Renewable Power for Military & Crisis Management

Cutting Costs, Saving Lives, and Increasing Operational Effectiveness

David J. Muchow, Former Pres. and CEO
SkyBuilt Power
dmuchow@muchowlaw.com (+1) 703.625.4115
Overview

- The Power Challenge for Military and Crisis Management
  - Presentation Focus is on Military Tactical Off-Grid Solutions – Similar needs/solutions for Crisis Management
- The Role for Renewables
  - Cutting Costs, Saving Lives, and Better Operations Support
- Examples of Systems Deployed or Available Now
- Concept Demonstrator Project for EDA
The Challenges

Fuel Supply Convoy Example – Logistics Nightmare
What’s Needed

- Rapid Deployability – Operational Flexibility:
  - More rapid response world wide – mobile, light weight solutions, rugged, resilient

- Cut Logistics
  - More teeth (point of spear), less tail (logistics)
  - Reduce the “the tether of fuel..”

- Save Lives from IEDs – fuel convoys are key targets
  - For every 24 fuel convoys in Iraq, 1 soldier is injured or killed
What’s Needed (Cont’d.)

- Cut Costs with Renewables – Fuel, Maintenance, Personnel
  - Est. Fully Burdened Cost of Fuel (FBCF) for US Military Deployed Forces
    - $15 - $400/gal. (3.1 – 83.6 Euros/L) to run a generator in the field (fuel + maintenance at that site)
    - Afghanistan Fuel 2010 - 375 million gallons (1.42 billion L.)
    - If fuel supplied by air (not ground) $50 - $100 or more/gal. delivered (10.5 Euros/L – 20.9 Euros/L)
Problems with Typical Generator Power Systems

- Power dense, but require constant refueling
- Can be unreliable and require constant maintenance and spare parts, distracting soldiers from the mission;
- Are noisy, give off a heat signature and can give away the position of the forces;
- Are often oversized for the power output required and are inefficiently utilized;
- Require fuel storage/depots - a target
- Pollute the environment.

- Better to harvest free energy on site than ship fuel hundreds of miles
The Opportunities – Use more Renewables

- Power without fuel – reduce fuel convoys and resupply requirements
- Cut costs - payback often in a few years or less depending on site
- Rapidly-deployable
- Much less maintenance – more tooth, less tail – more focus on the mission
- Mobile – air, rail, road, sea
- “Plug-and-Play” – Modular & scalable to meet varying power requirements
- May incorporate multiple input sources – solar + wind + micro-hydro + back-up generator, etc.
- Rugged – operate in any climate
- Proven, commercial-off-the-shelf (COTS) components
- Renewables are a great “Hearts and Minds” leave behind for Sustainable Economic Development – simpler, less expensive to operate
Cost Savings

- Lower operations costs
  - Reduce or eliminate the cost of fuel and remote grid power
  - Up to 97% less generator run time for deployed units in the field (some caveats).
- Capital + operating costs can be recovered, turning a power cost center into a power profit center

Example:
- Depending on site, autonomy, other factors
  - Payback period: months to a few years
  - Total cost savings after 30 years: 5-10kW system, $1.5-$2 M
A Few Examples of Renewables for Tactical Deployed Forces

- Number of uses/types growing – tents, backpacks, etc.
- 500W up to Micro-Grid Compatible Systems
- Containerized Systems
- Trailers
- Skids
- Soldier Portable Systems
- Microgrids
  - Lockheed – SkyBuilt, Rapidly Deployable Air Field
  - Trailer Based Micro-Grid Systems – Mobile Tactical Microgrid
Shelter Systems

Pre-Fabricated, Shelter-Based Systems for Base Load or Backup Power, Telecom, Ops Centers – saving up to 95%+ on fuel

- Pre-fabricated shelter and renewable energy power system in a rugged package.
- Fully automatic power – solar + wind + back up batteries.
- Options: generator, remote control, customer reporting, maintenance and service, etc.
- Secure, climate-controlled space for operations center, communications headquarters, equipment shelter, etc.
- US Army certified – years of field deployment
Containerized Power – Designed for extreme temperature environments
Drop and Operate Deployment
Containerized Communications Power – Desert Climate
Containerized Systems - Military Deployment
Africa – Solar + Wind + Battery Backup
Trailer-Based Power Systems – US Army

- Fully automatic solar (high efficiency blankets) + wind + battery bank + diesel generator systems built onto military or commercial-grade trailers.

- Sets up in 45 min.

- Used by the US Army; combines mobility, rapid deployment, ruggedness, adaptability, reliability and high quality with relatively low maintenance.

- It provides power anywhere you can drive.

SkyBuilt’s SkyTrailer™ at a remote installation. Figure is for illustrative purposes only. Actual equipment and system configuration may vary.
Skid Systems - US Govt. Project

• 1 kW – Sets up in 3 hours
• Rapid Deployable Solar
• Solar/Battery/Gen./HVAC - /Data Logger Monitoring
Rapidly Deployable Solar Racks – Military

- Rapidly-deployable system for deploying standard, commercial-off-the-shelf (COTS) crystalline solar panels in the field - SkyRack
- Sets up in one hour per rack or 8-12 panels
- Plug more racks in for expandability
- No nuts and bolts to loose
- Can be anchored with sandbags, rocks – no ground anchors required
Microgrid - USAF’s First Rapidly Deployable Airfield Powered by Renewables – US Air Force Smart BEAR Project

- Micro grid system
- Power for 3,400 airmen and 15,000’ runway
- Generators + solar + wind + batteries
- Target – 15-25% reduction in generator run time
- 64kW of renewables (solar + wind)
- Rapidly deployable
- Lockheed is prime contractor, SkyBuilt is sub for the Renewable power system
The U.S. Air Force’s Basic Expeditionary Airfield Resources (BEAR) program equips forces with lightweight, air-transportable assets used to establish mobile air bases. To improve the reliability of power to critical systems, increase the efficiency of generation to reduce costs, and enhance security by reducing reliance on fuel convoy, Lockheed Martin is providing the Integrated Smart BEAR Power System (ISBPS). The ISBPS is a rapidly deployable intelligent power system integrating a variety of energy sources, including renewables, into the existing BEAR power grid.
EDA Concept Demonstrator

- **Goal**
  - Demonstrate cost savings, fuel and logistics reductions, and rapid deployability from renewable energy systems
- **Provide Two Systems - ready in 90-120 days**
  - SkyTrailer - Advanced Renewable Energy Trailer – the Mobile Tactical Microgrid – rapidly deployable military grade trailer
  - Suit case Size System - Man portable Solar/Wind/Battery unit to replace small generators in the field
- **Install these systems in the Field in typical operating conditions**
- **Data log their results in comparison to diesel generation, etc.**
- **Provide a Detailed Technical System Performance Report on the Results to EDA**
Concept Demonstrator: #1: Trailer-Based Renewable Power Systems
The Mobile Tactical Microgrid
Solar, Backup Generator, Battery Automatic System
Note: Trailer only, PLC and Humvee, etc. not Included
Mobile Tactical Microgrid (MTM)

- Military spec trailer
- 7,000VA Max Power Output
- Solar PV blankets – 4.92kWp
- Generator – 3kW, MEP Tactical Quiet Generator
- Batteries – 23kWh Lead Acid (AGM) or 50.4 kWh Lithium Ion
- On or Off Grid Options
- Available in 90-120 Days
- Rapid Set up

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Concept Demonstrator #2 - Soldier Portable Power
Man-Portable Renewable Energy System in a Pelican Case

- A rugged and reliable, soldier-portable power system for communications, sensors, battery charging, etc.
- Lithium Polymer Battery, 832Wh
- Powers communications, medical devices, soldier radios, equipment
- Sets up by one person; one man lift – 27 lbs. (12.2 kg. – battery case wt.)
- High efficiency solar blankets, 246Wp
- One 200W wind turbine
European Defense Agency – Military Green 2012
June 19-20, 2012 Brussels, Belgium

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