” or both referred to collectively as the “Parties”. In consideration of the mutual covenants set forth herein, the Parties agree as follows:

1. Scope of Agreement -- This Agreement is applicable to conditions under which Company and Customer agree that one or more generating facility or facilities of ten megawatts or less and related interconnecting facilities to be interconnected at less than 60 kilovolts ("Facilities") may be interconnected to Company’s facilities, as described in the application.

2. Establishment of Point(s) of Interconnection -- Company and Customer agree to interconnect Facilities at the locations specified in this Agreement, in accordance with the Austin Energy Distribution Interconnection Guide for Customer Owned Power Production Facilities less than 10MW (the “Rules”) or any successor rule addressing distributed generation and as described in the attached Appendix D (the "Interconnection").

3. Responsibilities of Company and Customer -- Customer shall, at its own cost and expense, operate, maintain, repair, and inspect, and shall be fully responsible for, Facilities specified on the application. Customer shall conduct operations of Facilities in compliance with all aspects of the Rules, and Company shall conduct operations on its facilities in compliance with all aspects of the Rules, and as further described and mutually agreed to in the applicable Facility Schedule. Maintenance of Facilities shall be performed in accordance with the applicable manufacturer’s recommended maintenance schedule. Customer agrees to cause Facilities to be constructed in accordance with specifications equal to or greater than those provided by the National Electrical Safety Code, approved by the American National Standards Institute, in effect at the time of construction.

Each Party covenants and agrees to design, install, maintain, and operate, or cause the design, installation, maintenance, and operation of, its facilities so as to reasonably minimize the likelihood of a disturbance, originating in the facilities of one Party, affecting or impairing the facilities of the other Party, or other facilities with which Company is interconnected.

Company shall notify Customer if there is evidence that operation of Facilities causes disruption or deterioration of service to other utility customers or if the operation of Facilities causes damage to Company’s facilities or other facilities with which Company is interconnected.

Company and Customer shall work cooperatively and promptly to resolve the problem.

Customer shall notify Company of any emergency or hazardous condition or occurrence with Facilities which could affect safe operation of Company’s facilities or other facilities with which Company is interconnected.

Customer shall provide Company at least 14 days’ written notice of a change in ownership or cessation of operations of one or more Facilities.

4. Limitation of Liability and Indemnification

a. Notwithstanding any other provision in this Agreement, with respect to Company’s provision of electric service to Customer other than the interconnections service addressed by this Agreement, Company’s liability to Customer shall be limited as set forth in Section 5.2.1 of Company’s Commission-approved tariffs, which are incorporated herein by reference.

b. Neither Company nor Customer shall be liable to the other for damages for anything that is beyond such Party’s control, including an act of God, labor disturbance, act of a public enemy, war, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment, a curtailment, order, or regulation or restriction imposed by governmental, military, or lawfully established civilian authorities, or the making of necessary repairs upon the property or equipment of either party.

c. Notwithstanding Paragraph 4.b of this Agreement, Company shall assume all liability for and shall indemnify Customer for any claims, losses, costs, and expenses of any kind or character to the extent that they result from Company’s negligence in connection with the design, construction, or operation of its Facilities as described in the application; provided, however, that Company shall have no obligation to indemnify Customer for claims brought by claimants who cannot recover directly from Company. Such indemnity shall include, but is not limited to, financial responsibility for: (a) Customer’s monetary losses; (b) reasonable costs and expenses of defending an action or claim made by a third person; (c) damages related to the death or injury of a third person; (d) damages to the property of Customer; (e) damages to the property of a third person; (f) damages for the disruption of the business of a third person. In no event shall Company be liable for consequential, special, incidental or punitive damages, including, without limitation, loss of profits, loss of revenue, or loss of production. The Company does not assume liability for any costs for damages arising from the disruption of the business of Customer or for Customer’s costs and expenses of prosecuting or defending an action or claim against Company. This paragraph does not create a liability on the part of Company to Customer or a third person, but requires indemnification where such liability exists. The limitations of liability provided in this paragraph do not apply in cases of gross negligence or intentional wrongdoing.

d. Please check the appropriate box.

Private Entity

Notwithstanding Paragraph 4.b of this Agreement, Customer shall assume all liability for and shall indemnify Company for any claims, losses, costs, and expenses of any kind or character to the extent that they result from Customer’s negligence in connection with the design, construction, or operation of Facilities as described in the application; provided, however,
that Customer shall have no obligation to indemnify Company for claims brought by claimants who cannot recover directly from Customer. Such indemnity shall include, but is not limited to, financial responsibility for: (a) Company’s monetary losses; (b) reasonable costs and expenses of defending an action or claim made by a third person; (c) damages related to the death or injury of a third person; (d) damages to the property of Company; (e) damages to the property of a third person; (f) damages for the disruption of the business of a third person. In no event shall Customer be liable for consequential, special, incidental or punitive damages, including, without limitation, loss of profits, loss of revenue, or loss of production. The Customer does not assume liability for any costs for damages arising from the disruption of the business of Company or for Company’s costs and expenses of prosecuting or defending an action or claim against Customer. This paragraph does not create a liability on the part of Customer to Company or a third person, but requires indemnification where such liability exists. The limitations of liability provided in this paragraph do not apply in cases of gross negligence or intentional wrongdoing.

☐ Federal Agency
Notwithstanding Paragraph 4.b of this Agreement, the liability, if any, of Customer relating to this Agreement, for injury or loss of property, or personal injury or death shall be governed exclusively by the provisions of the Federal Tort Claims Act (28 U.S.C. §§ 1346, and 2671-2680). Subject to applicable federal, state, and local laws, each Party’s liability to the other for any loss, cost, claim, injury, liability, or expense, including reasonable attorney’s fees, relating to or arising from any act or omission in its performance of this Agreement shall be limited to the amount of direct damages actually incurred, and in no event shall either Party be liable to the other for any indirect, special, consequential, or punitive damages.

e. Company and Customer shall each be responsible for the safe installation, maintenance, repair, and condition of their respective facilities on their respective sides of the Points of Interconnection. Company does not assume any duty of inspecting Customer’s Facilities.

f. For the mutual protection of Customer and Company, only with Company prior authorization are the connections between Company’s service wires and Customer’s service entrance conductors to be energized.

5. Right of Access, Equipment Installation, Removal & Inspection — Upon reasonable notice, Company may send a qualified person to the premises of Customer at or immediately before the time Facilities first produce energy to inspect the interconnection, and observe Facilities’ commissioning (including any testing), startup, and operation for a period of up to three days after initial startup of Facilities.

Following the initial inspection process described above, at reasonable hours, and upon reasonable notice, or at any time without notice in the event of an emergency or hazardous condition, Company shall have access to Customer’s premises for any reasonable purpose in connection with the performance of the obligations imposed on it by this Agreement or if necessary to meet its legal obligation to provide service to its customers.

6. Disconnection of Facilities — Customer retains the option to disconnect from Company’s facilities. Customer shall notify Company of its intent to disconnect by giving Company at least thirty days’ written notice. Such disconnection shall not be a termination of this Agreement unless Customer exercises rights under Section 7. Customer shall disconnect Facilities from Company’s facilities upon the effective date of any termination under Section 7. Subject to Commission Rule, for routine maintenance and repairs of Company’s facilities, Company shall provide Customer with seven business days’ notice of service interruption.

Company shall have the right to suspend service in cases where continuance of service to Customer will endanger persons or property. During the forced outage of Company’s facilities serving Customer, Company shall have the right to suspend service to effect immediate repairs of Company’s facilities, but Company shall use its best efforts to provide Customer with reasonable prior notice.

7. Effective Term and Termination Rights — This Agreement becomes effective when executed by both Parties and shall continue in effect until terminated. The Agreement may be terminated for the following reasons: (a) Customer may terminate this Agreement at any time, by giving the Company sixty days’ written notice; (b) Company may terminate upon failure by Customer to generate energy from Facilities in parallel with the Company’s facilities within twelve months after completion of the interconnection; (c) either Party may terminate by giving the other Party at least sixty days written notice that the other Party is in default of any of the material terms and conditions of the Agreement, so long as the notice specifies the basis for termination and there is reasonable opportunity to cure the default; or (d) Company may terminate by giving Customer at least sixty days’ notice in the event that there is a material change in an applicable rule or statute that necessitates termination of this Agreement.

8. Governing Law and Regulatory Authority — Please check the appropriate box.
☐ Private Entity:
This Agreement was executed in the State of Texas and must in all respects be governed by, interpreted, construed, and enforced in accordance with the laws thereof. This Agreement is subject to, and the parties’ obligations hereunder include, operating in full compliance with all valid, applicable federal, state, and local laws or ordinances, and all applicable rules, regulations, orders of, and tariffs approved by, duly constituted regulatory authorities having jurisdiction.

☐ Federal Agency:
This Agreement was executed in the State of Texas and, to the extent not inconsistent with all applicable federal law (including, but not limited to: (a) the Anti-Deficiency Acts, 31 USC §§1341, 1342 and 1501-1519; (b) the Tort Claims Act, 28 USC Chapter 171, §§2671-2680, and 28 CFR Part 14; and (c) the Contract Disputes Act of 1978, as amended, 41 USC §§601-613), must in all respects be governed by, interpreted, construed, and enforced in accordance with the laws thereof. This Agreement is subject to, and the Parties’ obligations hereunder include, operating in full compliance with all valid, applicable federal, state, and local laws or
ordinances, and all applicable rules, regulations, orders of, and tariffs approved by, duly constituted regulatory authorities having jurisdiction.

9. Amendment -- 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.

10. Entirety of Agreement and Prior Agreements Superseded -- This Agreement, including the attached application and Facility Schedules, 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 Points 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 herein.

This Agreement replaces all prior agreements and undertakings, oral or written, between the Parties with regard to the subject matter hereof, including without limitation [specify any prior agreements being superseded], 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.

11. Written Notices -- Written 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:

(a) If to Company:

________________________________

________________________________

(b) If to Customer:

________________________________

________________________________

The above-listed names, titles, and addresses of either Party may be changed by written notification to the other, notwithstanding Section 10.

12. Invoicing and Payment -- Invoicing and payment terms for services associated with this agreement shall be consistent with applicable Substantive Rules of the Commission.

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

14. 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.

15. Headings -- The descriptive headings of the various parts of this Agreement have been inserted for convenience only and are to be afforded no significance in the interpretation or construction of this Agreement.

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

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

[COMPANY NAME]     [CUSTOMER NAME]

BY:_____________________________   BY:___________________________________
PRINTED NAME      PRINTED NAME

________________________________   ______________________________________
TITLE: __________________________   TITLE:_________________________________
DATE:___________________________   DATE:_________________________________
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Appendix E
Network Interconnection Specifications
1. **Purpose**

This appendix to the Austin Energy “Distribution System Interconnection Guide” will detail the requirements, safeguards, modeling, and performance criteria that are required for successfully integrating distributed generation (DG), typically Solar PV, operating at less than 1000 VAC on the Downtown Network, that meet all of the initial requirements in Section B.3. Please refer to Appendix A of the guide for a map of the Secondary (Downtown) Network.

The requirements shall be met at the point of common coupling although the devices used to meet the requirements can be located elsewhere.

This specification does not address self-protection of the DG or provide any safeguard to the operating facility as that is the responsibility of the DG owner. Implementation of DG on the network fundamentally affects the design of the network and may result in outages to the customer. The customer is required to acknowledge and accept that outages may occur, and Austin Energy will not be liable for any damages to the DG system, or outages that are a result of the customer's DG system backfeeding the AE system, since although the methods outlined in this section are fairly detailed, they do not guarantee the system will never backfeed.

This specification does not address financial impacts as a result of curtailing generation during periods of low customer loads. It is the responsibility of the customer to understand the impact to the generation capability, and Austin Energy will not be liable for any loss of generation as a result of curtailment systems required to interconnect the system.

2. **References (covered in Section G as well)**

   - IEEE 1547.6 - IEEE Recommended Practice for Interconnecting Distributed Resources with Electric Power Systems Distribution Secondary Networks.
   - ANSI C84.1 - Electric Power Systems and Equipment.

3. **Introduction and Background**

Secondary Networks were not designed to accommodate generation of any kind. They were designed to provide highly reliable service to dense urban areas by putting multiple feeders in parallel. For safety reasons, they are designed to intercept and react to faults that could cause backfeed on the network system, and as a result, network protectors (NP) are designed to instantaneously open upon detecting a reverse current flow. Distributed generation can be installed, as long as steps are taken to ensure that backfeed will not occur.
All DG on the secondary network must be inverter-based and less than 2 MW. Typical synchronous or induction generators can easily contribute fault currents that exceed a network protector's rating.

**Note:** Emergency or standby generators may not utilize closed-transition transfer switches where facilities are connected to the Downtown Network.

4. **Fundamental Design Requirements**

The primary concern about tripping network protectors is that they operate by interrupting current flow using spring-loaded finger contacts, so as a result, their lifetimes are typically a limited number of operations, compared to an average circuit breaker which has almost unlimited operations. In addition, network protectors (NP) are not designed or tested for interrupting increased fault currents, so these restrictions have led to some fundamental requirements as outlined in IEEE Standard 1547.6, Section 6:

- DG may not cause any NP to exceed its fault interrupting capability.
- DG may not cause any NP to separate two dynamic sources.
- DG may not cause any NP to connect two dynamic systems together.
- DG may not cause any NP to operate more frequently than prior to DG operation.
- DG may not prevent or delay the NP from opening for faults on the network feeders.
- DG may not delay or prevent NP closure.
- DG may not energize a de-energized network.
- DG may not require the NP settings to be adjusted except by consent of the area EPS operator.
- DG may not cause an islanding condition within part of a grid network.
- DG may not remain connected to the network if 50% or more of the NP’s serving the network are open.

Distributed generation on a secondary spot network must be designed with all above requirements taken into consideration.
5. **Network Interconnection Requirements**

**Part 1: Network Interconnection Utilizing Load Calculation and System Sizing Analysis**

The customer should contact the AE Accounts department to obtain the usage data and calculate the minimum loads for the months of November, December, January, and February. Contact System Engineering for all-new facilities.

**A. Determine average minimum load for the facility (see example below)**

1. Contact AE customer support for actual daily metered load data. If not available, divide total usage for the month by the number of days in the billing cycle to get the average usage per day (if not already shown on bill).
2. Take the results from step 1 and divide by 24 to get average use/hr.
3. Take results from step 2 and divide by 2 to get estimated minimum load for the month.
4. Take the average of the four months (if available) to determine the average minimum load.

**B. Determine estimated PV system size**

The Solar PV system should be sized no greater than 25% of the minimum load from step 3 to qualify for a de-minimis installation per PUCT guidelines. Refer to **Part 2** of this appendix for "de minimis" requirements for interconnection.

### Service Details

**Example from Customer Bill**

Step 1: $30000 \text{ kWh} / 29 \text{ days} = 1034.5 \text{ kWh}$

Step 2: $1034.5 / 24 = 43.1 \text{ kW}$

Step 3: $43.1 \text{ kW} / 2 = 21.6 \text{ kW min load}$

Step 4: Maximum PV system size = $5.4 \text{ kW}$
Part 2: Network Interconnection Utilizing “de minimis” Method

Conceptually, the goal of “de minimis” interconnection is not that complex - the distributed generation must not generate more than the facility load at any given time to prevent backfeeding and tripping a network protector, as described in Section 7 of IEEE 1547.6. This is achieved by sizing the distributed generation small enough so that it is unlikely that the load drops below the generation during operational hours, resulting in backfeed.

Part 3: Network Interconnection Utilizing "Dynamic Controls" or Alternate Methods

To prevent backfeeding which will trip a Network Protector, a solar PV system must not generate more than the facility load at any given time. This can be achieved through dynamically controlled inverters which are interfaced to a digital control system that instantaneously monitors dynamic generation and utility supply and modulates generation to maintain a defined minimum forward current flow through the network protectors.

6. Control System Design Requirements

Only contractors with a minimum of 2 years of experience installing commercial Solar PV systems should attempt the design and execution of a system interfaced to the downtown network for safety reasons, due to the complexity of the installation, as well as the high fault currents involved. The solar contractor is also responsible for contracting for engineering services to perform the design of the control system. The engineer must be licensed in the state of Texas.

- The control system shall have a minimum import relay installed, which should continuously monitor both the generation and utility supply, set to maintain a 3:1 ratio of utility supplied power to on-site generation. If the customer load drops so that the utility supply is below this 3:1 ratio, the relay should send a signal to the inverter to either reduce or disable generation.

- The control system must have a backup minimum import relay installed along with a shunt trip electronically reclosable breaker set to a minimum forward current in case the primary control system fails.

- All CT’s shall be metering accuracy class.

- The network protectors shall be monitored by AE, and loss of any network protector shall result in loss of a control signal that will shut down the inverter(s). The solar contractor shall provide a wet (24VDC) signal to AE to route to the network protectors and then return to a dry contact on the inverter. Loss of this signal shall cause the inverters to shut down.
• It is recommended that the control system be remotely connected via Ethernet to enable remote diagnostics by the contractor.

Refer to Figure E-1 on Page 86 for a conceptual diagram of the system and controls.
7. **Design, Installation, and Commissioning Requirements**

Once the system size and control setpoints have been defined, basic design drawings and documents shall be submitted for approval per the Interconnection process.

The overall system one-line diagram, three line diagram, System Instrument and Control schematic, including complete controls narrative, and a control wiring diagram shall be submitted for joint review. All drawings should be sealed by an electrical engineer licensed in the state of Texas.

A commissioning test for the proposed installation will be jointly developed based on the final system design and intended operation. After installation, the system will not be energized for testing prior to the commissioning test.

8. **Maintenance and Operation Requirements**

There should be a short review of the system after the first 6 months of operation. The requirement is for there to be zero actuation of the network protectors caused by the DG. Note that in normal operation, AE will occasionally open network protectors for maintenance activities and these actuations will not be considered being caused by the DG.

Failure of the control system, resulting in backfeed that trips the network protectors, will result in the system being locked out by AE until the contractor can review and modify the control system with new setpoints, and the commissioning tests repeated to validate the new settings.

**It is the customer’s responsibility to ensure the control system does not trip the network protectors.** Therefore, a long-term maintenance contract for the control system is strongly recommended so the customer can reap the projected economic benefit of the system.
Appendix F
Emergency Response Service (ERS) Application
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1. ERCOT Emergency Response Service (ERS) Process

This process applies to ALL customers served by the AE Electrical System.

AE Customer Participation Requirements:

- Load Shed ERS customers will not require any technical approval.
- Load Shed with Generation will require a simple review to verify that the generation is not paralleled with the AE distribution.
- ERS Generation utilizing Parallel generation on the AE Distribution system must be approved by Austin Energy System Engineering Department. Refer to the main sections of this guide for details on that process.
- ERS Generation utilizing Parallel generation on the AE Transmission system must be approved by Austin Energy Substation & Transmission Engineering & Construction Department. Key Accounts will be the point of contact.
- Closed-transition transfer-switching is not permitted for customers on the Downtown Network. (Refer to Appendix A.) All non-network customers shall refer to "Distribution System Interconnection Guide for Customer Owned Power Production Facilities less than 10 MW" for interconnection requirements.
- Austin Energy prohibits accessing or modifying utility meters and CT enclosures. Customer based sub-metering CT’s may not be used in Austin Energy equipment.

If you are interested in AE’s Qualified Scheduling Entity (QSE) representing you in the ERS Program:

- Contact AE Key Accounts at 512-972-7637.
- Key Accounts will determine which type of ERS program is best for you.
- Key Accounts will assist you in completing and submitting "Exhibit F - ERS Application Form" to AE.
- System Engineering will review Exhibit F and approve or request additional information and/or clarification.

If you already have a third party QSE representing you in the ERS program:

- Please follow the process outlined on the next page.
- AE’s System Engineering group will perform a technical review of your application and facility and approve or request additional information and/or clarification.

**Application Checklist for ERS Load Customers with Generator**

- [ ] 1) Completed ERS Application and Interconnection Application (if required).
- [ ] 2) Copy enclosed of site electrical one-line diagram and schematic drawings showing the configuration of all generation equipment, current and potential circuits, and protection and control schemes.
- [ ] 3) Copy enclosed of any site documentation that indicates the precise physical location of the proposed generation facility (e.g., USGS topographic map or other diagram or documentation).
2. Emergency Response Services (ERS) 3rd Party QSE Representation Process Flowchart

This flowchart represents the steps 3rd Party QSE’s should follow to represent ERS customers within AE’s Service Area.

- **Start**
  - 3rd Party QSE
    - Contact Austin Energy (AE) Government Relations Division
      - (512) 322-6314
  - AE Gov’t Relations
    - Provide instructions pertaining to completion of AE’s Exhibit F of Austin Energy Interconnection Guide
  - 3rd Party QSE
    - Complete Exhibit F of Interconnection Guide
  - 3rd Party QSE
    - Submit completed Exhibit F of Interconnection Guide to AE System Engineering
  - AE System Engineering
    - Review/Approve and/or request additional information/modifications from 3rd Party QSE
  - AE System Engineering
    - Submit approved Exhibit F to AE Gov’t Relations
  - AE Gov’t Relations
    - Provide 3rd Party QSE with signed document allowing participation of ERS customer

- **End**
### 3. Exhibit F - ERS APPLICATION FORM

**ERS Customer Information**

<table>
<thead>
<tr>
<th>Designated Contact Person:</th>
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<tbody>
<tr>
<td>Address:</td>
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<tr>
<td>Telephone Number:</td>
<td></td>
</tr>
<tr>
<td>E-Mail Address:</td>
<td></td>
</tr>
<tr>
<td>Customer Name:</td>
<td></td>
</tr>
<tr>
<td>Location Address:</td>
<td></td>
</tr>
<tr>
<td>Facility Phone # (Day/night):</td>
<td></td>
</tr>
<tr>
<td>Facility E-Mail Address:</td>
<td></td>
</tr>
</tbody>
</table>

**ERS RESOURCE**

Nameplate Rating of generator (if applicable): ________ (MW)

Contract Time Period:

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<tr>
<th>Time Period</th>
<th>TP1 (5:00AM TO 9:00AM) Maximum Offer: ______(kW)</th>
<th>Load Description: ________________</th>
</tr>
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<tbody>
<tr>
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<td>□ ERS-10 Non-Weather-Sensitive</td>
</tr>
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<td></td>
<td>□ ERS-10 Non-Weather-Sensitive</td>
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</table>

<table>
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<tbody>
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<td></td>
<td>□ ERS-10 Weather-Sensitive</td>
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<tr>
<td></td>
<td>□ ERS-30 Weather-Sensitive</td>
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**Applicant Signature**
I hereby certify and acknowledge that, to the best of my knowledge, all of the information provided in this Interconnection Request is true and correct.

QSE Company: ____________________________ (print)
QSE Representative: ________________________ Date: ____________
ERS Customer: ____________________________ Date: ____________

**Austin Energy System Engineering Review**

☐ Reviewed  ☐ Resubmit

Meter ID: ____________________  Service Point ID: ____________________  Feeder: ____________________
Appendix G

“Electric Vehicle Connection Guide for Residential Customers”
1. Purpose

The Austin Energy “Electric Vehicle Connection Guide for Residential Customers” is to provide guidelines and configurations for connecting plug-in electric vehicles (PEVs) to a residential Time-of-Use (TOU) metering system. The guide contains information on application processes, technical requirements, applicable codes, metering configurations, and rate structures.

Customers will have the option of getting their Electric Vehicle (EV) usage on a separate meter with a Time-of-Use rate. Otherwise, customers can keep their EV load as part of their whole house consumption for the standard rate. For Time of Use metering, apply for a residential sub-meter (EV Meter) thru the AE program. The Rate Structure for Time of Use metering can be found at the following:

http://www.austinenergy.com
- Select the “Programs” tab
- Select the “Plug-In Austin” tab

2. Electric Vehicle (EV) Charging Basics

Power is delivered to the Electric Vehicle (EV) onboard battery through the EV inlet to the charger. The charger converts Alternating Current (AC) from the home to the Direct Current (DC) required to charge the battery in the vehicle. The charger and EV inlet are considered part of the EV. A connector is a device that, by insertion into an EV inlet, establishes an electrical connection to the EV for the purpose of charging and information exchange. The EV inlet and connector together are referred to as the coupler. The Electric Vehicle Supply Equipment (EVSE) consists of the connector, cord, and interface to utility power. The interface between the EVSE and utility power will generally be a plug and receptacle. At the present time, the Society of Automotive Engineers (SAE) has agreed that all vehicles produced by automakers in the United States will conform to a single design, known as the J1772 Standard.

3. Connection Classifications

For Austin Energy designations, there are two classifications of connection to Electric Vehicles. They are as follows: (1) Level 1 and Level 2 <10 kW and (2) Level 2 >10 kW.

For Level 1, 120 volt AC, the system uses a standard 120 volt AC branch circuit, which is the lowest common voltage level found in residential areas. Typical amp ratings for these receptacles are 15 or 20 amps. All EVs come equipped with Level 1 chargers from auto manufacturers. It is the slowest, but simplest, charging.

For Level 2 <10 kW, 240 volt AC, the system is typically described as the “primary” and “standard” system for the EVSE for both private and publicly available facilities. This system specifies a single-phase branch circuit. A typical circuit rating would be 40 amps.
For Level 2 >10 kW, 240 volt AC, the system allows a much faster battery charge, but Level 2 has a higher level of safety requirements than Level 1 under the National Electrical Code (NEC), including the requirement that the connector and cord be hardwired to the control device and premises wiring in certain cases. The J1772-approved connector allows current as high as 80 amps (100 amp rated circuit). Level 2 charging (240 volts, maximum 80 amps) usually requires a dedicated circuit and will most likely require an electrical panel upgrade.

4. Application Processes for Electric Vehicle Connections

The customer/contractor is required to obtain an electrical permit for construction of any facility interfaced to the AE system per Austin Electrical Code Section §25-12-111. This applies to all entities served by Austin Energy: residential, commercial, and government agencies. All procedures for obtaining a City of Austin (COA) electrical permit apply regardless if the system is installed within Austin or a separate extraterritorial jurisdiction (ETJ). The system must be installed in compliance with the National Electrical Code (NEC), NFPA 70.
4.1. Process for Residential Systems – Level 1 and Level 2 <10 kW

Residential Systems less than 10 kW are generally required to have Electric Service Planning Applications (ESPA) only for upgrades to the main electrical service. Residential systems may require electrical permitting. A COA electrical permit must be pulled for the installation of a 240-volt charging station that is hard wired into the home, or the installation of a 240-volt receptacle for which to plug a Level 2 charging station into. Residential systems less than 10 kW should use the following process for obtaining a permit. Systems in this category are typically handled through the AE One-Stop Shop which can be reached at:

One-Stop Shop: (512) 974-9112 (or)

the preferred contact is via email which is at:

One-Stop Shop email: aeBSPA-ESPA@austinenergy.com

a. The customer is required to submit an ESPA for review for connection to the AE system only for upgrades to the main electrical service. Generally, it should still be submitted for tracking purposes. It can be found on the AE website at (or call AE Customer Service at 512-494-9400):

http://www.austinenergy.com
- Select the “Contractors” tab
- Select the “Electric Service Design & Planning” tab
- Select “Learn More About Submitting an ESPA”
- Select “View and Download the ESPA”

b. If the customer is required to go through plan review for obtaining an electrical permit, the ESPA must be accompanied with a full set of drawings. Call COA Plan Review at 512-978-4000.

c. Upon successful completion of the process, the contractor will receive an electrical permit. Contact the COA Permit Center at 512-974-2747.

d. Contractor builds system and installs residential EV Meter circuit. Note: Any significant change in the design must go back through the plan review process.

e. After the system is installed, the contractor shall request the final electrical inspection from the COA Electrical Inspection department via AMANDA or call 512-480-0623. Permit is then released.

f. Austin Energy sets the EV Meter and the process is complete. Call AE Metering at 512-505-7045.
Electric Vehicle Connection Application Approval Process – Residential Systems Level 1 & Level 2 <10kW

1. Special approval (ESPA) is generally not required for <10kW system (ESPA required only for upgrades to main electrical service)

2. Plan review – if required, provide plans and ESPA to City of Austin for an electrical permit

3. Obtain electrical permit (permitting is required for hard wiring into home or for installation of 240-volt receptacle)

4. Contractor – install residential EV Meter circuit

5. Final inspection (via AMANDA) by COA Electrical Inspector and permit released

6. Austin Energy – set EV Meter for residential Time-of-Use program

Approval Process Flow for Residential Systems <10 kW
4.2. Process for Residential Systems – Level 2 >10 kW

Residential Systems greater than 10 kW are required to have Electric Service Planning Applications (ESPA) for upgrades to the main electrical service. Residential systems may require electrical permitting. A COA electrical permit (but not an ESPA) must be pulled for the installation of a 240-volt charging station that is hard wired into the home, or the installation of a 240-volt receptacle for which to plug a Level 2 charging station into. Residential systems greater than 10 kW should use the following process for obtaining a permit. Systems in this category are typically handled through the AE Distribution Design groups which can be reached at:

**One-Stop Shop:** (512) 974-9112  
(or)

the preferred contact is via email which is at:

**One-Stop Shop email:** aeBSPA-ESPA@austinenergy.com

a. The customer is required to submit an ESPA for review for connection to the AE system for upgrades to the main electrical service. It can be found on the AE website at (or call AE Customer Service at 512-494-9400):

http://www.austinenergy.com

- Select the “Contractors” tab
- Select the “Electric Service Design & Planning” tab
- Select “Learn More About Submitting an ESPA”
- Select “View and Download the ESPA”

b. If the customer is required to go through plan review for obtaining an electrical permit, the ESPA must be accompanied with a full set of drawings. Call COA Plan Review at 512-978-4000.

c. Upon successful completion of the process, the contractor will receive an electrical permit. Contact the COA Permit Center at 512-974-2747.

d. Contractor builds system and installs residential EV Meter circuit. Note: Any significant change in the design must go back through the plan review process.

e. After the system is installed, the customer/contractor shall request the electrical pre-inspection from the COA Electrical Inspection department via AMANDA or call 512-480-0623. Pre-inspection covers only the transformer and concrete encased electrode and trench (only if needed).

f. The contractor shall request the final electrical inspection from the COA Electrical Inspection department via AMANDA or call 512-480-0623. Permit is then released.

g. Austin Energy sets the EV Meter and the process is complete. Call AE Metering at 512-505-7045.
Electric Vehicle Connection Application Approval Process – Residential Systems Level 2 >10kW

1. Submit completed ESPA to Austin Energy for >10kW system (ESPA required for upgrades to main electrical service)

2. Plan review – provide plans and ESPA to City of Austin for an electrical permit

3. Obtain electrical permit (permitting is required for hard wiring into home or for installation of 240-volt receptacle)

4. Contractor – install residential EV Meter circuit per design

5. Schedule electrical pre-inspection using COA’s AMANDA system (only if needed)

6. Final inspection (via AMANDA) by COA Electrical Inspector and permit released

7. Austin Energy – set EV Meter for residential Time-of-Use program

Approval Process Flow for Residential Systems >10 kW
5. General System Layout and Technical Requirements

This section reviews general system layouts and components for simple Residential EV Systems. Figure G-1 represents a simplified diagram illustrating the key requirements for typical EV systems less than 10 kW.

![Simplified Diagram for Level 1 and Level 2 (<10 kW) for "typical" EV System (with Time of Use Meter)](image)

The charging station in Configuration 1 refers to a standardized cord that is provided with the EV. The Level 2 EVSE could also be directly hardwired, bypassing the receptacle.
Figure G-2 represents a simplified diagram illustrating the key requirements for other “typical” EV systems, greater than 10 kW, that require review by AE.

The charging station in Configuration 2 refers to a directly hardwired system. This configuration would most likely require an electrical panel upgrade.

Notes from Figures G-1 and G-2 (see this page and previous page):

1. **Service Disconnect**
   All customers must have a code-compliant service disconnecting means. Refer to the AE Design Criteria Manual for specifics.

2. **Overcurrent Protection**
   Overcurrent protection to be sized per NEC Article 625.40.
3. **EV Meter (to be on Time of Use rate)**
   
a. **Installations**
   
i. Contact **AE Complex Metering: (512) 505-7045 or EV/ET staff (512) 482-5376.**
   
ii. Refer to Figures G-1 and G-2 for examples of simplified EV installations. Contact AE Complex Metering for any clarification.
   
a) Note: The EV Meter shall be grouped with billing meter and disconnects.
   b) Facilities with <200 amps current would typically use a self-contained meter.
   c) Facilities with >200 amps current would typically use an instrument rated meter.
   d) Final determination of meter type and configuration shall be made by the AE Metering group.
   
iii. Refer to the AE website for detailed meter socket, meter hub, and other related equipment.
   
iv. [http://www.austinenergy.com](http://www.austinenergy.com)
   
   - Select the “Contractors” tab
   - Select the “Electric Service Design & Planning” tab
   - See “Austin Energy Design Criteria Manual”

4. **Receptacle/Interface/Connection**
   
The interface between the EVSE and utility power will generally be a plug and receptacle. A receptacle (120-volt or 240-volt rated in the case of Figure G-1) or a hardwired 240-volt connection (in the case of Figure G-2) shall be provided for the customer’s service connection to the EV system. EVSE connection to comply to NEC Article 625.44. Disconnecting means rated 60 amps or more to comply with NEC Article 625.42.

5. **EVSE/Charging Station**
   
   Charging station to comply with IEEE 1547 and P2030.1 safety standards. The EVSE is a safety device that allows electricity to flow. Safety is enhanced by enabling two-way communications between the charging station and the EV and by safely delivering and managing electrical energy between an electrical source and an electric vehicle. The EVSE consists of the J1772 connector, cord, and interface to utility power.

6. **Electrical Plug**
   
   All vehicles produced by automakers in the United States will conform to a single design, known as the J1772 Standard.

7. **EV/Charger**
   
   Power is delivered to the EV’s onboard battery through the EV inlet port to the charger. The charger converts Alternating Current (AC) from the home to the Direct Current (DC) required to charge the battery in the vehicle. The charger and EV inlet port are considered part of the EV.
End of Interconnection Guide