Building a Solar Generator
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Why Build a Soar Generator

- Field Day – AARL
- Winter Field Day
- Jamboree-on-the-Air (BSA)
- Portable Operation
- Emergency Power
Why Build a Soar Generator
Comparing Solar and Gasoline Generators

Solar Generators
• Clean and quiet
• No fuel to store
• Weather dependent
• Low upkeep
• Higher initial cost

Gasoline Generators
• Easily available
• More power for lower cost
• Need to store fuel
• Difficult to start
• Carbon monoxide
Components of a Solar Generator

- Solar Panel
- Charge Controller
- Battery
- DC/AC Power Inverter
Solar Panels

- PV panel should be sized to match the capacity of battery and charge controller
- Capacity of battery in AH divided by 5
- Example: 40 AH / 5 = 8 A
- 100W panel = 5.5 A
- 1 - 100W solar panel for a 40 AH battery
Solar Charge Controllers

- Regulates the power going from the solar panels to the batteries
- PWM: More simple circuitry; less efficient; less expensive; light weight
- MPPT: High voltage panels can be used to charge a 12v battery bank; converts excess voltage into amperage; 95+ percent efficient; heavier; more expensive
PWM Solar Battery Charge Controller
(FlintHills Radio)
MPPT Solar Battery Charge Controller (Newegg)
Deep-Cycle Batteries

• Sealed Lead-Acid (SLA)
  o Gel Cell
  o AGM (Absorbent Glass Matt) batteries
• LiFePO₄ (lithium-iron-phosphate)
• LiFeMgPO₄ (lithium-iron-magnesium-phosphate)
Benefits of AGM Batteries

- Good option for Ham radio use
- Sealed - low maintenance
- Heavy
- Less expensive
Benefits of LiFePO$_4$ Batteries

- Twice the run-time and a third the weight of a comparatively sized lead-acid battery
- Handles high loads better, less voltage drop
- May last as long as 3,000 cycles
- Nearly maintenance-free
- Mounts any orientation; up recommended
- Less fire danger than earlier lithium designs
Charging a LiFePO₄ 12V Battery

• Bulk/Absorb: 14.2 – 14.6 Volt; 0 – 2 hours
• High charge rate: Capacity/2 (40AH/2 = 20A)
• Float: 13.6 Volt or less
• Best to stored at a partial charge
Charging a LiFePO$_4$ 12V Battery
Discharging a 40AH LiFePO$_4$ Battery

- Maximum continuous discharge: 30 A
- Maximum 30 second current pulse: 80 A
- Cut-off Voltage: 10V
- Run-time @ 10A: 240 minutes
- Run-time @ 30A: 80 minutes
- Run-time @ 23A: 100 minutes
- 100W HF radio: 180 minutes
Discharging an LiFePO$_4$ Battery
Built-in Battery Management System

- Protects from over charge/discharge
- Limits charge/discharge currents
- Monitors cell temperatures
- Balance the cells during charging
For long LiFePO$_4$ battery life

• Keep the battery temperature under 30°C
• Keep charge/discharge currents under 50% capacity; 20% preferred
• Charge battery above 0°C
• Do not cycle battery below 10-15% SOC
• Do not float the battery at 100% SOC
Power Inverters Converts DC to AC current

• Modified Sine Wave
  o Simulates sine wave
  o Not compatible with many devices
  o Less expensive
Power Inverters - Convert DC to AC current

• Pure Sine Wave
  o Clean power; household AC
  o Better for motors and electronics
  o Greater efficiency
Common electronic devices that should not be used with a modified sine inverter

- Battery chargers
- Variable speed tools
- Electric shavers
- Newer TV’s
- Some laptops
- Induction cooktops
- Items with brushless motors
- Coffee makers
- Electric blankets
- Microwaves
- Audio equipment
- Laser printers
- Many digital clocks
- Medical equipment
Non Grid-Tied PV/Solar System
Solar Generator Block Diagram

- Solar Panels: 90 Watt, 6 amp output
- Charge Controller: 10 amp
- 15 amp fuse
- 10 awg
- Inverter: 400 Watt, 3 1/5 amp output
- 4 awg
- 6 awg
- 60 amp circuit breaker
- Batteries, 12 Volt, 220 amp*hour
## Costs to Build Your Solar Generator

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>COST</th>
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<tbody>
<tr>
<td>100 Watt 12V Solar Panel</td>
<td>$110.00</td>
</tr>
<tr>
<td>40AH Valence Battery (eBay)</td>
<td>$100.00</td>
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<tr>
<td>Solar Charge Controller (FlintHills Radio)</td>
<td>$40.00</td>
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<tr>
<td>300W BELTTT Pure Sine Wave Inverter</td>
<td>$50.00</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$300.00</strong></td>
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Resouces

• https://sunelec.com/home/
• http://ki0bk.no-ip.com
• https://www.solacity.com/how-to-keep-lifepo4-lithium-ion-batteries-happy/
• https://lithiumwerks.com/valence-batteries/standard-modules/rt-modules/
• Craigslist, eBay, Amazon, Newegg, etc.
The End