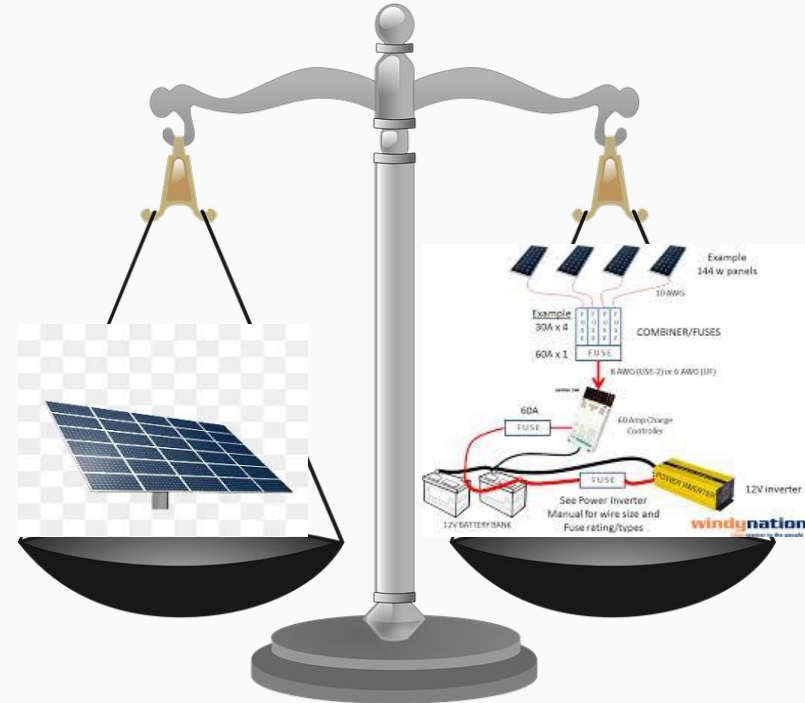


# Hardware and Tools



# Balance of the system (BOS)

All mechanical and electrical equipment and hardware (besides the major components) that are needed to finish the installation

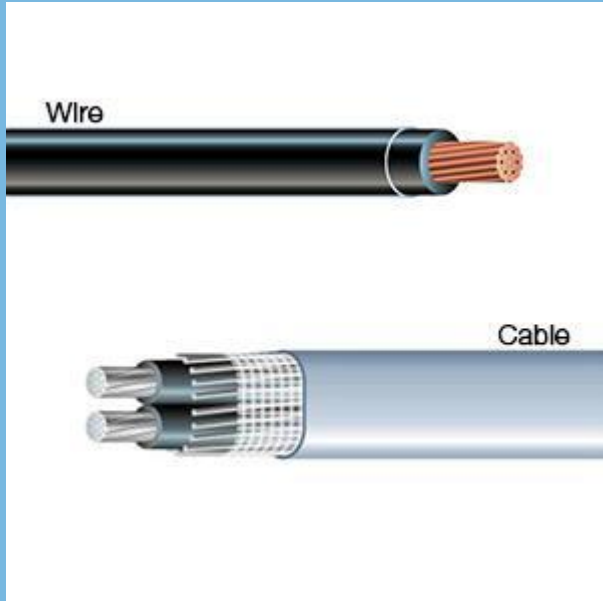


# Wires



- A copper or aluminium conductor → metals that allow current to flow freely
- Despite its higher cost, copper has lower resistance and is less easily corroded than aluminum

# Cables



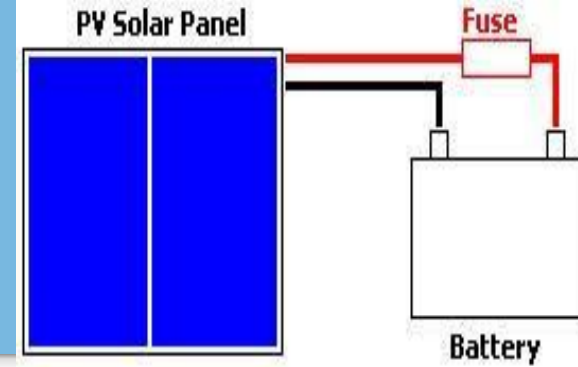
- Two or more wires inside a single sleeve
  - Sleeve on a cable is present to protect wires from water, UV light, and high heat

## Common Wire Types



- PV - used to connect PV Modules
- THHN/THWN- used inside cable trays and conduits
- USE/UF- designed for underground use
- RHH/RHW- rubber insulated for connecting batteries
- NM- used for AC wire in the interior of the house

# Fuses and Circuit Breakers



- Known as an Overcurrent Protection Devices (OCPD)
- Disconnects the circuit when the currents exceed their rated capacity
- Usually within a combiner box

Fuse

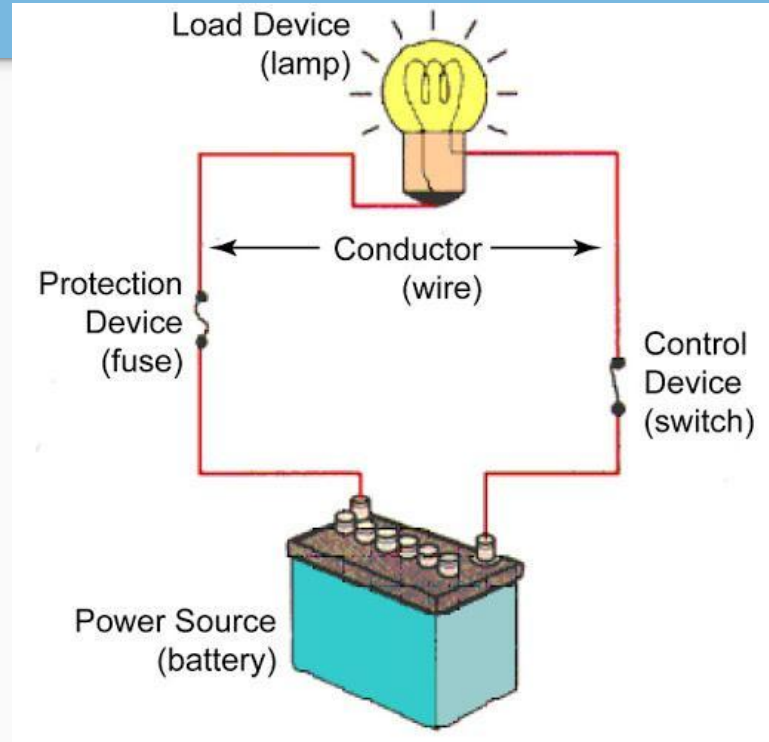


Circuit Breaker



# Fuses and Circuit Breakers

- Must have a capacity equal to or less than the conductor to which it is connected or else it will not function



# Combiner Box

- An enclosed box to safely combine ONLY parallel connections of conductors
- Bonds multiple wires together when you have multiple strings of PV modules
- Overcurrent circuit protection boxes (OCPDs) are within this box as well





# Disconnects

- A device that breaks the circuit to stop the flow of electricity in case of emergency, repair, or maintenance
- Combiner box can also function as a disconnect
- PV array and batteries should each have their own disconnect



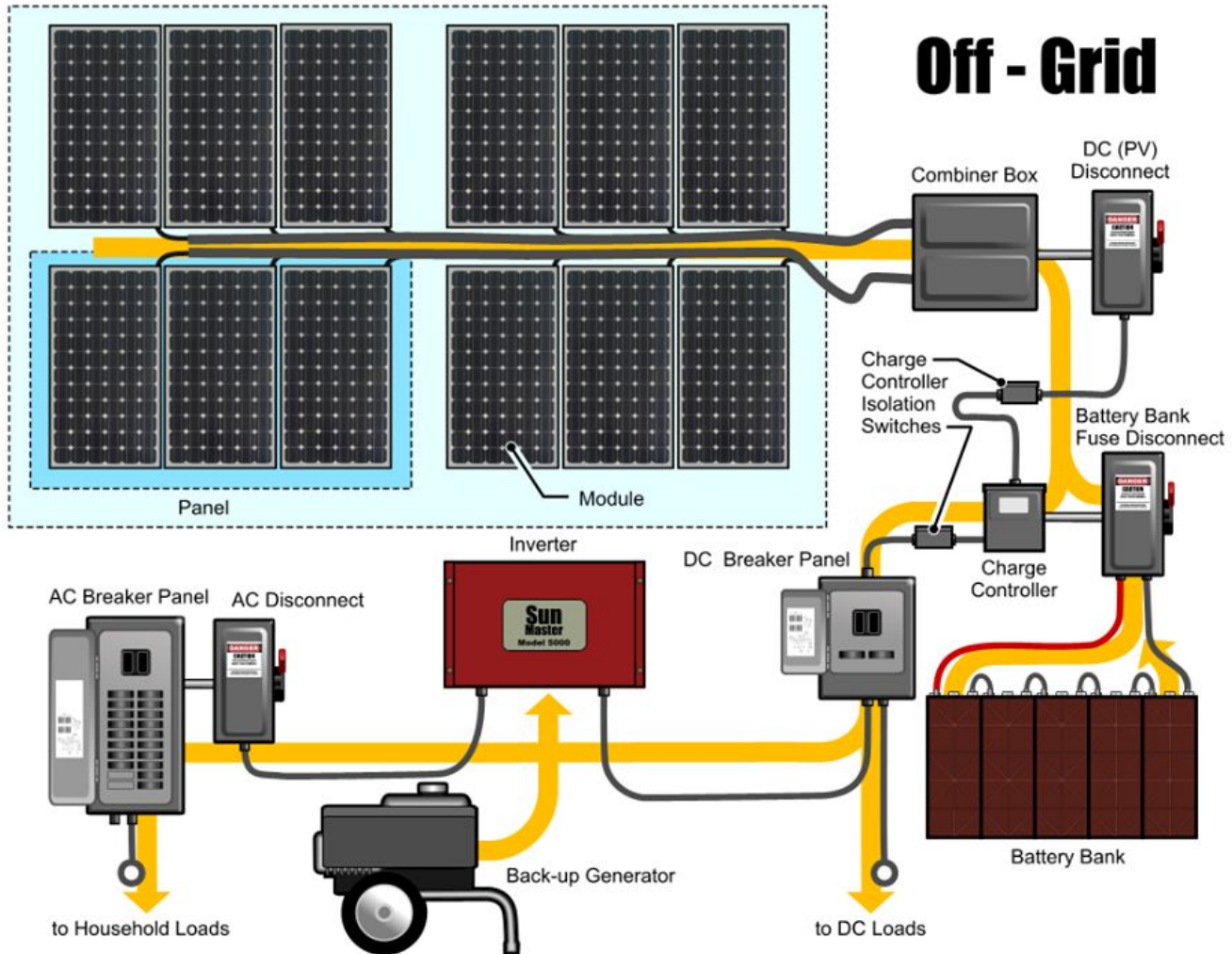
# Grounding

- Connects all the electrically conductive parts to have the same potential voltage as the Earth by connecting it to Earth
- Reduces the chance of electrical shock
  - Instruction manual will have instructions on how to ground your system



Array or PV Power Source

# Off - Grid



# 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

# Tools

## Angle Gauge



Determines the actual tilt of the solar array or roof pitch

# Tools

## Solar Pathfinder (Hardware or App)



### Sun Tracker AR 4+

Sunrise, sunset and position

Zuzana Eskinasi

★★★★★ 3.3, 6 Ratings

Free · Offers In-App Purchases

- 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