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## Options for EnviroKarma Solar Battery Backup Systems, rev. 7/7/2023

Battery Backup Systems (BBS) from EnviroKarma are designed to provide reliable power at the lowest cost with reasonable quality/value components. The heart of the systems are appropriately sized pure-sine Inverters designed to provide up to 1500 watts at 120vAC for the smallest portable system, 3000 watts for 'backup loads' larger loads at a jobsite, camping or even an entire house. This is more than a single average 'home outlet', and should be enough power to run several individual appliances, or used as a 'generator' to energize multiple 120vAC outlets in a home as long as the total load does not exceed Inverter capacity at any given time once the home has been isolated (disconnected) from normal Grid power and any Grid-tied PV system.

This is typically NOT enough to run private wells which are typically 240ac, and have 2hp or larger motors with high 'surge' load at startup. Wells typically require larger Inverters (8kw-10kw), which is certainly possible but requires care design with significantly more Solar, battery and a bigger inverter.

There are multiple ways to configure and install a BBS to meet your needs. Variables are:

1. Type of installation: stationary shelving or portable to determine recommended battery type and capacity.
2. Number of Solar panels, determining how much Energy is available daily to capture or use.
3. Type of batteries: Flooded Lead Acid (FLA), Absorbed Glass-Matt (AGM), or Lithium
  - FLA, commonly called 'deep cycle' or RV batteries are the least expensive, but require periodic maintenance watering, and will spill acid if tipped over.
  - AGM, are non-spillable sealed lead and last about 700-2000 charge/use cycles if discharged to no more than 50% of total capacity.
  - Lithium batteries are about 30% more expensive than AGM, but smaller, lighter, and will last 2000-5000+ charge/use cycles if discharged no more than 80% regularly.
4. Number of batteries, determining how much energy is available when Solar is not available. Typical 'small system' batteries are available in about the same max capacity of 100ah x 12v = 1kWhr of energy for ease of use and handling in about the same space. Lithium batteries are significantly lighter, and a little smaller, and require half as many for same usable energy; but they cannot be charged if core temp is below freezing, so they need to be inside, or provision made to warm them to keep above freezing.



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Popular packages:

1. **The 'Overnighter'**, a small Portable (fits in a standard 20" 'Carry-on' bag), featuring:
  - a. 1500 watt pure-sine inverter with (2) built-in 120v outlets
  - b. (1) 100ah-12v Lithium battery yielding up to 1 kWhr energy per charge
  - c. 20amp PWM charge controller (small and inexpensive)
  - d. Custom 'jumper cables' for fast charging from a vehicle when solar is not available.
  - e. One, or two, 100watt – tier1 mono-crystalline solar module, foldable wood rack, 25' cable. This is enough for light camping, charging cordless tools, or small critical loads.

**Total cost for BBU with (1) 100watt module and 25' cable = \$1187** for base model, additional 100watt solar module and folding rack is available for \$200 for faster re-charge and more energy available each day. Includes custom Male-male adaptor(s) available for backfeed to outlets to energize whole 'circuits', and custom jumper cables for recharging the unit from vehicles.



2. **The 'Journeyman Weekender'**, is a medium sized Portable (built on a rolling toolbox), featuring:
  - a. 3000 watt pure-sine inverter with (2) built-in 120v outlets, and one 120v-30amp outlet with your choice of outlet/inlet to match your planned use ... OR, upgrade the Inverter to output 3000watt split-phase (120/240v) if you need to run small 240v loads.
  - b. (2) 100ah-12v Lithium batteries yielding up to 2 kWhr energy per charge
  - c. 20amp PWM charge controller (small and inexpensive) for trickle charging, or (suggested) 40amp MPPT if you expect to use more Solar Energy every day.
  - d. 100watts – 1000 watts of Solar, depending on expected use – tier1 mono-crystalline solar module, foldable wood racks for ground or roof, or direct mount to your trailer, cabin. The amount of Solar is sized to provide your typical daily Energy needs.



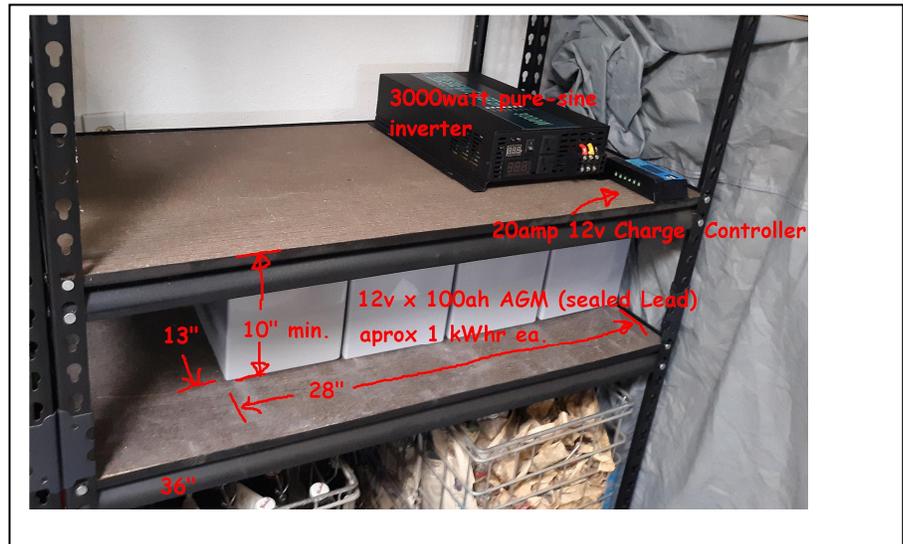
This system is enough for job sites, small cabin weekends, camping, charging cordless tools, and small 240v loads (like a shallow well with a small pump) if upgraded to the split-phase Inverter. **Typical package cost for a 120v system with 30amp RV output is \$2612 and upgrade to 240v split phase with NEMA 14-50 outlet and M-M adaptor is \$3003** . Additional Solar can be added (up to 1000 watts can be installed) for quicker re-charge and more daily Energy needs. Optional Male-male adaptor(s) are available for backfeed to 120v or 240v outlet to energize whole house 'circuits', and optional jumper cables for direct recharge from vehicles are available if Solar is unavailable or Energy use exceeds battery capacity.

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3. **'Whole House'** systems are available to backup important loads when the Grid Power goes down. **Base model configuration for a stationary system in a garage will cost around \$3200 with 4x AGM batteries**, 400w solar module and matching charge controller, etc. Batteries can be added, or switched from AGM to Lithium... and modules could be added to provide faster daily recharge and more daily Energy for extended outages.

If there is NOT already a 240v NEMA 14-50 outlet available within 4' of shelving unit location, then one can be added to backfeed power during outages. Typical install costs \$250-\$800 depending on type of Service and desired location for the outlet. Alternatively, extension cords and adaptors can energize the home by backfeeding two existing 120v 15amp outlets with custom adaptors:

- 365-410w solar recommended minimum (depending on brands available) with MPPT charge controller to generate 1.5kWhr-3kWhr per day depending on season and hours of sun
- 3000w pure-sine 120vAC inverter, plenty to run a refrigerator, lights, charge phones/computers, and other basic 120vAC loads. NOT intended for A/C, well pumps, or other large 240v loads.



- 4 AGM batteries, each providing about 1 kWhr max (0.5kwhr usable per charge) Additional AGM batteries and cables may be added at a cost of \$250 each for additional capacity, or switched to Lithium for longer life and about 0.8kWhr capacity each at a cost of \$450 each.
- Garage shelf mount, typically in a 18"x36"x72" shelving unit, requiring 2 shelves for system
- Standard 240v NEMA 14-50 outlet will be used for 'backfeed' in case of Grid Outage after 'Main' disconnect has been turned off to isolate the home from the Grid, and all other 240v circuits, including grid-tied Solar circuit, have been turned off to prevent overloading the backup Inverter. Cost of outlet is NOT included in BBU system cost as a fixed cost because there are many variables; but typical install cost adds \$300-\$800 when done by a Licensed Electrician.