



Global Solar EPC O&M services and technologies

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## **TECHNICAL ASSISTANCE REQUEST: For the project entitled:**

**CROSS – 20', 40' Container Roll-Out/Rapid-Deployment Solar System: MILITARY GRADE LOW PROFILE VARIOUS TILT ANGLES HIGH POWER DENSITY PER CONTAINER RELOCATABLE solar systems = SAVE LIVES**

**Abstract:** US Department of Defense (DoD) case studies revealed that electricity accounted for up to **70% of fuel use on operations**, and in some cases at a cost of almost **US\$400 per gallon** and **many lives in war areas**. When discussed these results with some of its resource sector clients, they cited similar examples of the cost of fuel for their international mining operations and in disaster areas where fuel had to be airlifted in.

The recent **hurricane Dorian** category 4 storm that came through the Bahamas 2019, and the hurricane **Maria** category 4 storm that came through Puerto Rico in 2017 where a **large percentage of the island has no power for a long time** and **many deaths were the result**.

**Integration engineering** is the **innovation** and the **key** to integrate different **existing** and **developing new technologies** are a **real technological challenge** to meet the **renewable energy needs of the friendly military forces, 1<sup>st</sup> responder agencies, and private contractors, companies world-wide** and the accompanying and environmental prerogatives.

Following our own experiences placing diesel generators and resupplying fuel in remote dangerous locations in the military, we identified a need for a military-grade, low profile, various tilt angles, high power density/container solar PV generators that were logistically just as easy to deliver and mobilize. Our objective was to design a military tough rugged durable hardly military grade, low profile to the ground, with various tilt angles, relocatable renewable power solution that could leave the staging location and be delivered anywhere in the world ready to connect with minimal or no civil works, and be quick and easy to assemble & de-assemble over and over again.

**CROSS was evaluated and deployed at NATO (North Atlantic Treaty Organization) Corps Warfighting – Exercise 'Arcade Fusion 2019'** Cornwall, England with multinational troops from the Allied Rapid Reaction Corps (ARRC). This is the largest exercise of its kind since the cold war to show ability, unity and awesome power of NATO before the **NATO SUMMIT 2019 & NATO's 70<sup>th</sup> anniversary** in **LONDON, England** on **12/4/2019** where attended by all head-of-states from NATO. <https://www.facebook.com/AlliedRapidReactionCorps/videos/2545214682411092/>

The **CROSS platform was chosen by NATO ARRC** because - **Container Roll-Out/Rapid-Deployment Solar System. Unmatched as never before without precedent innovative**, the Container Roll-Out Solar System (CROSS) is **the world first & only**:

- **military grade, & low profile, & various tilt angles, & high power density per container, & Expandable & mobile factory assembled relocatable solar array that can be quickly and safely assemble & de-assemble over and over again at any site.**

CROSSs are available in 20 ft and 40 ft configurations (CROSS20: and CROSS40), and can be stacked seven (7) high during transportation, secured to each other via twist-locks, and rolled into or out of 20ft or 40ft ISO shipping containers. The CROSS can be lifted by forklift at one end and rolled into a shipping container on its heavy-duty rollers. CROSS is fitted with torsion springs at the bottom of each array, which supports raising the panels through the 10/20/30 degree tilt angles. The lifting of the arrays to the required angle is measured in seconds. Currently, one 40ft container with full load of seven CROSS40s has a power density of +30.45KW DC. CROSSs are **structurally certified for hurricane wind regions** in accordance with USA BMS35, BMS36 and AS/NZS1170.2:2011 – Structural Design Actions: Wind Actions.

CROSSs are delivered to site pre-assembled and pre-wired to DC isolators, and are generally matched to containerized Battery Energy Storage System/s (BESS), which includes inverters, batteries and control systems. This means the entire **MICRO GRID/OFF-GRID** solar or hybrid system can be picked up by forklift, side-loaders, or airlift and moved to the next site, without the need for refits or refurbishment.

Due to **real estate space on the ground** and **weight constraint of transportation vehicles for solar panels and BESS**, **increase power density** of the solar panels and BESS means **decreasing cost of transportation per watt**, **needing smaller square footage of ground for installation**, **even faster setup**, and **smaller real estate needing less security personnel**.

The Team at EEI is targeting to **integrate existing** and **developing new technologies** to **improve greater than +15% power density per solar container and corresponding BESS**.

(1) Evaluating and Testing for power output comparison of highest power density bi-facial panels vs. mono PERC half-cell / interdigitated-back-contact (IBC) panels in the CROSS platforms.

- The top 2 best mono PERC half-cell, IBC solar panel manufacturers in 2019-20 illuminated based on the highest efficiency power density solar panels.
- VS.
- The top 2 best bi-facial solar panels with highest power density watt/panel.

Mono- PERC Half-cell, Back Contact Cell (IBC)



VS. Bifacial



(2) Evaluating and Testing for best Battery Energy Storage System (BESS) system from USA companies - Stand-Alone military grade containerized BESS for mobile/rapid-deployment (in shipping container) compatibility to CROSS platforms.

