# Solar Shuttle Enterprises
# “Solar Shuttle”
# Solar Trailer

**A photo essay showing some of the nearly 30 events from year 2010 where the Solar Shuttle provided event power around Texas and the USA!**


## The Solar Shuttle…

**A Portable Renewable Energy Resource Providing 100% Solar Electricity for Events, Education, and Support for First Responders in Times of Emergency.**

**Silent. Fuel-free. Pollution-free. Reliable.**


**100% solar power for Irving, Texas Earth Day Sound Stage, April 10, 2010. (3,500 attendees.)**


**Powering vendors at "Live Green Expo", Plano, Texas, April 17, 2010. (18,000 attendees.)**

**City of Dallas, Texas Earth Day sound stage, April 18, 2010. (10,000 attendees.)**

**City of Fort Worth, Texas "Prairie Fest", April 24, 2010. (4,800 attendees.)**

The Solar Shuttle powered 10 bands at Prairie Fest 2010, including "Brave Combo", a multiple-Grammy Award winning group. There's no utility power anywhere in the Nature Reserve. The Solar Shuttle and its predecessor systems have been the ONLY source of power at this event since 2006!

**Invited by Frito-Lay to Power Exhibitors at the Frito-Lay "Eco Fair", April 27, 2010.**
Frito-Lay Corporate Headquarters, Frisco, Texas.


**Mayfest, Fort Worth, Texas, April 29-May 2, 2010. (225,000 attendees.)**
The Solar Shuttle powered several booths for the entire four-day event (including an air conditioner!)

**Midwest Renewable Energy Fair, Custer, Wisconsin, June 18-20, 2010. (22,000 attendees.)**
Powering 42 vendors in the two main buildings and the Main Information Tent.


**Solar Shuttle at a Simulated Emergency Communication Exercise, June 26 & 27, 2010.**
The Solar Shuttle provided 100% of the electricity needed for the entire weekend exercise.


**Powering the Mother Earth News Fair Main Tent in Seven Springs, Pennsylvania, Sept 25-26, 2010.**
(16,000 attendees.) The Shuttle looks large here .. but look again! (See next photo.)

**The Solar Shuttle (yellow circle) is dwarfed by the main tent. More than 160 exhibitors took part.**
44 exhibitors were outside. 120+ were inside the resort main hall (background).

**Solar Shuttle Interior View. Looking forward from the rear, equipment stowed, ready for transit.**


All systems, including the solar panels, are fully redundant for the ultimate in reliability.

Equipment in the racks, starting from the top down:

- Two Exeltech 5,000 watt true sine-wave inverters (top units in each rack).
- Two Exeltech 1,100 watt sine-wave inverters (below main inverters).
- Two Blue Sky Energy maximum-power-point trackers/charge controllers (white boxes below main inverters).
- Circuit breaker bays: All circuit breakers are magnetic-trip (not thermal). This means they are unaffected by temperature, and will trip at their specified current regardless of the ambient conditions. All battery-side DC breakers are UL-rated for DC operation, with very high-current interrupt capability. AC output is protected by UL-certified circuit breakers and UL Listed overcurrent shutdown circuitry.

The blue bins (photo above) contain a variety of utility items such as emergency lights, tie-down straps, tape, tools, extension cords, power strips, tire compressor tire inflator attachment, and miscellaneous hardware. Almost anything one would need for an event .. or an emergency power situation.


AC power from the Solar Shuttle is available less than one minute after arriving on site. The solar panels do not need to be deployed for electricity to be generated, though they are usually set up and positioned toward the sun for optimal energy production.

When the Solar Shuttle is in operation, whether for event power or emergency purposes, only one inverter is typically used at a time. This provides an identical backup "just in case". For notes, there have been zero equipment failures in more than 12 years of providing solar power.

In this photo, the left-side 5,000 watt inverter is active. The other three inverters are available to provide more power if needed, or, in the unlikely failure of a main inverter, serve as immediate backup sources.

**Solar Shuttle Interior – View from Inside Looking to the Rear**
**The Two Large White Battery Enclosures in the Foreground Hold More than 1/2 Ton of Battery.**

Each battery box contains a set of four Rolls-Surrette lead-calcium batteries, wired for 24Vdc, and rated for 10 kilowatt-hours at a 20-hour discharge rate. Each main inverter (topmost unit in each rack) as well as the backup inverters (rectangular units below the main inverters) are also visible.

Large cables exiting the side of the battery box connect both battery systems in parallel when needed, doubling the total energy reserve to 20.16 kilowatt-hours. An additional 50% battery capacity was added in 2013 in the form of a third and fourth battery banks (not shown), increasing the total battery reserve to 30.8 kilowatt-hours. All four battery systems can be used independently, or paralleled in any combination as needed.

Separating the battery systems and adding an inverter to each one creates completely four separate systems. This allows for 400% redundancy, and the ultimate in reliability. Should a failure occur in one system, an identical system is immediately available and can be online in seconds. It should be noted .. in more than 12 years of providing portable solar power, there has never been a failure of any kind in any of the equipment. If it's well designed, properly built, and responsibly treated and maintained .. it will last a very long time.

With only five hours of sunlight per day, the Solar Shuttle PV system can generate and store enough energy to power emergency communications equipment, portable cell-phone towers, medical refrigerators, battery chargers for first-responders' radios and cell-phones, and countless other loads. Best of all, the Shuttle can do so almost indefinitely, and unattended. Unlike noisy mechanical generators, no refueling or maintenance of any of the equipment is required when deployed.

**Given the option of a generator .. or the Solar Shuttle .. which would YOU prefer for your event?**

## Solar Shuttle Electrical Specifications

| | |
|---|---|
| ♦ Power Source | Photovoltaic Modules (exclusively) |
| ♦ Photovoltaic Module Manufacturer/Model | Sanyo HIT-215 premium PV, high-output, high-temperature. |
| ♦ Total Number of Photovoltaic Modules | 10 |
| ♦ Photovoltaic Module Specifications | 215 Watts. 5.13 amps at 42 volts (at maximum power point). |
| ♦ Nominal Total PV Panel Output Power | 2,150 watts rated (+10%/-0%). 2,500 watts measured output. |
| ♦ PV Adjustment Range | 0° (horizontal) to 90° (ver tical). Manually positioned and locked. |
| ♦ Charge Controllers (two) | Blue Sky Energy SB50 with optional Digital Data Display. |
| ♦ Charge Controller Maximum Current | 50 Amps each. |
| ♦ Peak Charge Controller Output Power | 3,000 watts |
| ♦ Batteries | Rolls-Surette S420, 6Vdc, deep-cycle lead-calcium, flooded-cell. |
| ♦ Total Number of Batteries | Eight – four each in two separate 24Vdc systems. |
| ♦ Battery Amp-Hours (each battery)* | 420 amp-hours @ 20 hour discharge rate (20.16 kWh).* |
| ♦ Battery Configuration | Two independent banks, four series batteries each (24Vdc). |
| ♦ Auxiliary Battery System | 24Vdc at 445 amp-hours (10.68 kWh additional reserve). |
| ♦ Total Battery Amp-Hours | 1100 amp-hours @ 20 hour rate (all battery banks in parallel). |
| ♦ Total Battery Reserve** | 30,840 watt-hours @ 20 hour rate (all battery banks on line).** |
| ♦ Main Inverters (two) | Exeltech MX, 5 kW, true sine-wave, continuous duty. |
| ♦ Auxiliary Inverters (two) | Exeltech XP, 1.1 kW, true sine-wave, continuous duty. |
| ♦ Total Continuous AC Output (all inverters) | 12.2 kW $AC_{rms}$ (no time limit except for battery reserve). |
| ♦ Peak AC Output Power (all inverters combined) | 25.2 kW $AC_{rms}$ (surge). |
| ♦ Inverter Safety Switches | Yes. Main inverters – DC input @ 300 Amps. UL certified. |
| ♦ Over-current Protection | UL certified magnetic-trip breakers. Unaffected by temperature. |
| ♦ AC Output Voltage | 120 V, 60 Hz, 102 Amps $AC_{rms}$ maximum continuous. |
| ♦ AC Output Waveform (all inverters) | True sine-wave. Total harmonic distortion less than 1.5%. |
| ♦ AC Output Receptacles (Main Inverters) | NEMA 5-20 (4 per system), accepts 15 and 20 amp NEMA plugs. |
| ♦ AC Output Receptacles (Backup Inverters) | NEMA 5-15 (2 per system), accepts 15 amp NEMA plugs. |
| ♦ Energy Metered | Yes, on main MX inverters. |
| ♦ Data Output | Ethernet interface to 802.11g wireless router. |
| ♦ Safety Certifications | |
| Underwriters Laboratories | UL Listed to UL1950, UL1703, UL1741, UL489, and others. |
| National Electric Code | Fully compliant with the National Electric Code, NEC Section 250 "Portable and Vehicle-Mounted Generators", and other Sections. |

* An auxiliary battery system was added in 2013, increasing the total capacity by 50% to 30.8 kWh.

** Two smaller portable solar power systems are available for loads at your event that are remote from the Solar Shuttle. (See next page.)

**Special thanks and acknowledgement to the many Solar Shuttle sponsors:**

| | | |
|---|---|---|
| ♦ **Exeltech** | 12,200 watts of sine-wave inverters | www.exeltech.com |
| ♦ **Texas Instruments** | Ten Sanyo high-output photovoltaic modules | www.ti.com |
| ♦ **Blue Sky Energy** | Maximum Power Point Tracking & Metering | www.blueskyenergy.com |
| ♦ **APW Mayville** | Custom Inverter Racks | www.apwmayville.com |
| ♦ **Radiant Solar Technology** | Custom Battery Enclosures | www.radiantsolartech.com |
| ♦ **Licor Biosciences** | Solar Irradiance Sensors | www.licor.com |
| ♦ **W & W Silk Screening** | Custom Vinyl Graphics | www.wwsilk.com |

**Need more power?**
Events often need additional or temporary power at sites remote from the main power. Why rent a separate generator? Instead, the Shuttle Power Wagon™ and Shuttle Power Cart™ auxiliary power systems may solve your problem!*

For instance:

- Races often have participant registration at a location far removed from the start/finish line.
- Small public address systems are needed to make announcements such as child lost and found!
- Battery charging stations for two-way radios used by event volunteers help keep your event running smoothly. (Can also be used to charge cell phones!)
- After-hours area lighting. A safety feature! Avoids running extension cords in dark areas!

... and many others.

**Shuttle Power Wagon™**
Ideal for small-to-medium loads up to several hours.
(Solar panel not shown.)

**Shuttle Power Cart™**
Ideal for small loads and/or short-term use.

**Shuttle Power Wagon™ and Shuttle Power Cart™ Specifications**

| Specification | Shuttle Power Wagon™ | Shuttle Power Cart™ |
|---|---|---|
| DC Power Source | Photovoltaic Module (exclusively). | Photovoltaic Module (exclusively). |
| Photovoltaic Modules | One. | One. |
| Photovoltaic Module Output | 240 Watts. | Either 40 watts (integral) or 180 watts (external). |
| Charge Controller | BZ Products MPPT 500 with digital display. | BZ Products MPPT250 with digital display. |
| Batteries | Four Crown Battery 12CEA100 | One Crown Battery 12CEA100 (12V). |
| Battery Amp-Hour Rating | 200 A-H at a 20 hour discharge rate. (4.8 kWh). | 100 A-H at a 20 hour discharge rate. (1.2 kWh). |
| Battery Configuration | Two in series, two sets in parallel (24Vdc). | One battery. 12V. |
| Inverters (one) | Exeltech XP1100, 1,100 watts, true sine-wave. | Exeltech XP250, 250 watts, true sine-wave. |
| Output Voltage and Current | 120 Volts, 60 Hertz, 9.2A, true sine-wave. | 120V, 60 Hz, 2.1A, true sine-wave. |
| AC Output Receptacles | Two NEMA 5-15. Accepts 15 amp NEMA plugs. | One NEMA 5-15. Accepts 15 amp NEMA plugs. |
| Safety Certifications | Underwriters Laboratories: UL Listed to UL1950, UL1703, and others. | Underwriters Laboratories: UL Listed to UL1950, UL1703, and others. |
| National Electric Code | Fully compliant with the National Electric Code, NFPA 70, 2008, 2011 Editions. NEC Section 250 "Portable and Vehicle-Mounted Generators", and other Sections. | |

* The Shuttle Power Wagon™ and Shuttle Power Cart™ are available for rent only in conjunction with the Solar Shuttle and must be arranged at the same time as the Solar Shuttle.

**For more information, contact Solar Shuttle Enterprises**

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