Safety and Maintenance
High Voltage!

- Electricity does not warn you before shocking you
- High voltage shocks can kill you
- Turn everything off before you touch the system
Use Personal Protective Equipment such as hardhats, safety glasses, safety shoes, or gloves when handling solar equipment.
Thermal Runaway

- Cells can rapidly heat and release electrolytes, flames, and dangerous fumes in inappropriate conditions
- Solar modules should not exceed 25 C
- Heat adds resistance to the current, so for every degree above 25 C the performance will drop by 0.5%
- Read the manual for appropriate operating temperatures
Batteries

- If there is liquid near batteries, assume it is battery acid
  - Do not touch the liquid! It will burn skin and clothes
  - Dab a cloth in a solution of baking soda mixed with water to clean off the top of the battery

- Batteries are capable of overheating but come with protective equipment that protects it from extreme voltage, current, or incompatible temperatures
Crimped Cables

- Poorly crimped cables can potentially spark or short circuit acting as a possible fire starter
- If cables must be cut, use a high-quality crimper tool
Weather

- If high wind speeds occur, make sure the foundation is secure!
- Earthquakes can cause electrical wiring to tear away from the system which can lead to a short circuit and could turn into a fire
  - Run electrical wiring through a flexible conduit between large structures that can easily move
- If there are lightning storms a few times a year, use lightning protection devices
  - Devices encourage the strike to travel through a predetermined path
Animals

- Be careful if an elephant walks by the solar array, it might think the solar array is a lake and will attempt to sit on it

- Bird droppings can shade solar modules

- Rats or other rodents can chew wires
  - Possible falling leaves on those wires can cause fires
  - Cage off the edge of rooftop PV arrays if there are concerns about rodents
Please Remember..

- Have a partner check your work and watch for risk
- Read the manual
- Safety is the most important thing!
Operation and Maintenance of the System

- Important to do once a year
- Identifies problems that can come from age or the environment to help insure that the system is functioning
Module Maintenance

- Dust on the modules reduces the production of the system
  - Regularly clean off modules if in an area without regular rainfall

- Do not pour cold water on hot modules
  - Temperature difference could shock and crack the glass

- For rooftop arrays, check drainage and watertight seals
Battery Examination

- Inspect the area for liquid
- Check to see if the sides of the battery are bloated
  - Could be a sign of undercharging, over-discharging and/or sulfate build-up
- Test the voltage between the batteries and between battery cells to ensure minimal voltage differences
Inverter and Charge Controller Examination

- Clean air filters of the cabinet if accessible
- Both electronics tend to overheat
  - Use fans to prevent overheating, make sure to examine the fans yearly
- Check fuses, circuit breakers, and lightning arrestors
- Test for continuity on the system ground and equipment ground
- Most inverters and charge controllers last for 10 years
Inverter and Charge Controller Examination

● DC Over Voltage
  ○ Measure the voltage of the PV combiner box to check if voltage exceeds the input of charge controller or inverter

● AC Under/Over Voltage
  ○ Disconnect all AC sources and test the AC voltage
  ○ If it is within range, manually restart the inverter
  ○ If out of range, call the inverter manufacturer
Tools

Kill A Watt Meter

- Measures the power of individual equipment to help determine your consumption per device and possible voltage drops
- Calculates kWh, W, V, A, Hz, VA, PF
- Only plugs into the AC outlet after the inverter
Tools
Multimeters

- Measures voltage, current, and resistance
- Checks for continuity of the circuit
Tools
Clamp Meter

- Equipped with a clamp to measure current indirectly
- Clamps allow measurements to be taken without interrupting the circuit
Determines the actual tilt of the solar array or roof pitch
Tools

Solar Pathfinder
(Hardware or App)

- Measures the path of the sun and the shade in a particular location

- Helps to determine what the PV production will be
Tools
Hydrometer

- Measures the specific gravity in flooded lead-acid batteries
- Gravity helps to determine the voltage of each cell
- Large voltage differences indicate a malfunctioning or dead battery
Tools

Cable Crimper

- Used to join two metallic ends such as a connector to the end of a cable, or a cable to another cable.