GoodLeap Design, Installation and Commissioning Standards

goodleap

Document Revision History		
Version Number	**Date**	**Revised By**
1.0	June 3, 2024	Ryan Inchaurregui
2.0	June 12, 2024	Ryan Inchaurregui
3.0	Nov 1, 2024	Ryan Inchaurregui
4.0	Nov 14, 2024	Ryan Inchaurregui
5.0	Nov 27, 2024	Carlos Lozano
6.0	Feb 21, 2025	Ryan Inchaurregui

OVERVIEW

This guide demonstrates how GoodLeap validates and enforces the requirements and standards for the design, installation and commissioning of GoodLeap PV and BESS systems.

SECTION 1: DESIGN STANDARDS:

System Specifications

- 3kW – 25kW
- Percentage offset of electrical usage must adhere to local utility requirements and any applicable rebate requirements
- KWH/KW: 800 MIN

Approved Equipment - Modules and Inverters

Modules and inverters installed on GoodLeap systems must be listed on GoodLeap's Approved Vendor List. Verify your preferred equipment with your GoodLeap Project Portfolio Manager before moving forward with designs.

Allowed Structures

Below is a list of approved mounting structures and eligible home types. If a structure is not present on this list, it is not eligible for GoodLeap's TPO products. Except Ground Mounted PV Arrays, all systems are to be installed on the primary structure associated with the account.

- Single Family Homes
- Duplexes/Triplexes
    - Customer must own roof/attic space
    - Customer must own wall where electrical equipment is installed
- Detached Garage/Guest suite
    - Assuming full code compliance & structural integrity
- Townhomes
    - Customer must own roof/attic space

- Customer must own wall where electrical equipment is installed
- Manufactured Homes
  - Customer ownership of the property land
  - Must have permanent foundation
  - PE Letter, Signed & Sealed validating structural integrity of the home
- Pergolas, carports, and covered patios are prohibited.
- Systems must be either installed on the ground, or on the primary structure. A combination of roof and ground mount is prohibited.

Flush Mounted System Requirements

- Designs are to be completed per the National Electric Code (NEC) and International Building Code (IBC) per the AHJ adoption cycle.
- Racking, modules, and mounting hardware must be installed according to the manufacturer's engineered requirements.
- Array(s) must be mounted on a permitted, code-compliant structure following all local jurisdictional safety requirements.
- Heat producing vents must never be spanned over with PV modules nor be allowed to come in contact with modules. Heat will damage the modules and will compromise the system's performance.

Flat Roof/Tilt Up Mounted System Requirements

- Designs are to be completed per the National Electric Code (NEC) and International Building Code (IBC) per the AHJ adoption cycle.
- Racking, modules, and mounting hardware must be installed according to the manufacturer's engineered requirements.
- Tilt-up arrays are only allowed on flat roofs - GoodLeap does not allow reverse tilt installations.
  - Tilt-up arrays must consist of only modules in single rows. Two or more rows on a single tilt-up structure are not allowed.
  - A tilt-up array must connect to only one roof surface (For example: a row of tilt-up modules cannot span over a hip or valley) The lower side of the array must be no higher than 8 inches from the roof.
  - Provide all specifications and dimensional details for tilt-up arrays including make/model of all structural components used.

Ballast System Project Requirements

Ballast systems are not preferred, but will be accepted on low slope roofs under the following conditions:

- Designs are to be completed per the National Electric Code (NEC) and International Building Code (IBC) per the AHJ adoption cycle.
- Racking, modules, and mounting hardware must be installed according to the manufacturer's engineered requirements.
- Must provide structural PE stamp and structural load calculations showing site-specific snow, wind, and seismic loading for the roof surface(s) with PV mounted on them. The letter must specify that the roof will support the dead load of the ballast system's weight and all other applicable loads.
- The proposed system is not in a Hurricane-Prone Region (ASCE 26.2). See 3.4.2 for the definition of Hurricane-Prone Region. Refer to ASCE website https://asce7hazardtool.online/ to determine if the system is in this defined region or ASCE/IBC codebook for wind tables.
- Correct spacing

Ground Mount Requirements

- Designs are to be completed per the National Electric Code (NEC) and International Building Code (IBC) per the AHJ adoption cycle. Ground mount installations are acceptable following these requirements:
  - Racking, modules, and mounting hardware must be installed according to the manufacturer's engineered requirements.
  - Pier drilled footings are preferred but spread footings and ground screws are permitted if the mounting surface is non-penetrable to required depths or a ground screw is installation preference.
  - Ground mount structures shall be installed to the minimum allowable approved engineering requirements. Elevated ground mount structures for shade or storage are prohibited.

Must be permanently fixed to the mounting surface and comply with local AHJ restrictions and property setbacks.

- The utilization of non-compliant UL Listed ground mounted racking systems are prohibited
- Customer must own the property where the ground mount will be installed.
- Trenching depth of conduit to point of interconnection shall be a minimum of 18" to TOC

- If using bifacial modules, conductors shall be sized in accordance with article 310 of the National Electrical Code.

Shade Analysis Guide

Shading will be determined by LiDAR when available. If LiDAR is unavailable, all surrounding trees and structures that cause shade must be manually modeled and accounted for.

If trees have been trimmed or removed after the most recent satellite image, please provide onsite pictures to eliminate or reduce the amount of shade on the array. GoodLeap will use these photos to modify our internal shade analysis. It is better to provide as many photos as possible to show any justification for shading discrepancies.

Site information image(s)

- Potential shading obstructions: Provide images of the overall condition of the property and any potential shading obstructions (for example: chimneys, vent pipes, HVAC equipment, trees, etc.).
- While GoodLeap recommends photographic evidence taken on-site, current satellite imagery with at least 5" resolution will suffice.

For installations where trees have been trimmed or removed, and when any other shade-causing items have been removed, or other items/obstacles added to the site, provide photos for the pre and post installation conditions. In all cases where trees will be trimmed or removed to increase solar access, the trees must be completely trimmed below the roof line or removed completely.

Design Inputs and System Loss Details

- General Settings
  - Simulation: PVWatts v6, Aurora
  - Shading engine: On
  - LiDAR Shading: On
    - When available and accurate. If not available, all shade producing objects (trees, structures) must be manually accounted for.
  - Horizon shading: On
- PV Watts
  - Inverter Efficiency: 97%
  - DC to AC ratio: 1.5
  - Weather Dataset: NSRDB-PSM3, NREL-PSM
- System Loses

- Nameplate rating: 1.00%
- Mismatch: 1.50%
- Connections: 0.50%
- Light-Induced Degradation:1.50%
- Wiring: 2.00%
- Soiling: 2.00%
- Availability: 2.00%
- Shading: Varies by site
- Age: 0.00%
- Snow:
  - 0% - AL, AZ, AR, CA, FL, GA, HI, LA, MS, NV, NM, NC, OK, OR, SC, TN, TX, VA, WA
  - 2% - DE, KS, KY, MD, MO, NJ, NY (City of New York Only), UT, WV
  - 4% - CO, CT, ID, IL, IN, IA, MA, NE, NH, OH, PA, RI
  - 7% - ME, MI, MT, NY, ND, SD, VT, WI, WY
  - 10% - MN
  - 16% - AK
- Other: 0.00%

Formatted: English (United States)

SECTION 2: INSTALLATION STANDARDS

Safety

Throughout the installation of the PV and BESS system, appropriate safety standards must be met. Utilize the OSHA standards for Green Job Hazards, and NFPA 70E Standard for Electrical Safety in the Workplace. There are (6) six major hazards that need to be accounted for at every installation site:

- Falls
- Lockout/Tagout
- Crane and Hoist Safety
- Electrical Hazards: Arc Flash and Shock
- Heat/Cold Stress
- Personal Protective Equipment

At minimum, the installing partner must have the following documents/PPE:

- SSSP – Site Specific Safety Plan. This is to identify the risks associated with the installation site of the PV and BESS equipment. The SSSP must include the lock out tag out procedure that identifies any potential electrical shock hazards on site and ensures they are isolated from the installers performing work.
- EAP – Emergency Action Plan. In the event of a serious incident, the installation crew must have documentation and contact numbers for the nearest emergency room location and nearest hospital location.
- PPE – Personal Protective Equipment. Everyone on site must utilize the OSHA specified PPE while conducting work as determined by the hazards present onsite and installing partners safety program:
    - Eye/Face Protection
    - Respiratory Protection
    - Head Protection
    - Foot Protection
    - Electrical Protective Equipment
    - Hand Protection
    - Fall Protection

Roof Quality

Addressing the roof age and condition with the homeowner during the sale or site survey is critical. Remember that the PV system will be going on the roof for 25 years or more. A thorough investigation of the roof membrane is the first step in designing an attachment solution that will be leak-free for decades to come. Roof leaks are ultimately costly to all parties and severely impact customer satisfaction.

Roof Types Not Allowed for GoodLeap installations:

- Clay Tile
- Slate Tile
- Glazed Tile
- Metal Shingle
- Metal Tile
- Wood Shake
- Cal Shake
- Tar & Gravel
- Copper

Low Slope Roofs

- Any roof under 2/12 (9.5 deg) is considered a low slope roof. A low slope roof must have the appropriate roofing material installed. TPO, EPDM, Foam, rolled comp, modified bitumen are acceptable. Any type of shingle is not acceptable due to potential leaks. If you encounter a low slope roof that has shingles, it must be reroofed prior to installing solar. Proper low slope roof mounts must also be used for installation. Manufacturers data sheets and documentation must be reviewed to confirm mounts can be installed on low slope roofs.

Roofing Attachments and Penetrations – Roofing attachments and penetrations must be properly flashed and sealed to the following applicable standards: supplied design drawings, International Building Code, Asphalt Roofing Manufactures Association, and the Tile Roofing Institute. Any product installed shall meet or exceed manufacturer specifications.

The following requirements shall be observed:

- All attachments shall have, at minimum, two forms of seal; 1. Mechanical and 2. Chemical.
- Flashings shall not contain any exposed nails or screws susceptible to the environment.
- Flashings shall not be installed to contact any existing roof flashings.
- Flashing components shall be all metal with the appropriate
    - waterproofing for the installed environment.
- Pilot holes must always be drilled prior to lagging any standoff into a rafter to ensure proper embedment. Appropriate sealant must be used underneath the base of a given standoff to ensure a water-tight seal around the lag bolt. Lag bolts must embed into the actual structural member the minimum depth the project engineering requires. All unused pilot holes or temporary holes created for safety anchors must be repaired and patched prior to completing the project.
- Clean and healthy roofing paper is critical to ensuring a good seal. Underlayment must be cleaned before attaching any sealant/flashing.
- If nails are removed to remove tile, seal all holes with proper sealant.

Structural Considerations

It is important to understand the age and type of framing the house has before selling and designing a PV system. New homes are built with up-to-date building code standards that

will generally be acceptable for additional rooftop PV loads. Older homes may need to be evaluated more carefully and structural upgrades considered before adding PV to the roof. Roof framing must be evaluated and confirmed to be able to handle the additional live and dead loads of adding a PV.

Equipment Installation Standards

All components of the PV System and BESS shall be installed to manufacturer specifications, supplied design drawings, and must meet or exceed NEC 110.12 pertaining to the installation's quality and workmanship.

Electrical Point of Interconnection

All electrically interconnected components shall meet or exceed Article 705 of the National Electric Code related to the Interconnection of Electric Power Production Sources.

- Any circuit breaker installed must be UL Listed for PV Back feed and shall match the panel manufacture.
- PV System breaker shall be installed at the opposite end of the main circuit breaker.
- Wire terminations inside the service panel shall be stripped, terminated, and torqued, to the manufacture specifications.
- After PV Breaker is installed, verify 240V L to L with multi meter.
- Load side taps, Insulation Piercing Connectors or IPC's must be installed per manufactures specification. If utilizing this method, a fused AC Disconnecting means will be required. Verify line voltage prior to energizing the load side of the disconnect.

Utility provided Renewable Meter Adapters (RMA), or Generation Meter Adapters (GMA), must follow utility requirements for interconnection.

Inverter Installation

SolarEdge - Installation Support Line (510) 255-8503

- Inverter clearances must be observed
  - Left/Right: 4" Minimum
  - Top/Bottom: 8" Minimum
  - Between Inverters: 8" Minimum
  - Vertically Stacked: 16" Minimum
- Mounting of the inverter shall utilize the supplied mounting brackets and follow manufactures specifications.

- Conduit connections need to utilize the factory knockouts. If utilizing ¾" conduit, the factory supplied reducing washer needs to be utilized.
- DC Wiring will enter the left side of the inverter and AC Wiring will enter the right side of the inverter.
- CT Installation of all customer loads, including existing PV systems, must be captured by the CT's. CT's must be placed between the main conductors and service meter.

Enphase - Installation Support Line (877)797-4743 Option #2 Option #2

- **IQ Combiner Panel**
- **IQ Combiner Panels are required for all PV Only systems with a maximum load of 80A. If the system exceeds the IQ Combiner capacity, a solar load center with stand alone Envoy is acceptable.**
- **PV + BESS are allowed to install a solar load center with a stand-alone Envoy. Photos are required of the Envoy serial number.**
    - Combiner installation clearances require at least 3' from the bottom of the combiner to the ground.
    - Combiner must be installed with the Envoy at the top due to the factory installed weep holes.
    - Install only Eaton BR Type breakers as required by the manufacturer.
    - CT Installation of all customer loads, including existing PV systems, must be captured by the CT's. CT's must be placed between the main conductors and service meter. Verify that the CT's are the correct polarity by utilizing the arrow indicator pointing towards the load (away from the grid).

Enphase Microinverter

- Utilize racking manufacture attachment bolts to ensure proper bonding within the system.
- Verify secure connector installation with an audible "click" between microinverter and modules
- Only factory supplied adapters are to be utilized. Field made adapters are prohibited.
- Q cable ends must be secured with factory provided sealing caps.
- Q Cable "jumpers" must be made using manufacture supplied components and installed per manufacturer specification.

Tesla - Installation Support Line +1 650 963 5655

- Inverter clearances must be observed
    - Minimum lateral wall space 18.2"
    - Minimum clearance; Left, Right, Above, Between 2"

- Solar inverter to Internet router 328’ Max
- Nuerio CT’s 15’ Max

- Mounting of the inverter shall utilize the supplied mounting brackets and follow manufactures specifications.
- Conduit connections need to utilize the factory knockouts.
- CT Installation of all customer loads, including existing PV systems, must be captured by the CT’s. CT’s must be placed between the main conductors and service meter.
- Mid-Circuit Interrupters (MCI)
  - MCI’s are only compatible with Staubli MC4 and EVO2 connectors. Cross mating of connectors is prohibited.
  - Always connect an MCI to one end of a series string or mounting plane sub array string.
  - MCI’s must be installed with a minimum clearance of ½" from module glass
  - Shall be connected in series with a module combination not to exceed 165 Vdc

DC Connectors – Factory and Field Made

- Module to module connectors shall only be mated with the same manufacturer. Cross mating of connectors or “MC4 compatible” connectors is prohibited.
- Power optimizer or Microinverter connectors must be the same manufacture as the module connectors. Cross mating of connectors is prohibited.
- Connectors made in the field are preferred to be Staubli MC4 and shall be installed per manufactures specifications. This includes tooling, assembly and proper torque.

Battery Energy Storage Systems

Commissioning Settings

- Batteries shall be commissioned in a Time-Based Control setting which utilizes the stored energy on a daily basis to maximize customer savings. The time base control needs to allow for a Minimum of 20% backup reserve, which will allow the customer to use the reserve in the event of a power outage.

Tesla Powerwall

- Only Tesla devices are compatible with the Powerwall, no third-party equipment in lieu of Backup Gateway or Backup Switch.
- No lineside or load site taps are permitted for Backup Gateway tie-in/feed
- Backup systems are only permitted with 120/240V single phase service only.
- 200A Maximum service or 200A of backup loads per NEC load calculations.
- For on-grid systems with a backup generator, the Backup Gateway must be connected upstream of generator MTS/ATS
- Powerwall must not interact with (or must be completely isolated from) any other storage systems or generation sources not listed with UL1741

SolarEdge

- Battery clearances must be observed
    - 8” minimum clearance on all sides of the battery.
    - Battery shall be mounted on non-combustible surfaces and must extend 28” on both sides.
    - 48” non-combustible surface above (overhangs less than 28” must be non-combustible.
    - 164’ maximum distance from Inverter to battery
- Mounting of the battery shall utilize the supplied mounting brackets and follow manufactures specifications.
- Conduit entries must utilize factory knockouts. For ¾" a reducing washer must be utilized.

Enphase

- Enphase requires all personnel installing or commissioning the Enphase Energy storage system to complete the Installation Certification Course. This is available through Enphase University.
- Battery clearances must be observed.
    - If mounting outdoors, the unit shall have a minimum bottom clearance of 6” and a top clearance of 12”
    - If mounting indoors, the bottom and top Clearance of 12”
    - Note, a full Enphase energy system will typically utilize 10’ of wall space.
- IQ System Controller clearances must be observed.
    - 36” from the bottom of the controller AFF
    - 12” from the top of the controller
    - 6” on both left and right sides of the controller
- Mounting of the energy controller shall utilize the supplied mounting brackets and follow manufactures specifications.

- Conduit entries must utilize factory knockouts. For ¾" a reducing washer must be utilized.
- Battery has a vertical tilt limitation of +/- 5 degrees.

Conduit General Requirements - When running conduit from the array to the equipment location, always consult the homeowner before installing the conduit run. The conduit run is one of the most aesthetically sensitive parts of a home PV installation and must always be gone over in detail with the homeowner prior to installation. In addition to the National Electric Code, the following must be observed:

- Always try to run conduit so that it follows natural roof lines like ridges, hips, valleys, and downspouts. Local Fire Marshall roof access guidelines may place other restrictions on conduit routing. Keep conduit runs clean and neat with offsets, 45-, and 90-degree bends.
- When routing conduit on the roofing surface, it must always be elevated 1-3 inches off the roof surface with a minimum clearance of ½". This will allow for less temperature and ampacity derating and will keep the wires and conduit cooler on hot days. The clearance off the roof will also prevent debris from collecting causing premature decay of the surface.
- Rooftop conduit support attachments must be of the following types:
    - Attached with a penetrating fastener and flashed to the roof surface using a recognized conduit support product made for the purpose and appropriate for the roofing type.
    - An additional mount of the same type used to support the PV array racking, (applicable for the roofing type) with a conduit clamp attached using the appropriate hardware.

Mounting devices designed for the purposes with a non-penetrating method of mechanical attachment capable of securing conduit and allowing for thermal expansion and contraction.

Installation Validation Photos and Document requirements

Photos of the complete system must be collected per the Quality Assurance Review Standard Operating Procedure document. Include photos of a quality assurance inspection report indicating work was performed in accordance with design documents. The photos below are the required list for project funding.

1. Inverter placard with serial numbers
    a. SolarEdge – Photo of inverter placard with serial number
    b. Enphase – Photo of combiner panel serial number

   c. Tesla – Photo of inverter placard with serial number
2. Photo of the module placard showing module type and wattage.
3. Photo of the Main Service Panel showing breakers and installed current transformers (CT's).
4. Photo of all batteries showing serial number and model number.
5. Photo of all arrays showing all modules installed.

SECTION 3: TESTING AND COMMISSIONING

After the system is fully installed, the crew lead or electrician must turn the system on to ensure proper functionality of all components before leaving the site. Testing parameters of 600W/ m^2 the following must always be verified:

- All circuits must be checked for Ground Faults
- DC and AC conductors must be tested for IRT in accordance with NETA standards
- DC circuits must be tested for polarity prior to landing on terminals
- DC and AC voltages and currents must be checked and confirmed to be within expected range
- System AC power output must be confirmed and benchmarked against irradiance and temperature
- Inverters and monitoring must be setup and commissioned per the manufacturer's instructions.
    - Enphase
        - Commission with Enphase Installer Toolkit 3.0
        - Verify all microinverters are synchronized and the system is producing power
    - SolarEdge
        - Commissioning with SolarEdge SetApp
        - Verify all optimizers have been paired and the system is producing power
    - Tesla
        - Commissioning with Tesla's Powerhub
        - Verify Tesla solar inverter is registered, connected, and producing power

All "as built" system characteristics must be recorded.

- Includes string layout and any changes to the original plan set. Inverter/optimizer locations must be mapped on a string layout and submitted to GoodLeap.
- Photos of the complete system must be collected per the QA pic list.
- The system must remain off after the site commissioning until the utility issues permission to operate (PTO) for the system.
- Instruct the homeowner as to the operation and activation of the system.
- When possible, leave all disconnects and breakers in the "on" position except for the one the homeowner will activate after PTO is granted. Add a tag to this breaker or disconnect reminding the customer of this requirement.
- For all TPO projects, monitoring must be setup and GoodLeap must be added as the "owner" of the system following the instructions from the manufacturer.
    - The email used for the owner must be: monitoring@goodleap.com
    - Mapping of the system layout is required in the monitoring portal
        - Maps need to match the final installed layout

Granting GoodLeap Monitoring access

Enphase – Associating a system with GoodLeap

There are two options for enabling GoodLeap access to Enphase systems

- Option 1: Associate system during initial registration
    - On the first page of the system activation form under system access
        - select the checkbox for Third Party Owned
        - enter monitoring@goodleap.com to the owner section under email
- Option 2: Associate system after registration
    - Navigate to the site in the Enphase Enlighten portal
    - Click the Settings button (gear icon)
    - Scroll down to the System Access section
    - Under email address, enter monitoring@goodleap.com and click Save
    - Set System Maintainer to GoodLeap and click Save

Additional Resources:

- Enphase Installer Support
- Granting Company Monitoring Access

- Managing API Settings

SolarEdge – Associating a system with GoodLeap

There are three steps to providing GoodLeap with access to SolarEdge

- Associating your SolarEdge account with GoodLeap's SolarEdge Account
- Setting GoodLeap's associated account permissions
- Granting GoodLeap access to the specific site for TPO projects

Associating your SolarEdge account with GoodLeap:

- Log in to the SolarEdge monitoring portal using your SolarEdge account
- Click on your username and then My Account
- Click on the Associated Accounts tab
- Click the + Add Associated Account button
- In the form that pops up, enter monitoring@goodleap.com as the email address
- Click Save

Setting GoodLeap's associated account permissions

- On the Associated Accounts tab, click GoodLeap's name to open the Associated Account Details pop-up
- Set Site Access Policy to Per-Site
- Set Access Level Limit to View/Edit
- Click Save
- Granting GoodLeap access to the specific site for TPO projects

Granting GoodLeap access to the specific site for TPO projects

- Navigate to the site in the SolarEdge portal
- Select the Associated Accounts tab
- Click Grant Access
- In the pop up, set the Associated Account to GoodLeap
- Set Access Level to View/Edit
- Check the checkbox and click Save

Additional Resources:

- SolarEdge installation guides
- SolarEdge installer support
- MySolarEdge App Guide

Tesla Powerhub – Associating a system with GoodLeap

- Please reach out to certifiedinstaller@tesla.com to add GoodLeap (monitoring@goodleap.com) to sites once commissioning & activation is complete.

Additional Resources

- Registering Your Tesla Solar Inverter
- Connecting to Tesla Solar Inverter
- Monitoring Your System
- Transferring Ownership of Your Solar System