

Emergency power options

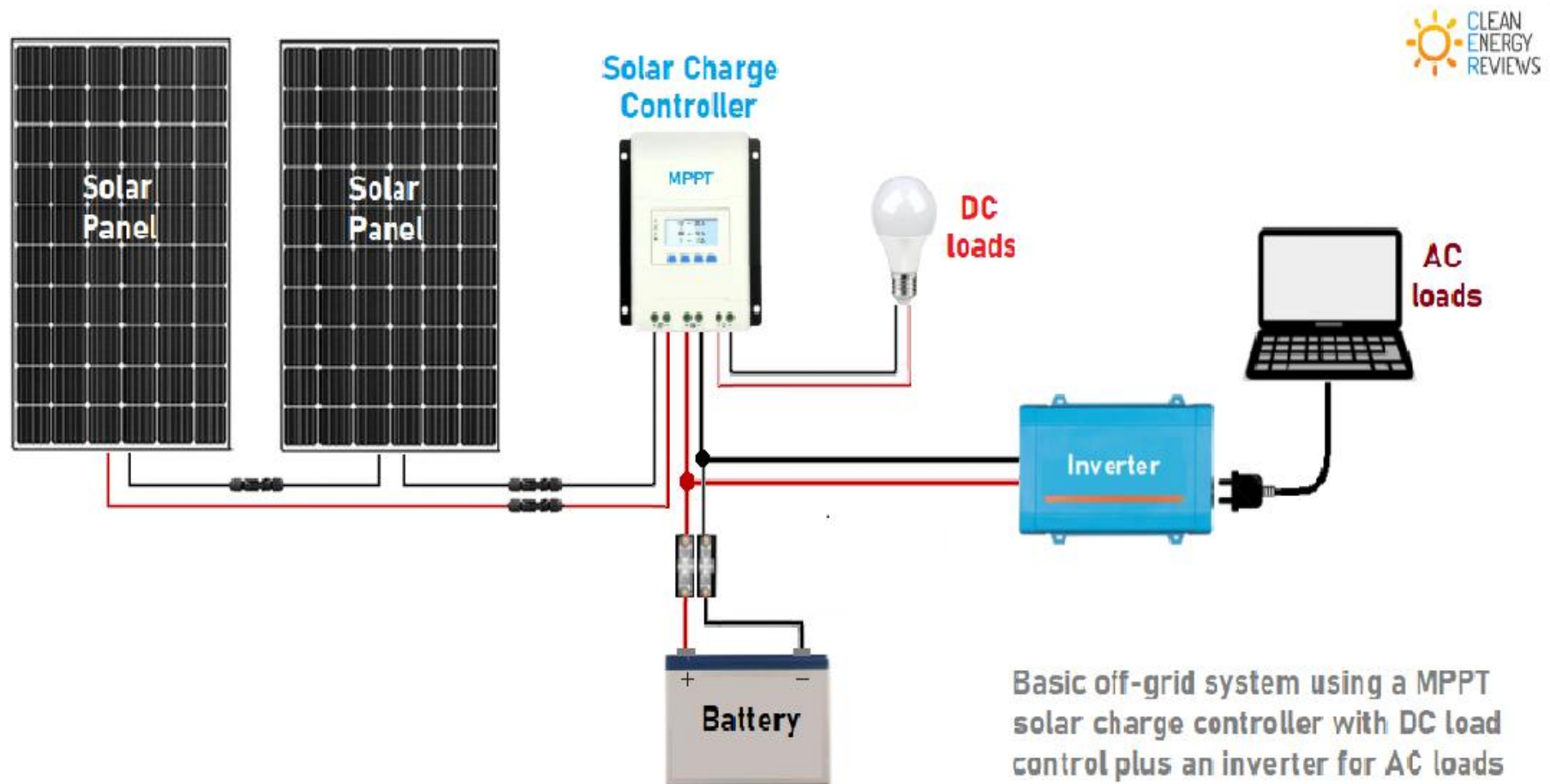


Solar, battery, fuel hybrid combination

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 or battery WH
 - 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.
 - DC to AC Inverter is clean and safe for microchips

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.

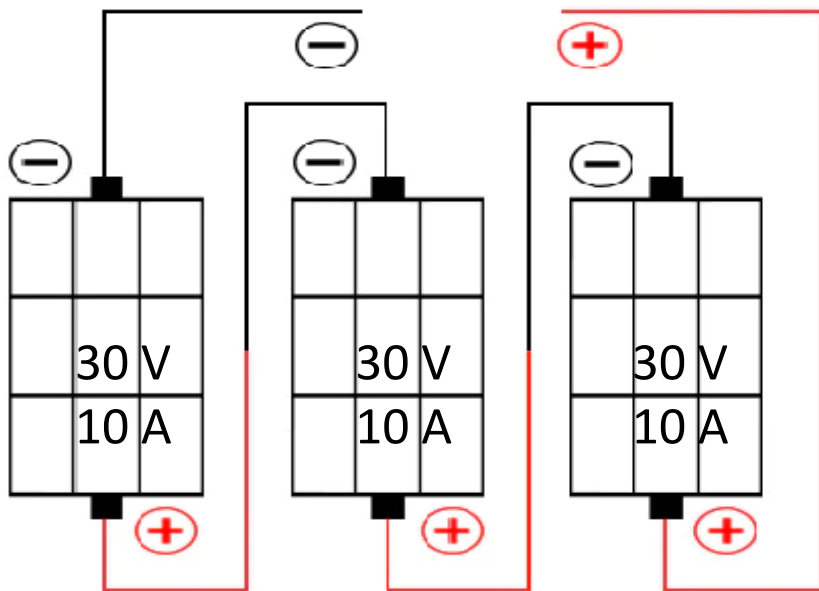
•Sun orientation hours of power, face South

- 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.

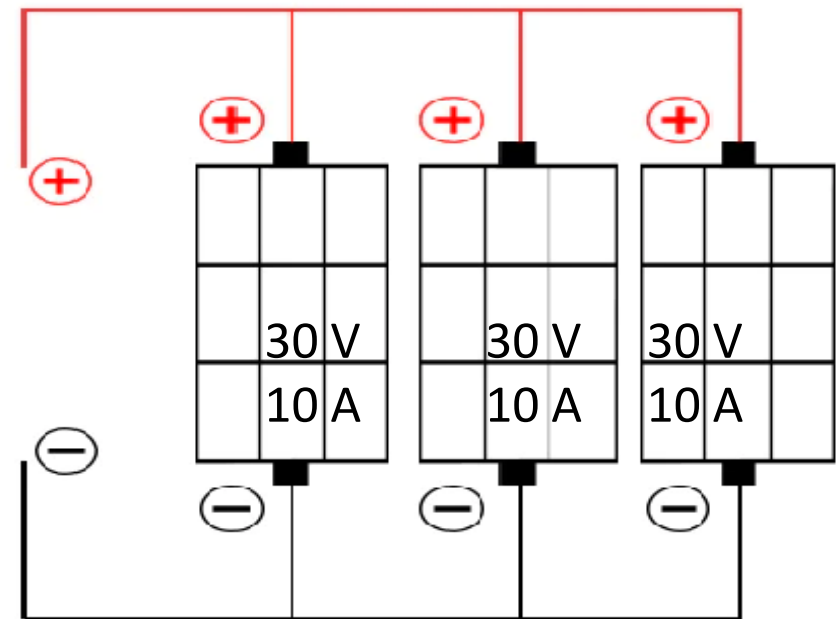
Voltage adds
Amps stay the same



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
 - 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

Power Delivery options

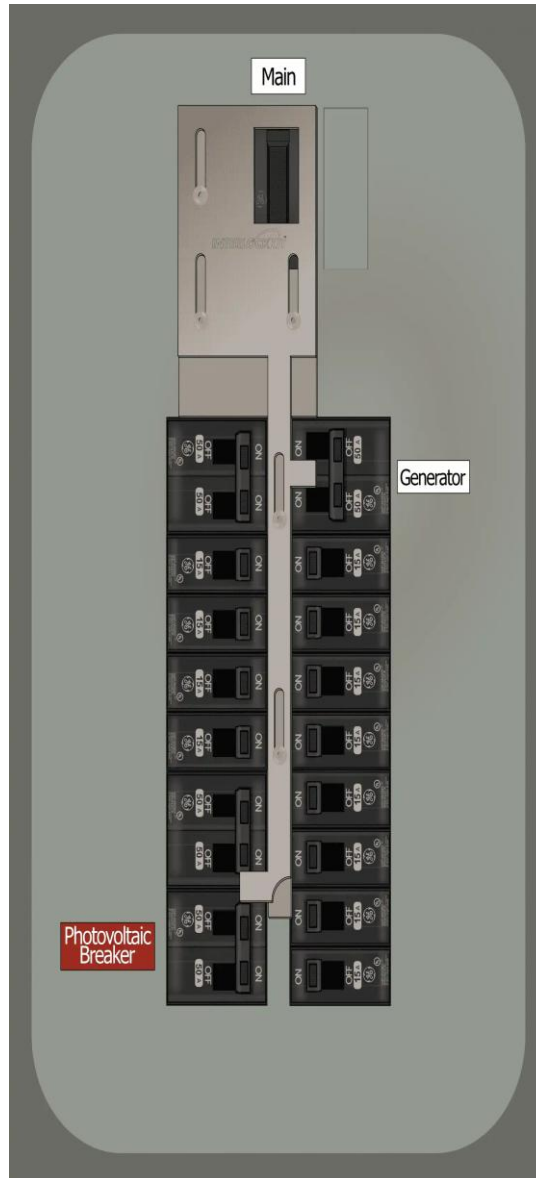
- **Extension Cord:**

- Gauge of cord limits watts and amps it can carry and is length dependent:
 - See handout, 14 AWG 13-15 amp, 12 AWG 18-20 amp, 10 AWG 25-30 amp

- **Generator Interlock Or Transfer Switch** into breaker panel

- Allows generator to plug directly into house breaker panel by a backfeed transfer breaker switch or interlock switch and power selected circuits.
- Manual interlock mechanism forces the main power switch to be off when generator breaker is on.
- Transfer Switch manually switches between generator and grid power with its own breakers.
- Circuits selected are limited to power output of generator. 240 V vs 120v and amperage.
- Need minimal of 120V and 30 amp output on generator. Ideal is 240V 30-50 amp output.
- **NEEDS Washington state electrical L and I permit.**
- Average cost for electrician \$700-1500.
- DIY \$300-500.

Generator Interlock



Manual Transfer Switch Panel















BORA.
Workhorse XT™

PLIER
DOUBLER
1ST



SEE IT IN
ACTION
REARREDESSE
EN ACTION
VERBODEN
ACCORD



MAX
1000 LBS
450 KG

MAX
1000 LBS
450 KG



Configuration rapide
Configuration rapide



Emballage
emballage en carton
Carton en carton



Appuyez sur le bouton
45, 30 x 30 pouces
Poussez le bouton de
25 x 25 pouces

MAX
1000 LBS
450 KG

















