SOLAR STIK™

After-Action Report
Solar Stik™ in Galveston, Texas for Hurricane Ike

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1. Executive Summary: Brian Bosley, the Chief Operations Officer, and Dr. Stephanie Hollis, both representatives for Solar Stik™, arrived in Galveston right after Hurricane Ike passed over the city. They brought with them three of the company's revolutionary new solar and solar-wind generators in order to help the first responders and the people of Galveston. Initially, the authorities were skeptical and ordered Brian and Stephanie to leave, but they relented when Brian showed just how effective the Solar Stik™ System was.

a. During their five-day stay in Galveston, Solar Stiks™ provided power for charging laptop computers, radio batteries and flashlights to the police, fire department, and the Texas Army National Guard. They also provided power for lighting inside Ball High School, which was used as a shelter and mess hall for victims and responders. They even powered coffeemakers and microwaves for people onsite. Solar Stik™ "Power Paks" acted as auxiliary power units (APUs) for emergency vehicles, allowing them to conserve their fuel and eliminating diesel noise & exhaust fumes.

b. While in Galveston, Brian and Stephanie received a number of impassioned calls from other parts of southern Texas requesting more Solar Stiks™. Galveston school officials were so taken with the system that they are making plans to buy one, following in the footsteps of other visionary school districts like Broward County, FL.

c. The following report provides a detailed look at how Solar Stiks were used by first responders and the citizens of Galveston and offers some recommendations regarding how to use them better in the future.

TABLE 1

EQUIPMENT DEPLOYED TO GALVESTON

Power Storage Capability: 600 Amp-Hours
- Two Power Pak 100s**
- One Power Pak 100 Pro-Series
- Two Expander Pak 100s
- Two Power Pak 50s

Power Generators:
- 300 Watts Solar (3 100W Solar Stiks)
- 200 Watts Wind (One of the Solar Stiks with Air Breeze wind generator)
- 1000W Honda Gasoline Generator

Inverters / chargers:
- Pro-Verter Pak (1250W Inverter / 30A Charger)
- Inverter Pak 1000S
- Inverter Pak 1100M

Fuel:
- 5 Gallons Unleaded Gasoline

**Numbers refer to capacity of batteries in Amp-Hours.

RED text = Problem, gap, or void in Emergency Response or Service
BLUE text = Solution, improvement, or recommendation
GREEN text = Ancillary benefit

2. Day One (Saturday, Sep 13):

a. We arrived onto I-45 at approximately 1:30 (8 hours after the eye struck Galveston). The wind was still blowing at about 40MPH with higher gusts and feeder bands from Ike were still passing through.

b. A law enforcement officer was diverting traffic from the highway onto a detour. He stated that there was too much debris on the highway for safe passage, and that only Law Enforcement and Emergency Personnel were being allowed into Galveston at this time.

> Problem: Needed authorized access to gain entry into affected areas.
>
> Solution: Subsequently, we convinced a secondary officer at the detour point to allow us through because we were bringing power generators to the Emergency Operations Command (EOC) on the island. In the future, we should acquire credentials establishing us as "emergency responders".

c. Upon arrival into Galveston, we located the emergency personnel zone. Ball High School was the evacuee shelter for civilians as well as the staging area for all first responders including FEMA. We parked across the street from the high school, and approached a law enforcement officer, asking him if there was anyone who needed portable power right away.

> Problem: Needed point of contact for immediate and proper and effective implementation of systems into theater.
>
> Solution: Find out from local law enforcement and FEMA before event, contact local AM radio stations.

d. We were referred to a FEMA coordinator located at the front of the high school where evacuees were being sheltered in the cafeteria. Many of the evacuees had gathered on the front entrance to the school. Mr. Bill Campbell with BCFS (Health & Human Services) was coordinating personnel on scene and services for the evacuees. We briefly conversed with him regarding our equipment, and he asked to use it for lighting the front facade of the building and low-level lighting inside the cafeteria. (The cafeteria was used as the main shelter area for the evacuees). The cafeteria was located in the center of the school building and had no windows or access to outdoor areas.

Problem: A 5000W portable generator was located by the front entrance, but could not be used to reach the cafeteria deep within the building structure. (Fuel-driven generators should never be utilized indoors – hazards include carbon monoxide and fire.)

Solution: Power Paks – independent operation, can be used inside any building. Fully charged Paks can be taken inside and required equipment connected without regard for location, fumes, noise... etc.

Problem: The 5000W generator at the front of the school was used to operate only two 100W lights in the entranceway, burning fuel at the rate of 1.2 GPH.

Solution: Power Paks – supplies only the power that is required for appliance operation.

e. Four Power Pak 100s were employed to provide lighting inside and outside the school for the evacuees and official personnel.

3. Day Two (Sunday, Sep 14):

[Weather – 70 degrees, cloudy skies with rain squalls, wind 20-25MPH (estimated)

a. The parking lot where we were located was between FEMA's EMS staging area, and the US Army's command center & triage field hospital.

b. At first light, we deployed three systems in the parking lot: Two Solar Stiks™ and one Solar Stik™ Breeze. We retrieved the four Power Paks that had been used the previous night and set up a "charging station" consisting of every Power Pak (7) and Solar Stik™ (3) available from inventory.

Problem: Due to the enormous size of the storm, there were residual weather issues. Consistent clouds and storm squalls were present for the first full day after Hurricane Ike, reducing our ability to generate solar power to about 50%. Wind power was our primary power generation source during this time period as the weather also prevented deployment of traditional gas gensets.

Problem: Due to the number of available Power Paks, the power storage capabilities exceed the three Solar Stiks'™ power generation capabilities, even with the best of weather conditions.

Solution: Additional Air-Breeze wind generators, Pro-Verter Pak, and Honda 1000W generator. Using only a single Air Breeze in Galveston, the wind provided a steady source of charge, but it was not able to replace the tremendous power requirements due to the excessive number of Power Paks available on site. The Pro-Verter Pak provides an additional method to "store" power into the Pro-Series Power Paks and

Expander Paks. When traditional AC power is available from the grid or from a fuel-driven generator, it behaves as a 30 Amp battery charger, storing power into the Pro-Series Paks. When the AC power source fails, it automatically switches itself from a battery-charger to a 1250-Watt inverter.

c. For ease of operation, we decided to setup an "expanded" system including the use of a Honda Generator and the Pro-Verter. The two Solar Stiks™100 Terra units were connected by "daisy chain" method to the Solar Stik™ Breeze in order to funnel all available power into one bank of Power Paks.

d. The Honda EU1000i has a feature titled "ECO-THROTTLE". This feature adjusts the gas consumption to meet the load requirements. While used with the Solar Stik™ System, the Eco-Throttle feature was active, providing only the power necessary for the Pro-Verter as it charged the Power Paks.

e. All of the Pro-Series Power Paks were connected together using the inter-connector ports, with the Pro-Verter Pak also connected to the Paks.

f. We set up a table with the Pro-Verter Pak placed on top. Several AC power strips were connected to it to provide power to any equipment people needed to connect.

g. We also ran an AC power strip from the Pro-Verter to a "comfort station" inside the trailer consisting of:

- Refrigerator
- 1000W Microwave
- Coffeemaker & grinder

Under the table was located the Honda 1000W generator set which had only the Pro-Verter plugged into it.

h. Subsequently our charging station was configured so that everything that required power would receive it from the Power Paks. The Honda generator and the Solar Stiks™ would be exclusively providing recharge capability through the Pro-Verter.

i. We brewed some coffee. Stephanie took the carafe and went around to various on-site personnel advising them that we had power available if anyone needed it. First responders, National Guard personnel, police officers, and more immediately began to bring over radios, laptops, flashlights, cell phones, and other equipment to be recharged. In a span of about 15 minutes, every single AC receptacle was used.

Problem: Without radios and cell phones, there is virtually no ability to communicate. As mobile emergency response personnel depend on rechargeable equipment, there must be some form of power available on site for them to access.

Problem: Due to tidal surge over the island, portable power generators that would have otherwise been available were inoperable. Additionally, vehicles that could have been

used to recharge communications equipment were also inundated with water, rendering them useless.

Problem: Many law enforcement and official vehicles that were operable, did not have 12 VDC (cigarette lighter type) power outlets installed in them. Many outlets had been replaced or used for other equipment including built-in radios or computers, or simply removed to prevent smoking in a government vehicle.

Problem: Due to the extreme damage to the utility grid, there was no way to obtain fuel for cars or generators without having it trucked in from distant locations. Vehicles and generators that had fuel and were operable were limited to short durations of run time preserving as much fuel as possible.

Solution: Solar Stik™ System powered charging stations placed strategically throughout affected areas with notification from the "top" down to all emergency personnel. Additionally, contact, AM radio stations to notify local residents in affected areas where they can recharge cell phones.

j. U.S. Government officials began to arrive and were setting up "camp" in their cars. Fleets of ambulatory vehicles arrived and were stationed in the parking lot where we were located. Nearly all of the vehicles were to be used for the "9-1-1 response service". Due to the destruction of the phone service on the island, EMS crews use their ambulances to roam the neighborhoods looking for victims who needed help. It is shift work, so upon completion of a shift, the crews would rotate into the parking lot for rest and meals. In effect, the EMS vehicles became "RVs" supporting crews of 2-3 each as they slept, ate, and even bathed in them.

Problem: All of the ambulatory vehicles MUST run their engines constantly. If they shut down, they must be plugged into an 110VAC outlet (grid power) to keep their batteries in operating condition. As a result, vehicles engines had to idle constantly, emitting toxic diesel fume, making it difficult for most crews to sleep.

Solution: The Power Pak can serve as an Auxiliary Power Unit (APU), powering all of the vehicle's on-board electronics and negating the need for constantly running the vehicle. (Successful test performed on night three.)

k. We used the Honda generator and the Pro-Verter to top off all of the Power Paks from the previous night's usage, and then shut it down, opting to use the solar and wind to power the connected appliances for the remainder of the day. As people came and went with their rechargeable devices, we attempted to get a game plan for the shelter on night two. We were asked to continue to provide power for the lighting, with additional lighting necessary in the gymnasium where the FEMA personnel were establishing a presence. Also in the gym, a "mess hall" was being organized.

Problem: Unlike the cafeteria, the gym was located in an area that was accessible by a gas generator. Computer stations and lighting were the main requirements. The first problem was the lack of portable gas generators available. The second problem was the lack of extra long extension cords from the generator the stations requiring power.

Solution: Power Paks located throughout the gym providing power to computer stations and lighting. After determining the amount of power necessary, it was evident that swapping Power Paks once every 24 hours would suffice.

l. Late in the day on day two, buses began to arrive to relocate the evacuees from Galveston to San Antonio. The lone generator at the front of the school had run out of gas, and it was replaced with a Power Pak 100 to run the lights. The two Power Pak 50s were taken to the second floor of the school where first responders were sleeping in the hallways. 12VDC fans were connected to provide some ventilation and the Power Paks' built in lights provided low-level light for the hallway ensuring safe travel to the stairwells.

m. Colonel Epps from the Texas National Guard came over to inquire about a Pak for a Water/MRE distribution outpost where several men had no access power. A Power Pak 100 was made available to them. EMS Responders including Dallas Fire & Rescue were bringing us their entire bank of radio batteries for recharging, and several members of the National Guard were was charging multiple laptop computers.

n. Also, many residents of Galveston were using the Solar Stik™ charging station for their cell phones, many of who were simply trying to contact family to let them know that they survived. The Solar Stik™ provided the ability for people to help themselves instead of being completely reliant on first responders.

Problem: Several people were walking through the area holding active laptops, apparently searching for a Wi-Fi signal.

Solution: The Solar Stik™ can be used to support additional equipment like satellite dishes and antennas. A Solar Wireless Access Point (SWAP) Wi-Fi station can be setup and left to operate providing Internet signal wherever necessary.

o. The remaining Power Pak 100s were placed into operation in the cafeteria and the gym for the night. The weather was cloudy all day, with gusty winds. Solar power generation was only about 10 Amps hourly and about 8-10 Amps on average from the wind generator (full 24 hour cycle).

Honda Generator cumulative operation time – 10.5 hours total

4. Day Three (Monday, Sep 15):

Weather – 75 degrees, mostly clear skies, wind 10-15MPH (estimated)

a. The first full day of "Mess Hall" operations began at 4AM. Upon completion of service hours, we collected the Power Paks for their daily recharge. One station was left in the gym to power a couple of computers and a fan.

b. All Power Paks were brought from the school floors out to the station and connected. Stephanie continued to make coffee and provide microwave services to EMS crews who were rotating in or out.

c. We were asked to examine a police car to determine if we could use any of our adapters to provide the operator with power for recharging radios, cell phones, etc.

> Problem: Like many of the first responders, including members of FEMA who were sleeping in their car, there was extremely limited access to power.
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> Solution: Power Pak 50s can be kept in vehicles and used as necessary to recharge equipment or power devices. Because of its briefcase-like attributes, it is small enough to be stored in the trunk and placed in the passenger side of the front seat and used as necessary. Solar Stik™ charging stations can be setup throughout affected areas and discharged Power Pak 50s can be swapped at any station for charged units.

d. Later in the day, Power Pak 100s were taken back over to the gym where FEMA officials got their first close look at the system. The contacts on hand were:

- Mike Norwood (Email on attached list)
- Mark Gallagher – Boston, MA – Director of Disaster Operations Division
- Joe Burchette (Email on attached list)
- Christopher LNU (Need contact info)

e. Late in the day, one of the EMS crews asked to utilize a Power Pak to serve as an Auxiliary Power Unit (APU) for their ambulance. At 7:30PM Lewisville, TX Fire Rescue connected to a Power Pak 100 with a 350W pure sine wave inverter and retreated into the vehicle for rest.

f. The remaining Power Paks were dispersed into their previous roles for the night.
The weather was clear all day, with steady wind, and a constant 20-22 Amps from the solar and about 4 Amps constant from the wind generator.

Honda Generator cumulative operation time – 6 hours total

5. Day Four (Tuesday, Sep 16):

Weather – 75 degrees, mostly clear skies, wind 15-20MPH (estimated)

a. At 8:30AM on day four, the Lewisville EMS vehicle was still being successfully powered from the Power Pak. The remaining charge was about 20%.

b. The remaining activities on day four placed the equipment in the same roles as during the preceding days.

c. At the end of the day, however, the National Guard was in need of a microwave for popcorn. 12 bags of popcorn were successively and successfully popped in the microwave, powered from a single Power Pak 100 through the Pro-Verter.

d. The weather was clear almost all day, with steady wind, and a constant 20-22 Amps from the solar and about 4-6 Amps constant from the wind generator.

Honda Generator cumulative operation time – 8.5 hours total

6. Day Five (Wednesday, Sep 17):

Weather – 70 degrees, mostly cloudy skies, wind 10 MPH

a. Upon completion of the Mess Hall activities and dispersion of lighting in the school, at midday we began to break down the equipment and pack it for transport back to St. Augustine. We had multiple requests to stay from entities including local and visiting officials, responders, and law enforcement.

b. During breakdown, we inventoried our gasoline. The generator ran every day for several hours to accommodate for the extra Power Paks and equipment that was connected to the Pro-Verter Pak.

Total gasoline consumption for the entire period: 3 Gallons U.S.

TABLE 2

Recommended Equipment for future response efforts by Solar Stik™

- Deployment of additional Solar Stik™ Breeze Systems
- Wireless Internet and SWAP system (to establish LAN)
- ERCO Paks for personnel comfort
- Pelican RALS light systems – a robust field tested lighting system
- Assortment of cell phone recharging equipment