Solar Trade Ally Rating System

Developed by Energy Trust of Oregon

V 1.2

Table of Contents

Revisions

Energy Trust updates these Rating System rules concurrently with the Solar Electric Installation Requirements. Many thanks to the industry members who have provided feedback. Revisions from the previous version are summarized in the table below.

August 2017 Revisions

Section	Revision
1.1	Program Service scoring methodology revised to only include negative points from Application Design Rejections (No score impact from Pending Paperwork)
1.7	Modifier added to Quality Service score for installations that require no Corrections for Commercial projects or rural trade ally contractors
2.0	Minor Corrective Action outcome revised to inform contractor/customer and expedite incentive payment
3.0	Corrective Actions Defined section updated to align with current version of the installation requirements

1.0 Trade Ally Rating Overview

The Energy Trust of Oregon Solar program has established the following rating criteria for solar trade allies. Each trade ally will receive up to one star for each of three categories:

1. Program service
2. Quality service
3. Customer service

Trade ally ratings are assessed quarterly. Newly enrolled solar trade allies must complete one installation in the rating period in order to earn their initial star rating and be listed on the website. Existing trade allies who do not complete one installation in the rating period will be considered inactive.

1.1 Program service star

The program service score measures whether the application and technical design documentation meet all program requirements as evaluated by solar program staff and program verifiers. Application and system design reviews confirm compliance with the Solar Electric Program Guide and the Solar Electric Installation Requirements. Solar trade allies will begin each rating period with a program service score of 95 points. Projects that are marked "Pending Paperwork" will not count against the Program Service Score, although they must be resolved before a project can move forward.

- A program service score of 100 points or greater = 1 star
- A program service score of 75-99 points = ½ star
- A program service score of 74 points or fewer = no star

A trade ally's program service score is adjusted according to the following criteria:

- A system design contains no errors = +2.5 points
- A system design contains errors; enters **Design Rejected** status = -2.5 points

1.2 Quality service star

The quality service score measures installation performance as evaluated by Solar Program Verifiers. System installation verifications confirm compliance with the Solar Electric Installation Requirements. Solar trade allies will begin each rating period with a quality service score of 95 points.

- A quality service score of 100 points or greater = 1 star
- A quality service score of 75-99 points = ½ star
- A quality service score of 74 points or fewer = no star

A solar trade ally's quality service score is adjusted according to the following criteria:

- Installation requires no Corrections = +2.5 points
- Installation requires Minor Corrections = -2.5 points per Minor Correction
- Installation requires Major Corrections = -5 points per Major Correction
- Maximum penalty per project = -15 points

A modifier of +2.5 points is added to installations that require no Corrections for Commercial projects or rural trade ally contractors.

Refer to the Solar Electric Program Guide and the Solar Electric Installation Requirements for more information on verification site visits and refer to Section 3.0 of this document for the classification of each corrective action.

1.3 Customer service star

Solar trade allies will earn this star based on the volume of unresolved customer complaints reported to Energy Trust:

- 0-2 customer complaints = 1 star
- 3 customer complaint = ½ star
- 4 or more customer complaints = no star

Trade allies must comply with the customer service terms and conditions from enrollment forms *1171A: Trade Ally Enrollment Application* and *271E: Solar Electric Trade Ally Addendum.*

1.4 Star Rating Period

Star rating periods end on January 31, April 30, July 31, and October 31, and scores are calculated using the previous 12 months of activity; the quality service star evaluates projects with an **Installation Verified** date within the rating period; the program service star evaluates projects with a **Funds Reserved** date within the rating period. Star ratings last the duration between rating assessments.

1.5 Star Rating Report and Web Ratings

Trade Allies will receive a summary report of their performance in each category at the end of each rating period. This report is intended to highlight potential areas of focus to help improve program performance and overall business health. Reports are sent directly to the solar trade ally company owner or primary program contact and typically go out within one week of the closing of the rating period. Web ratings are updated the following business day after reports are issued.

1.6 Star Rating Benefits

Rating	Annual Amount*	Cooperative Marketing**	Training and Events**	Certification**/***	Solar Leads**	Pilot Programs**
★★★	$8,000	50 percent reimbursement	50 percent reimbursement	50 percent reimbursement	Yes	Yes
★★½	$4,000	30 percent reimbursement	30 percent reimbursement	30 percent reimbursement	Yes	No
★★	$1,000	30 percent reimbursement	30 percent reimbursement	30 percent reimbursement	No	No
Fewer than two stars	$400	Projects can be pre-approved but are not eligible for reimbursement	30 percent reimbursement	30 percent reimbursement	No	No

**Minimum $75 reimbursement per request, see steps to receive reimbursement for more details*
***Preapproval required to eligible for reimbursement, solar leads, or pilot programs*
****Trade allies who apply for and achieve NABCEP PV Company Accreditation may qualify to receive 100% reimbursement for costs associated with the accreditation application up to the annual cap.*

1.7 Corrections Dispute Resolution Process

In the event that a solar trade ally disagrees with a correction identified by a program verifier during the on-site installation verification, the process outlined below should be followed to ensure accuracy and fairness for each trade ally's rating.

1) Correction notice issued to solar trade ally.
2) If trade ally feels the correction was issued incorrectly, trade ally responds directly to program verifier to clarify or resolve the correction.
3) If satisfactory resolution cannot be reached between the solar trade ally and the program verifier, the solar trade ally can email program staff directly with a detailed written account of the concerns with the correction, and any extenuating circumstances, if applicable.
    - Send email to solar@energytrust.org
    - Subject line: "**ATTN: Corrections Dispute - #{PowerClerk ID}**"
4) Program staff will review the request and confer with the program verifier to determine if the correction was correctly issued or not. Program staff will follow up with solar trade ally if additional information is required.
5) Program staff will notify the solar trade ally of the verdict to keep or vacate the original correction. If the correction is vacated, it will not impact a trade ally's rating.

2.0 Definitions

Verification: The act of independent, third-party Solar Verifiers ensuring trade ally compliance with Solar Electric Installation Requirements and/or Solar Electric Program Guide; identifying opportunities for improvement and providing feedback for trade allies; and providing a quantitative metric to measure installation quality. Verification results are assessed in the following categories of work compliance: Pass, Minor Corrective Action, Major Corrective Action or Does Not Qualify (DNQ).

Pass: Work was satisfactorily installed and completed as submitted on the incentive application and is in program compliance. No corrective actions are necessary.

Corrective Action: A result from a verification site visit wherein a lack of compliance with the Solar Electric Installation Requirements and/or Solar Electric Program Guide is specified. Corrective actions are necessary and communicated to the trade ally. Procedures for jobs requiring corrective action are defined in Section 2.3 of the Solar Electric Program Guide. There are two types of corrective actions: Minor Corrective Action and Major Corrective Action.

Minor Corrective Action: Work is unsatisfactory, with minor problems associated with system performance, health and safety, system durability, customer education, or overall installation quality, and/or does not comply with the program requirements.

Outcome:

- Notice listing minor correction(s) required is emailed to contractor and customer with statement that system does not meet Energy Trust requirements until corrections have been made and that it is the contractor's responsibility to make the necessary corrections within 30-days.
- The trade ally's score is decreased by the negative points associated with the corrective action(s).
- Incentive payment is queued.

Major Corrective Action: Work is unsatisfactory, with potentially significant or serious problems related to system performance, health and safety, system durability, customer education, or overall installation quality, and is substantially noncompliant with the program requirements.

Outcome:

- Notice listing major correction(s) required is emailed to contractor with statement that system does not meet Energy Trust requirements until corrections have been made and that it is the contractor's responsibility to make the necessary corrections within 30-days.
- The trade allies score is decreased by **5 points** associated with the corrective action(s).
- Incentive payment is held until proof that the correction has been addressed is provided.

Does Not Qualify (DNQ): Work does not meet program requirements and the project is not eligible to receive an incentive. A DNQ is considered a major corrective action violation and the incentive reservation is terminated.

Outcome:

- Notice that the system does not meet program requirements is emailed to contractor and customer.
- The trade allies score is decreased by the negative points associated with the corrective action(s).
- No incentive payment is made.

3.0 Corrective Actions Defined

The Solar Electric Installation Requirements have individually been separated into Minor Corrections, Major Corrections, and Does Not Qualify. If corrective actions are identified during the verification site visit this chart will be used to guide determinations.

2.0	SYSTEM REQUIREMENTS		
2.1	**General**	**Type**	**Category**
2.1.1	System shall be grid-connected and installed on real property in Oregon that receives electrical service directly from Portland General Electric or Pacific Power.	DNQ	System Performance
2.1.2	System shall meet local utility interconnection and net metering requirements, if applicable.	DNQ	System Performance
2.1.3	The installation shall be of industry standard and workmanlike quality.	Major	System Performance
2.1.4	System design shall be documented with a complete PowerClerk project record and incentive agreement that accurately describes the project participants and system design, including: a. Incentive agreement signed and dated by authorized signatory b. Incentive agreement system summary generated with current version of system design c. Component description lists make and model of all system components (module, inverter, energy storage system (ESS), battery, etc.) for current version of system design d. Component description shows correct tile and orientation for all solar arrays e. Correct utility specified	Major	Consumer Information
2.1.5	System design shall be documented with a schematic diagram that accurately describes all electrical components to be installed (e.g., modules, inverters, energy storage systems (ESS), disconnects, and meters) and the wiring design. Diagram should include: a. Module series/parallel wiring b. Wire run from array to point of utility interconnection, including applicable sub-panels, with pre-existing wiring or sub-panels used in the AC run clearly labeled c. Conductor and ground wire types and sizing d. Conduit types and sizing e. Voltage drop calculations f. AC and DC breaker sizing	Major	Consumer Information
2.1.6	System design shall be documented with a physical layout diagram that accurately describes locations of major system components. Diagram should include: a. Layout of roof or installation location including existing obstructions b. Locations of installed modules, inverter(s), and energy storage systems c. Locations of pre-existing photovoltaic or wind components d. Locations of submitted TSRF measurement(s) e. Locations of all applicable electrical panels, meters and disconnects.	Major	Consumer Information
2.1.7	System shall be properly permitted, inspected, and in compliance with all applicable building and electrical codes.	Major	Health & Safety

2.1.8	System equipment installers shall be licensed according to the Oregon Building Codes Division and shall be working for a contractor that is licensed according to the Oregon Construction and Contractors Board.	DNQ	Health & Safety
2.2	**Materials**	**Type**	**Category**
2.2.1	Materials used outdoors shall be sunlight/UV-resistant and listed for outdoor locations.	Major	System Durability
2.2.2	Materials used shall be designed to withstand the temperatures to which they are exposed.	Major	System Durability
2.2.3	Dissimilar metals that have galvanic action (such as aluminum and copper) shall be isolated from one another using industry standard practices (such as properly-rated grounding lugs).	Major	System Durability
2.2.4	Aluminum shall not be placed in direct contact with concrete materials.	Major	System Durability
2.2.5	Fasteners used to secure modules and racking equipment shall be stainless steel. For substructure components, only high-quality fasteners shall be used (stainless steel is preferred). Stainless steel bolts shall be coated with an anti-seize lubricant to prevent galling and allow for removal during system maintenance or repair.	Major	System Durability
2.2.6	Structural members shall be either: a. Aluminum b. Hot-dip galvanized steel per ASTM standard A123 equivalent or better. c. Coated or painted steel (not allowed in marine environments). d. Stainless steel (recommended for marine environments). e. Pre-approved nonmetallic material. Nonmetallic mounting systems listed to the UL 2703 standard may be submitted for application review without pre-approval. f. Outdoor rated pressure treated lumber or laminated beams: i. Shall be installed using roofing flashing methods to prevent water pooling and UV exposure on top surface. ii. Shall not be installed in direct contact with roofing material, soil, or where exposed to extended periods of pooled water	Major	System Durability
2.2.7	For a residential, roof-mounted array, rails used for mounting modules shall be aluminum or stainless steel.	Major	System Durability
2.3	**Equipment and Installation**	**Type**	**Category**
2.3.1	All installed system components shall be new.	DNQ	System Performance
2.3.2	All components shall be mounted securely.	Major	System Durability
2.3.3	All building penetrations shall be sealed and fire resistance maintained: a. To prevent intrusion by insects, vermin, or weather, all penetrations to building shell (wall, etc.) resulting from the installation of the solar system shall be permanently sealed with appropriate water and pest-proof materials. b. Any penetrations through fire-rated assemblies shall be sealed and shall not reduce the fire resistance required by local codes and standards	Minor	System Durability; Health & Safety
2.3.4	All electrical equipment shall meet appropriate current electrical standards and shall be listed by a nationally recognized testing laboratory (e.g., UL, ETL). a. Inverters shall meet IEEE 929, 1374 and 1547 (listed to UL 1741) or their successor standards and shall be certified by the California Energy Commission	DNQ	Health & Safety

b. c. d.	Photovoltaic modules shall meet IEEE 1262 (listed to UL 1703) or their successor standards and shall be certified by the California Energy Commission Photovoltaic mounting systems and clamping devices used as part of a grounding system shall be listed to UL 2703 or successor standard Energy Storage Systems shall be listed to UL 9540 or successor standard except with program pre-approval.		
2.3.5	All listed and/or labeled electrical equipment shall be installed and used as shown in the included instructions and these Installation Requirements.	Major	System Durability
2.3.6 a. b. c.	Manufacturer warranties shall cover: Inverter for a minimum of 5 years against manufacturer's defects PV modules for a minimum of 20 years against degradation of performance below 80% of original output under standard test conditions Energy Storage Systems (ESS) for a minimum of 10 years against manufacturer's defects	DNQ	System Durability
2.3.7	All electrical equipment shall be listed for the voltage and current ratings necessary for the application.	Major	Health & Safety
2.3.8	Equipment shall not be modified such that it voids the listing or manufacturer warranty.	DNQ	Health & Safety
2.3.9	All required over-current protection shall be included in the system and accessible for maintenance. The inspection or maintenance of combiner or feed-through junction boxes shall not require the removal or displacement of modules or other obstructions.	Major	Health & Safety
2.3.10 a. b. c. d.	Means of disconnection shall be provided at the inverter(s) such that the inverter(s) can be safely isolated from all sources of power (DC input and AC output circuits) for service or in an emergency and: To allow the inverter electronics to be removed for service, disconnect switches shall be physically separable from the inverter chassis containing the main power electronics. To allow safe, quick operation, the means of disconnection shall be at the location of the inverter or—for AC disconnection only—within sight of the inverter with permanent signage providing the location of the disconnect per OESC 690.56(B). Disconnect switches shall be listed and designed for load-break operation (e.g., blade-type or circuit breaker). Pull-out style disconnects shall not be used. Microinverters shall be installed per the requirements of the local jurisdiction (e.g., may require installation of a rooftop AC disconnect, if roof-mounted)	Major	Health & Safety
2.3.11	All electrical terminations shall be torqued to specification, secured, and strain-relieved as appropriate. Wire ends shall be coated with terminating compound prior to termination to prevent loosening of the connection over time.	Major	System Durability; System Performance
2.3.12	All cables, conduit, exposed conductors, and electrical boxes shall be secured and supported according to code requirements and in accordance with their performance ratings (i.e., NEMA). It is recommended that high current carrying conductors 4 AWG and larger be megohm tested to confirm integrity of insulation	Major	Health & Safety

2.3.13	Conduit used for DC conductors shall be electrical metallic tubing (EMT). Flexible steel conduit or metal clad (MC) cable may be used as an alternative where allowed by the Oregon Electrical Specialty Code (OESC). PVC conduit may be used below grade, and above grade in marine climates where approved by the local jurisdiction	Major	Health & Safety
2.3.14	Array equipment grounding conductors (EGC) and DC grounding electrode conductors (GEC) shall be copper and shall be either minimum 6 AWG or protected from physical damage and sized to conform to the Oregon Electrical Specialty Code (OESC): a. Equipment grounding conductor (EGC) shall be sized and protected according to OESC 690.45(A) and 690.46. b. Grounding electrode conductor (GEC) shall be sized and protected according to OESC 690.47(C) and 250.64(B). c. If a single conductor is used for the AC EGC and the DC GEC, conductor sizing and protection shall conform to all of the OESC sections listed above. d. Trade ally is responsible for identifying any additional OESC sections that may apply.	Major	Health & Safety
2.3.15	Twist-on wire connectors shall not be used on DC conductors or ground wires. Instead, these wire connections shall be made using terminal strips in combiner boxes, feed through blocks in junction boxes, or other similar mechanical wire splicing devices. When outdoors or exposed to moisture, twist-on wire connectors used for AC connections shall be listed for usage in a damp/wet location.	Major	System Durability
2.3.16	Junction boxes and combiner boxes shall be listed and suitable for their environment and conditions of use. Boxes used in damp or wet locations shall have water-tight or properly flashed covers, screw holes and conduit connections.	Major	Health & Safety
2.3.17	Permanent, UV-resistant labels with engraved, stamped or printed text (i.e., not hand-written) shall be applied to system components where signage is required by the Oregon Electrical Specialty Code. When required, inverter disconnect label shall be placed on or near the disconnect box and not on the inverter chassis.	Minor	Health & Safety
2.3.18	Readily accessible disconnect switch covers (not switch handles) shall be secured closed for safety (i.e., padlock, zip tie, etc.). Because this may interfere with access during an inspection, the means to secure the cover plate may be left with the customer with instructions for use.	Minor	Health & Safety
2.3.19	Inverters shall be installed according to manufacturer's specifications and: a. Inverter shall not be installed in an unconditioned attic. b. Inverter shall not be installed with direct sun exposure that will impact its performance (i.e., on a wall with an azimuth between 120° and 300°, unless permanently shaded between the hours of 12:00pm and 5:00pm). c. Inverter shall be installed in an accessible location.	Major	System Performance
2.3.20	Micro-inverters shall include the installation of manufacturer-provided equipment that allows local monitoring of system performance and identification of inverter errors.	DNQ	System Performance
2.3.21	Where PV source and output circuits are installed in readily accessible locations, circuit conductors shall be guarded or installed in a raceway.	Major	Health & Safety

	Note: Guards typically include close fencing of the entire array, of sufficient height to render the area inaccessible, or, installation of materials to the mounting structure intended to screen and protect the conductors. If close fencing is installed the fence shall be minimum 5-feet high with a secured gate except with prior program approval.		
2.4	**Array Mounting**	**Type**	**Category**
2.4.1	If roof-mounted, the roofing material shall have at least 10 years of useful life remaining to ensure the roof will not need repair or replacement early in the System's operational life. If in question, evidence of this requirement may be met by providing either a copy of a recent roof inspection or a receipt showing the date of the most recent roof replacement.	DNQ	System Durability
2.4.2	If roof-mounted, the roof system shall be capable of handling additional load of the System. Augmentation of the structure may be required by building codes.	Major	Health & Safety
2.4.3	Array racking and mounting systems shall be engineered and installed to meet local wind, snow and seismic load requirements.	Major	Health & Safety
2.4.4	All roof penetrations shall be made watertight using roofing industry-standard methods of flashing that protect the warranty of the roof. Sealant compounds used shall be appropriate for the roofing material and application and shall not be the sole method of waterproofing. *Note: For asphalt shingle roofs this shall be accomplished with the use of some type of flat metal flange that extends around a penetration and is installed completely under shingles on the upslope side of a penetration, with the flange extending beyond the headlap of the roof covering. The bottom flange should then overlap the shingles on the downslope side. (Adapted from 2014 NRCA roofing manual)*	Major	System Durability
2.4.5	All mounting hardware shall be installed according to manufacturer specifications.	Major	System Durability
2.5	**Solar Access**	**Type**	**Category**
2.5.1	Solar resource shall be measured with an Energy Trust sun chart or approved shading analysis tool from the point on the array where shading is most significant. Details on using sun charts and a list of approved shading analysis tools are available on the Energy Trust Solar Trade Ally Forms & Resources webpage	DNQ	System Performance
2.5.2	Total Solar Resource Fraction ("TSRF") shall be calculated for each site and meet the following requirements based on the measurement tool used: a. On-site shade analysis: TSRF of 75% or greater at all points on the array for string inverters. Projects may include individual modules with a TSRF of less than 75% if the modules are electrically isolated from one another using microinverters or other pre-approved technology; however, those modules that do not meet the 75% requirement will not be eligible for program incentives. b. Remote Shade analysis: Each plane of the array(s) have a TSRF of 80% or greater to be eligible for incentives. Trade allies must submit a solar resource evaluation using an approved remote site analysis tool. For detailed instructions on using these tools and displaying the required information, please refer to the Energy Trust solar program website. c. For systems over 25kW in size minimal inter-row shading may be permissible with the Program's pre-approval.	DNQ	System Performance

2.5.3	It is recommended that the System be installed in an aesthetic manner that blends in with the building architecture. Small trade-offs in system performance due to sub-optimal tilt and orientation can greatly enhance the aesthetics of the installation and thereby increase long term public support for solar.	N/A	N/A
2.6	**Performance**	**Type**	**Category**
2.6.1	Array shall be sized to operate within the current, voltage and power limits approved and warranted by the inverter manufacturer and shall not exceed 135% of inverter output power rating based on the DC nameplate capacity of the modules at STC. The temperature-adjusted array voltage shall remain within the inverter limits at the extreme high and low temperatures expected at the installation site. Where available and appropriate, ASHRAE dry-bulb design temperatures may be used (use the 0.4% high temperature and extreme mean minimum temperature). In areas where ASHRAE data is not available (e.g., at higher elevations), historical record high and low temperatures should be used.	Major	System Performance
2.6.2	Wires shall be sized to keep voltage drop at or below 2% in the DC conductors from the array to the inverter. Voltage drop will be calculated using temperature-adjusted Vmp (max power voltage) of the array for the location's average high temperature adjusted with the temperature adders in Table 1 above.	Major	System Performance
2.6.3	Wires shall be sized to keep voltage drop at or below 2% in the AC conductors from the inverter to the point of connection. Example points of connection include the distribution panel that contains the main service disconnect(s), a supply-side tap, a pre-existing sub-panel with other loads, a generator transfer switch, or a switchgear.	Major	System Performance
2.6.4	AC voltage at the inverter shall be within the inverter's operating limits. At locations were utility service is higher than typical voltage, this may require a larger AC wire size or a shorter AC run than allowed under Section 2.6.3 to minimize voltage rise between the point of utility interconnection and the inverter	Major	System Performance
2.6.5	Voltage mismatch caused by partial shading of the array, different orientations of strings within the array and by variations in module voltages shall be minimized, allowing the inverter to operate within its maximum power point window. Modules in a single string shall be installed at the same tilt and orientation or with no more than 10° variation.	Major	System Performance
2.6.6	Each solar system shall be completed in accordance with reviewed design.	Major	System Performance
2.6.7	Each solar system shall be capable of full operation at the time of Verification and compliant with minimum safety standards. *Note: For solar systems that require access to online monitoring to determine if the system is capable of full operation access to the online monitoring must be available at the time of Verification*	Major	System Performance
2.7	**Production Meter**	**Type**	**Category**
2.7.1	Each solar system shall have the ability to measure total AC system production in kilowatt-hours with at least +/- 5% accuracy using one of the following methods: a. A production meter built-in to the inverter. It shall appear on the List of Eligible Inverters provided by the California Energy Commission as having an approved built-in meter. b. A system performance meter (i.e., a microinverter monitor). It shall appear on the List of Eligible System Performance Meters provided by the California Energy Commission	Major	System Performance

c.	A hard wired production meter. It shall appear on the List of Eligible System Performance Meters provided by the California Energy Commission5.Refurbished meters may be used with the Program's pre-approval		
2.7.2	Multiple-inverter systems may either combine output through a dedicated sub-panel from which the output is metered or use one electric meter for each inverter	N/A	N/A
2.7.3	When a hard wired production meter is installed, the solar system meter shall have a UV-resistant label identifying it as the Customer Owned Solar Generator Output.	Minor	Health & Safety
2.7.4	All hard wired meters shall be set at 000000 or 999999 at time of shipment to the installer to ensure accurate and consistent "start" readings for every system.	N/A	N/A
2.8	**Battery Energy Storage Systems**	**Type**	**Category**
2.8.1	Batteries shall be located in a secure enclosure that meets seismic requirements and is weatherproof as needed.	Major	Health & Safety
2.8.2	Access to live battery terminals shall be limited per Oregon Electrical Specialty Code.	Major	Health & Safety
2.8.3	Flooded lead acid batteries shall be housed in an enclosure with adequate spill containment and vented to the outdoors, with a nearby clearly marked OSHA 29 approved safety kit.	Major	Health & Safety
2.8.4	Battery and inverter cables shall be properly sized, with secured crimps and lugs on ends. Lugs and terminals shall be listed for the wire type used.	Major	Health & Safety
2.8.5	Charge controller and inverter settings shall be appropriate for the installation's batteries, and set for grid-tied optimum performance.	Major	Health & Safety
2.8.6	Temperature compensation probes for inverter and/or charge controller shall be installed to control battery charge properly.	Major	Health & Safety
2.8.7	Array configuration shall operate within current and voltage limits of charge controller, accounting for temperature-adjusted array voltage under record high and low temperatures for that location.	Major	Health & Safety
2.8.8	For hybrid systems utilizing wind or micro-hydro turbines in addition to PV, battery overcharge protection using turbine regulation and/or diversion controller and diversion load shall be installed.	Major	Health & Safety
2.8.9	Ground fault protection shall be added to the System if required by code and not included in the inverter.	Major	Health & Safety
2.8.10	Customer manual shall include instructions for operation, maintenance and safety procedures for batteries, charge controller and inverter.	Major	Health & Safety
2.8.11	Systems with lithium ion batteries must use an appropriate battery management system.	Major	System Durability
3.0	**CUSTOMER MANUAL**		
3.1	**General**	**Type**	**Category**
3.1.1	Upon completion of installation, solar trade ally shall instruct the customer on proper system operation and maintenance and shall provide the customer with a manual (the "Customer Manual") that includes, at a minimum, the required items listed in Section 3.2 below.	Minor	Consumer Information
3.1.2	The Customer Manual shall be bound in a durable fashion.	Minor	Consumer Information

3.1.3	The Customer Manual along with the system permit(s) (approved electrical and, where applicable, building permit) shall be available during the onsite system verification.	Minor	Consumer Information
3.2	**Required Items**		
3.2.1	System Overview Page that summarizes:	Minor	Consumer Information
a.	System's size and operating conditions		
b.	Make and model of system components including modules, inverter(s), batteries, and energy storage system(s), etc.		
c.	System start-up and shut-down procedures.		
d.	Emergency and service contact information		
3.2.2	Electrical As-built Diagram that accurately depicts:	Minor	Consumer Information
a.	All electrical components (e.g., modules, inverters, disconnects, and meters), plus main service panel and utility connection.		
b.	Module series/parallel wiring, conductor and ground wire types and sizing, conduit types and sizing, and voltage drop calculations.		
c.	Inputs from existing wind or solar systems, if present.		
3.2.3	Contractor Warranty covering all parts and labor for a minimum of two years	Minor	Consumer Information
3.2.4	Manufacturer Data Sheets for modules and inverter(s)	Minor	Consumer Information
3.2.5	If a hard wired production meter is not installed, informational sheet describing how to read the system's total kilowatt-hour production from the inverter or system performance meter (i.e., microinverter monitor). See Energy Trust Solar Trade Ally Forms & Resources webpage for examples.	Minor	Consumer Information
3.3	**Optional Items**		
3.3.1	The following optional items are recommended to be included in the Custom Manual and/or provided to the customer in digital format (PDF):	N/A	Consumer Information
a.	Inverter Owner's Manual		
b.	Manufacturers' Warranties		
c.	Energy Trust Incentive Application		
d.	Utility Interconnection/Net Metering Agreement		
e.	Parts and Source List with component serial numbers		
f.	Manufacturer Data Sheets for other system components		