Iron Flow Battery Microgrid Projects

- Stone Edge Farm Microgrid Project - Sonoma, CA
  - IFB for bulk shifting of PV to nighttime use

- US Army Corps System for FOB load following
  - Automatically starts generator to re-charge, saving fuel

- IFB 50kW/400kWh system installed at wind test facility in west Texas
  - Wind and solar shifting, DNV-GL testing multiple use cases

- IFB 50kW/400kWh system installed at Univ. of Calf. San Diego
  - Testing is microgrid environment for multiple use cases
Flow Battery Inherent Advantages for Microgrids

**Low cost, abundant electrolyte materials**
- Can ship dry, just add water
- Non-toxic, non-flammable

**8-hours nameplate capacity, 25 year life**
- No capacity loss with cycles, or time
- Flexibility for multiple uses

**DC/DC round trip efficiency ~75%**

**Fast response times for grid stability**
- Full power in <1 second

**Lowest LCOS when frequently cycled**
Military Forward Operating Base Microgrid

- Reduce Fuel Requirements

**Multi-Service Objective**
+ Fuel logistics is a linchpin to forward deployments
+ Costs in both $$ and lives

**Issue with Power Generation**
+ Revolves around generator efficiency over variable loads

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**Expeditionary variability**
Generators operate at sub-optimal loads the majority of the time
Forward Operating Base Microgrid
- Reduce Fuel Requirements

Regimental Combat Operations Center (COC)
- Power Generation: 60 kW “Tactical Quiet Generator”

- Seasonal Load Variations
  + Average 19.1 kW
  + Peak in winter at 60 kW

- Issue Revolves Around Generator Efficiency vs. Load
USACE FOB Microgrid Demonstration Project
- Introduce Long-duration Energy Storage

US Army - Fort Leonard Wood, Missouri
+ US Army Corps of Engineers operates a FOB test area
+ Standard 60 kW TQG with barracks loads

ESS Inc. Supplied “Custom” Iron Flow Battery System
+ Two (2) 30 kW “DC” Iron Flow Battery systems with 112 kWh of energy storage capacity each
+ Power Conversion System – 60 kW (208V AC)
+ Software to control generator

Operational Task for IFB Energy Storage
+ Form grid and follow FOB load
+ Control generator to recharge IFB systems
USACE FOB Microgrid Demonstration
- Introduce Long-duration Energy Storage

Iron Flow Battery at FOB Test Site – Ft. Leonard Wood
+ US Army Corps of Engineers operates FOB test area
+ Barracks load
  + ~2kW of lighting and plug loads
  + 8kW electric heater cycled as needed
+ IFB SOC to cycle between 20% and 95% State of Charge (SOC)
Forward Operating Base Microgrids
- Reduce Fuel Requirements

Attributes of Energy Storage for the Military FOB Microgrid Applications

+ Reduce use of generators, only operate at peak efficiency
  + Expecting 20-30% fuel savings
+ Combine with PV or wind and dramatically reduce generator use
+ With Iron Flow Battery, ship dry and add water at FOB
  + Saves 60% of shipping weight
  + Portable for redeployment
+ Non-toxic, non-flammable for safety with troops
+ Operates without air conditioning in hot environments
+ Silent watch capability
DELIVERING ON THE PROMISE OF ENERGY STORAGE

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