

Electric Power on the Go!

## **Managing Your AC & DC Power - Off-Grid**

**Presented By:**

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DC Electrical Loads

- 12-Volt DC is the Most Important Power source you will need when AC power is not available
- **Everything** Electric In Your RV Home Runs On 12 VDC Power Except:
  - Roof Air Conditioners
  - Microwave
  - TV & Satellite System
  - Residential Refrigerator

DC Power

- Maintain Your Battery Bank
  - Check Electrolyte In Wet-Cell Batteries Monthly
  - Top Off With Distilled Water Only
  - Keep Terminals & Cables Clean
    - Resistance Equals Heat, Heat Equals Wasted Energy

DC Power

- Maintain An Ability To Recharge Your Batteries
- An ME-SBC Keeps All Batteries at Peak Charge
- Solar Panels and Controller
  - Search eBay for used ones, They Last 20 Years
  - A Small Fuel-Efficient Generator
  - An Efficient Converter, Inverter/Charger or Battery Charger
  - Wind Or Water Power To Drive A Small Generator
  - See [www.samlexsolar.com/calculator](http://www.samlexsolar.com/calculator)

House Battery Charging

The Challenge is to Charge All Batteries When A Power Source is Available & Not Discharge Them When Not Connected

A Battery Isolator Allows This But is Very Inefficient

A Battery Control Center Uses A Solid State Control to Operate a Paralleling Relay to Control Battery Merging

A Permanent Battery Boost Switch Will Cause Imbalanced Charging

ME Smart Battery Combiner

Solar Panel Arrays

Solar modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect.

Supplements battery charging

Three Types of Solar Cells

Polycrystalline

Mono-Crystalline

Thin Film Arrays

90% of 2013 Production was Crystalline Silicone

Sensitive to the relative angle toward sun

The Most Efficient Solar Cell in Production Today is 21.5% (16.2 Watts/sq. ft.)

Typical RV System is 8% Efficient

Full Output is Only Possible When Sunlight is Concentrated Directly into Solar Cells

– June 21<sup>st</sup> at Noon or with a Motorized SolarArray Mount

Portable Solar Kit

Portable Solar Kit

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Portable Solar Kit

Portable Solar Kit

12-Volt WINDMILL (DB-400) Wind Generator

12-Volt Wind Generator

- WINDMILL (DB-400) 400W 12V Wind Turbine Generator kit residential, agriculture & marine.
- Built in MPPT charge controller + automatic and manual braking system & volt meter.
- DIY installation providing off-grid green energy power.

12-Volt Wind Generator

- FEATURES: Made for both land and marine. Integrated automatic breaking system to protect from sudden and high wind speed. Easy DIY installation methods with all materials provided. Can be used in conjunction with solar panels. MPPT Maximum power point tracking built into the wind turbine generator. Made with high quality Polypropylene and Glass Fiber material with a weather resistant seal.
- PROTECTION AGAINST: Salt water corrosion, UV protection coating, Sudden voltage surge and wind gust, high wind speeds with integrated automatic breaking system + manual breaking switch and over charging of battery.
- SPECIFICATION: Rated power: 400W, Rated speed: 46 ft/s, Voltage system: 12V, Cut-in wind speed: 6.7mph, Suggested battery capacity: 50A or larger, Number of blades: 3, Rotor diameter: 4 ft and Light weight: 16,75 lb.
- INCLUDES: 1 x Center piece + tail (including generator + MPPT), 3 x Blades, 1 x Nose cone, 1 x Manual break switch + voltmeter display box, 9 x Hex bolts (Large), 2 x Hex bolts (Small), 1 x Hex key, 11 x Nuts, 20 x Washers, 1 x Unilateral open wrench and 1 x Operational installation manual.
- WARRANTY: 1 Year manufactures warranty.

12-Volt Wind Generator

12-Volt Wind Generator

Hybrid Solar Windmill

Fuel Efficient Generator

Fuel Cells

Fuel Cells operate on a variety of fuels

LP gas (Propane or Butane)

Methanol

Natural Gas

The fuel is not burned, it is chemically processed

Fuel goes in one end, water and Carbon Dioxide come out the other.  
Fuels Cells are twice as efficient as an Internal Combustion engine-driven GenSet  
Fuels Cells are virtually silent

See for more

info:[http://www.siriusintegrator.com/images/2015%20RP250\\_RP500datasheet\\_10-8-15.pdf](http://www.siriusintegrator.com/images/2015%20RP250_RP500datasheet_10-8-15.pdf)

### **RP250/RP500**

LP/Nat Gas Fuel Cell

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LP/Nat Gas Fuel Cell

Efficiency

Fuel Cell Technology

**Whisper Quiet, Clean,**

**Green & Tax Credit Eligible**

Unlike loud, noxious engine generators, the RP's virtually silent fuel cell core enables the direct generation of DC power without emitting NOx and SOx pollutants.

RP

CO2 emissions are significantly lower than combustion based generators. By switching to an RP from a Thermoelectric Generator (TEG), a user can reduce carbon footprint by up to 50 tons/year or the equivalent of removing 10 cars from the road for a year. Fuel cell products like the RP are defined as renewable energy sources by the US government and are eligible for state and federal tax credits that can be \$3,000 per system or more.

Battery Technologies

Wet Cell

Limited Life-Good For 350 Charge/Discharge Cycles

Must be Constantly Charged-30%/month Discharge Rate

Electrolyte Boils Off Quickly When Heavily Charged or Discharged

Heavy

AGM (Absorbed Glass Mat)

Extremely Low Gassing-Meets Military Spec

No Corrosion

Long Life

Mounts in Any Direction

Lithium

Weighs 80% Less Than a Lead Acid Battery

Good For 4,000 Charge/Discharge Cycles or about 8 Years

2%/month Self-Discharge Rate

[http://www.siriusintegrator.com/images/Relion\\_DataSheets.pdf](http://www.siriusintegrator.com/images/Relion_DataSheets.pdf) for more information

600 Amp/Hr Lifeline AGM Battery Bank

Large Lithium Ion Battery

Large Lithium Ion Battery

Smaller Lithium Ion Battery

Smaller Lithium Ion Battery

## Lithium Ion's Advantages

Courtesy of RV Pro Magazine

Lithium batteries also offered faster charging times, charging to 99 percent in 2.5 hours versus up 13 hours for lead acid batteries.

Longer life

No freezing in extreme temperatures

Lighter battery weight

Ability to mount in any direction

No maintenance required

95 percent energy efficient

No corrosion

Lead free

Does not require a fully charged condition for storage

## Lithium Ion Applications

Forest River has chosen to install the Progressive Dynamics PD4060LIK converter/charger and the RELiON RB100 lithium battery in their New Forester/Sunseeker Ford Transit series RV.

## DC Power

- Suggested Upgrades
  - Replace ALL Incandescent Light Bulbs With L.E.D.'s
  - Use AGM Or Lithium Ion Batteries i.l.o. Conventional Wet-Cell
  - Upgrade Converter To One With A Charge Wizard
  - Only Replace Entire Battery Bank! Use Matching Battery Brand, Size and Capacity

## AC Power

- Use An Inverter To Convert DC Battery Power To AC Household Current
- Use A Small, Fuel-Efficient, Quiet Generator
- Build In A Generator For Greater Security & Efficiency
- Maintain Enough Fuel To Power Your Generator
- Turn Off ALL Non-Essential Loads

## AC to DC Converters

A Converter "converts" 110 VAC Shore Power to 12 VDC to power household lighting & appliances

Maintains the charge in household batteries

New Models Available with "Charge Wizard" Circuitry That Prevents Over-Charging of Battery

## Inverters

Converts 12 VDC from Battery Bank to 110 VAC to power electrical appliances such as televisions, microwave ovens, coffee pots, etc.

Operate from a simple 12 VDC outlet or can be hard-wired for specific AC Loads

Available in Modified & Pure Sine Wave Models

## Inverter/Chargers

Converts 12 VDC from Battery Bank to 110 VAC to power electric appliances such as televisions, microwave ovens, coffee pots, etc. when not connected to Shore Power or running the AC generator

Three-Stage Charger that Recharges & maintains battery bank @ peak charge  
Easier on Battery Banks Due to Three-Stage System

Example: Bulk Charge 150 Amps, Absorb Charge 75 Amps & Float Charge =  
Whatever You Are Taking Out

Replacing a Converter With An Inverter/Charger

Simply Unplug Converter & Retain it For an Emergency

Find a Suitable Dry Location Near the Battery Bank For Inverter

Keep It Close, 4/0 Battery Cable is Very Expensive!

Route AC Power From Your Breaker Panel

Route Inverter Power Back To a Sub-Panel

Transfer New Inverter Loads From Main Panel to New Sub-Panel

Install an Inverter Remote Control Panel

Enjoy!

Modified Sine Wave Inverters

A modified version of the square wave form to comply with 60 hz (Cycles per  
Second) requirements

Will cause GFI breakers to "buzz"

Causes Video Noise on CRT televisions

Must not be used to run induction loads such as air conditioners or refrigerators  
that use traditional compressors

Pure Sine Wave Inverter

Replicates AC power available from Shore or AC Generator

Can be used to power any AC Load

Very efficient use of DC battery power

MSH-M Hybrid Inverter/Charger

The MSH-M Series Inverter / Charger from Magnum Energy – a pure sine wave  
inverter designed with true hybrid technology allowing it to run larger loads from  
smaller generators.

MSH-M Hybrid Inverter/Charger

Hybrid technology: Most inverters only use one source of energy to power loads,  
either from incoming AC power – shore or AC generator – or from the batteries. The  
MSH-M Series combines the energy from both sources to power loads. This allows  
the inverter to recharge the batteries when there is surplus power or deliver more  
power to the loads if they require more than the AC input can supply by itself.

MSH-M Series Inverter/Charger

ME-ARC Inverter/Charger Control

AC Generators

Portable Generators

Inexpensive to purchase

Can be used in a variety of applications

Too D@\*#%\$\*D Noisy!

The Only Exception are the Inverter Models From Honda, Yamaha, Etc.

Do not meet NPS noise restriction of 60db @ 50 ft.

Not rated for continuous use

Relatively short lifespan (Throw-away)

High Fuel Consumption

A Little Diesel for  
B-Conversion RV's  
Built-In RV Generators  
Securely Built-In to Your RV or Towing Vehicle  
Quiet !!! Meet National Park Service Sound Level Requirements (60 dB(A) @ 50 ft)  
for National Park Use.  
Many Sizes Available to Fit Your Specific Needs  
LPG, Gasoline & Diesel Fueled  
Fuel Tank Built-In to The RV  
Wired Directly into coach's power distribution  
Remote Control conveniently located inside coach

Pros of LPG GenSets  
Ease of Installation – Uses On-Board LPG Supply  
Very Popular In Towable, Slide-In and Entry Level Diesel Motorhomes  
Excellent Choice for Low-Use Ownership  
Low Maintenance  
Run Extremely Clean

Cons of LPG GenSets  
Expensive to Operate – 6500 Watt Onan \$3.50/hr.  
20% Less Efficient 4Kw on Gasoline = 3.6Kw on LPG  
Very Thirsty – Will Empty two 7.5 Gal Tanks in 15 hours  
A typical weekend of dry camping ( 48 hours) will consume 8 bottles of LPG  
Once you are out of Propane, you cannot cook, heat water or heat your coach.  
Cannot be Easily Replenished, Must Locate an LPG Filling Station  
Cannot Be Operated Below 0 Degrees F

Pros of Gasoline GenSets  
Fuel source readily available  
Costs Less to Operate than LPG at similar Load  
20% More Energy in a Gallon of Gasoline Than a Gallon of LPG (120,000 BTU vs.  
96,000 BTU)  
I Highly Recommend Onan EFI Over Carbureted Models

Cons of Gasoline GenSets  
Must Add Fuel Tank if Used in a Towable  
Must Be "Exercised" at Least Once a Month  
Carburetor Can Gum Up in as Few as 29 Days  
Effective January 1, 2011, gasoline generator sets on trailers, diesel chassis or any  
other non-motorized mobile apparatus must have an EVAP generator set, approved  
tank, EVAP canister, hoses and fittings all meeting the CARB Tier 3 and EPA phase 3  
standards and specifications. This law applies in all 50 states.

Pros of Diesel GenSets  
Extremely Fuel Efficient  
Diesel Contains About 50% More Energy Than LPG  
A 30 Amp Diesel GenSet Will Average 7 – 10 Hours per Gallon of Fuel, 5 Hours at  
Rated Load  
At Average Load That Works Out to Be about 20 Cents/Hour-Depending on Cost of  
Fuel

Longevity – Will Operate Trouble-Free for Tens of Thousands of Hours

Low Maintenance

Can Share Same Fuel Source As Propulsion Engine on Diesel Coaches or Towing Truck

Cons of Diesel GenSets

Initial Purchase Price – About Twice That of a Comparable Sized Gas Unit

Size & Weight – About Twice That of a Comparable Sized Gas Unit

Requires It's Own Fuel Tank if Building Into a Towable

Q & A

Questions About ANYTHING

I Have Spoken About Today?