

Emergency power options

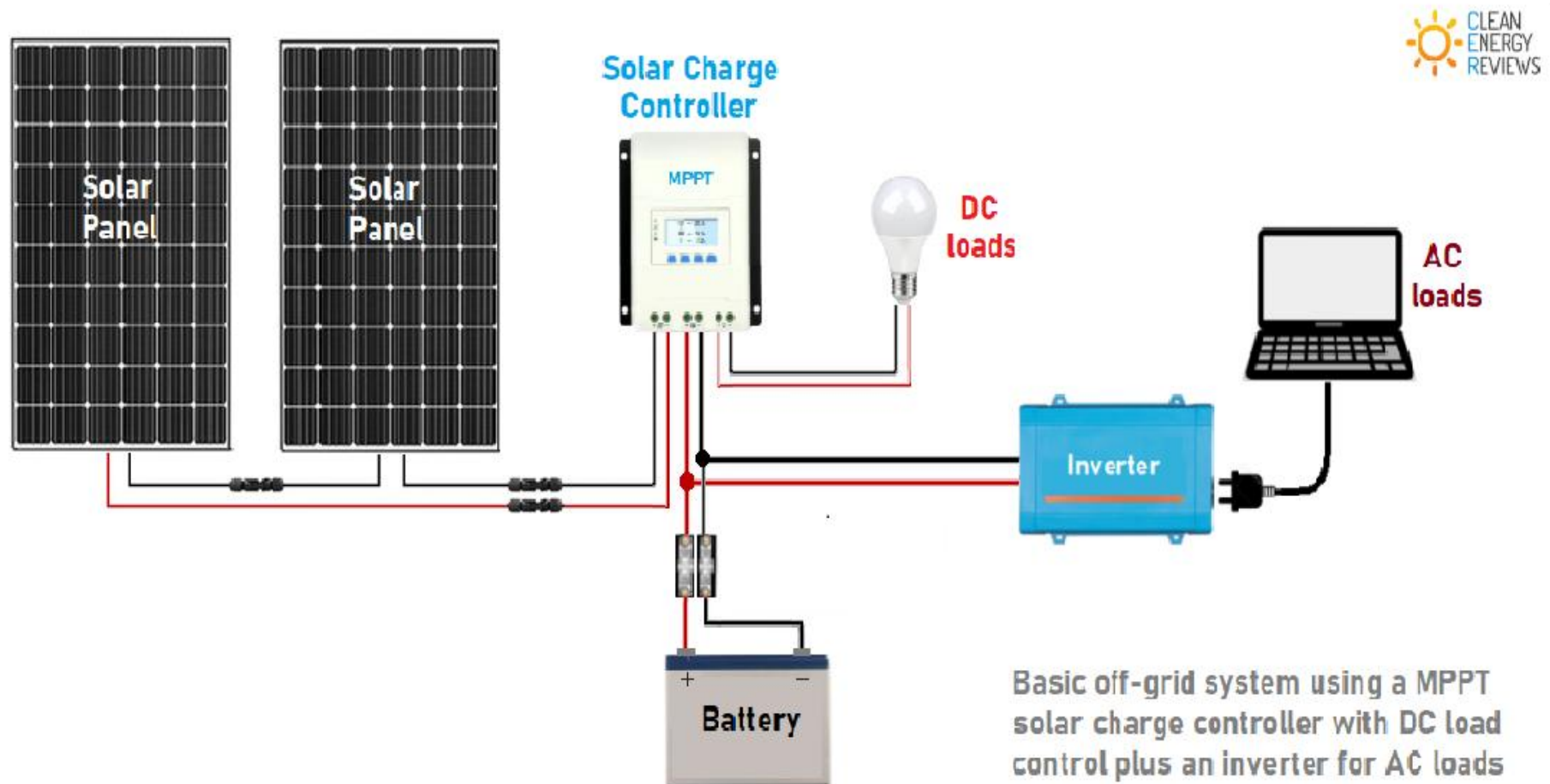


Solar, battery, fuel hybrid combination

General electrical principals

- Watt = voltage x current
 - Voltage pressure
 - Current is flow of electrons, higher amp larger wire AWG
 - Wattage is work done
- Direct Current DC no change in polarity
 - Battery, solar panels
- Alternating current AC-- alternates + and -
 - House outlets 120 volts, 15 amps = 1800 watts
 - Sine wave at 60Hz. Microprocessor chips in appliances require clean sine wave at 60Hz

Solar Battery Generator System



Integrated Solar Generators

- MPPT solar controller, battery, 120/240 V AC inverter, DC power output all in one unit
 - Advertised by AC inverter output in watts
 - Storage battery capacity in Watt hours—how many watts can the battery supply in one hour.
 - Mindful of varied options:
 - Number of solar input and voltage and amperage capacity , DC and USB output, expandability, battery chemistry.
 - Portable integrated adapted to emergency home vs home system adapted and made portable.

Solar Panel

•Watts advertised

- Done in ideal lab posted STD
- NMOT real world parameters, does not account for clouds, early morning and evening angle of the sun.

•Technological advancements

- Newer more efficient, Mono/Ply cryst, N-type, P-type, PERC
- Bifacial can use sun in more hours of the day, reflective sun.

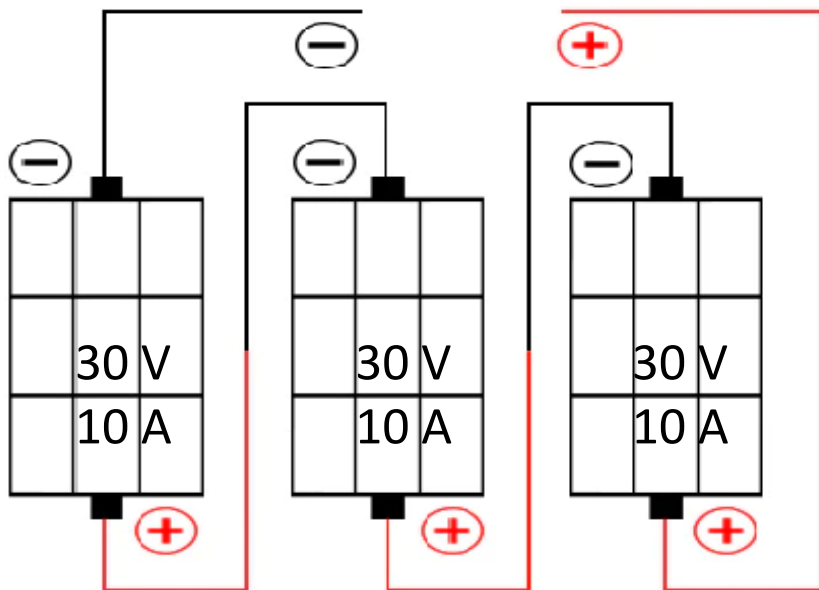
•Sun orientation hours of power, face South

- Our lat: 20-25 deg, 20 deg summer, 25deg winter
- Max power generation 10am-3pm, bifacial help morn evening

Wiring solar panels DC

- Group panels with same voltage and amps
- Series: voltage is added, amps stay same
 - **SUV: series ups voltage**
- Parallel: amps are added, voltage stays same
 - Higher amps, larger gauge wire with longer distance.

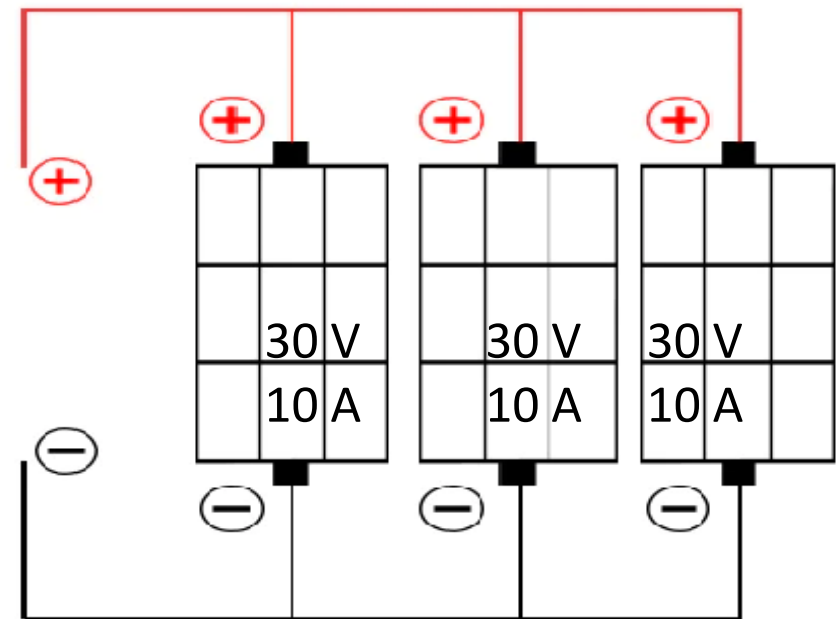
Voltage adds
Amps stay the same



Series

$$90\text{V} \times 10\text{A} = 900\text{W}$$

Amperage adds
Volts stay the same



Parallel

$$30\text{V}, 30\text{A} = 900\text{W}$$

How many Watt hours and panels do you need

- Determine what appliances are needed in an emergency. See list of appliances and Watt/hr
 - Add total watts needed in 24 hrs + appliances used short term
 - Long term to 24 hr: Refrigerators/freezers, fan, propane fireplace fan, GMRS/ham radios LED lights.
 - Periodic: clothes washer, wheat grinder, instapot, rice cooker, microwave, dehydrator, garbage disposal, septic sewage pump.
 - Watt hour battery capacity meet watt needs.
 - Solar panels able to charge battery in day light--average
 - 50% stated watts on panel for 5 hours, 25% for 2 hours
 - 400 watt panel, deliver 200W for 5 hrs + 100w 2 hrs = 1200W
 - 6100 Wat/hr battery need minimum 5, 400 Watt panels.
 - Most likely need to supplement with fuel generator.

Solar/Fuel Generator hybrid

- Use a fuel generator to charge solar battery generator with 120V AC
 - Fuel generator add 1800-3600 watts per hour to the solar battery.
 - Use the fuel generator at night to top off battery or morning if low.
 - If fuel generator has enough watt output, use periodic items and charge battery at the same time.
 - Use instapot, food dehydrator, wheat mill, wash clothes while charging battery.
 - Do not over draw your fuel generator watt capacity.
 - Fuel uses 1/3 gallon per hour 4000 watt generator, 2-3 hours/day 5-7 G/week
 - Gas stores poorly, 6 months even with nonethanol and additives
 - Propane stores long term, but less energy dense than gas.
 - Power delivery--extension cords. Know the amps/watts and gauge of cord wire
 - Gauge of cord limits watts and amps it can carry
 - See handout, 14 AWG 13-15 amp, 12 AWG 18-20 amp, 10 AWG 25-30 amp