ZBB Energy Corporation

ZBB EnerSystem™
Overview & Application

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Power Electronic Systems

- Intelligent Energy Management System
- Creates a Hybrid Power Conversion System
- Configurable, Modular, Flexible and Scalable for On-grid, Off-grid and as Grid-backup
- Combined with Energy Storage Supports Renewable Energy Sources and other Power Inputs
- Factory Built and Tested and Uniquely Configured to each Customer’s Application
ZBB EnerSection™
Power & Energy Control Center

- Modular design that integrates any power input, any storage device
- Patented common DC bus design
- UL 1741 qualified grid-tie inverters
- DC bus can seamlessly hybridize multiple battery traits - fast response with long discharge
- 125kW AC to 1000kW (1 MW) AC power rating
- Operates in ambient temperature - 30° to +50°C for outdoor/industrial specs
- In operation without fail >18 months
- NARI Test Procedure in Process
ZBB EnerSection Inverters

60 kW Inverter

Inverter Assembly - Milwaukee, WI

25 kW Inverter

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Basic Overview of the ZBB Battery

Anode: $\text{Zn}^{2+} + 2e^- \leftrightarrow \text{Zn}$

Cathode: $2\text{Br}^- \leftrightarrow \text{Br}_2 + 2e^-$

Bromine: $Q.\text{Br}^- + n\text{Br}_2 \leftrightarrow Q(\text{Br}_2)_n.\text{Br}^-$

Where $Q.\text{Br}^-$ is the Bromine Complexing Agent
ZBB EnerStore – V3 Battery Stack

Overview

Comprises of 60 cells in series
Nominal voltage of 100 V
Energy capacity of 7.2 kWh
Max continuous discharge of 3.6 kW
Size: 445mm x 385mm x 240mm
Dry weight: < 20 kg

Expected operational life > 3 years
Expected cycle life > 2,000 cycles
ZBB EnerStore V3 50 kWh Module

DC Power Electronics

8 x V3 Battery Stacks

Titanium Air Cooled Heat Exchanger

Electrolyte Storage and Pumps

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ZBB EnerStore Flow Batteries

Cell Stacks
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IIT Campus – Summer 2012

250 kW / 500 kWh Zinc Bromine Energy Storage System being installed at Illinois Institute of Technology (IIT) Galvin Institute’s “Perfect Power” campus micro grid project.

ZBB EnerSystem™ with:
- 2x 125kW ETC certified to UL 1741 standards inverter sections
- 10x 50kWh ZBB EnerStore 50 Zinc flow battery modules
- 300kVA Isolation transformer (480V/208V)
- EnerSystem Comm Module with local HMI and remote comms
- EnerSystem Grid Isolation Disconnect (GID) module
- 10’ x 40’ Secured, walk-in enclosure with external disconnect

ZBB’s EnerSystem™ GID allows for “islanding” capability to use the platform for emergency power to an adjacent campus building on grid loss.

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ZBB Projects – Summer 2012

United States
- Oregon State
- NAVFAC/SEI (So. Calif.)
- NAVFAC/SNI (So. Calif.)
- General Atomics (So. Calif.)
- Major Sports Stadium (Arizona)
- Military - Undisclosed (Texas)
- Eaton/Ft Sill (Oklahoma)
- Lower Valley (Wyoming)
- DoD/Transportable (Wisconsin)
- UWM (Wisconsin)
- CCG/IIT (Illinois)
- UE Corp. (N. Virginia)
- Envinity (Pennsylvania)
- Pualani Manor (Hawaii)
- Military – Undisclosed (Hawaii)

International
- BC Hydro (Canada)
- Dundalk (Ireland)
- China – Two Sites TBD
- JeJu Island (Korea)
- Honam Lab (Korea)

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