

**Proposed Agreement between California Energy Commission
and
EnerVault Corporation**

Title: Flow Battery Solution to Smart Grid Renewable Energy Applications
Amount: \$476,428.00
Term: 55 months
Contact: Avtar Bining
Committee Meeting: 9/1/2010

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance
10	Electric	ETSI	ARRA	\$9,623,697	\$476,428	\$0 0%

Recommendation

Possible approval of this agreement with EnerVault Corporation (EnerVault) for 48 months, \$476,428.00 cost share grant to supplement the contractor's American Recovery and Reinvestment Act of 2009 (ARRA) award. Under the U.S. Department of Energy (DOE) - National Energy Technology Laboratory (NETL) Smart Grid Demonstrations - Area of Interest 2 - Grid-Scale Energy Storage Demonstrations, 2.5 Demonstration of Promising Energy Storage Technologies - ARRA Grant Funds DE-FOA-0000036, Ktech Corporation, along with EnerValut as a key partner, was awarded \$4,764,284 in DOE ARRA funds for the Flow Battery Solution for the Smart Grid Renewable Energy Applications project. The project will demonstrate the commercial viability of EnerVault's novel Iron-Chromium redox flow battery energy storage systems (BESS) with a dual-tracking photovoltaic (PV) system and advancing a technology that is an essential building block of a clean, renewable-energy based Smart Grid. The total budget for the EnerVault project is \$9,528,567.

Issue

Historically, with the exception of pumped hydro, energy storage has been too expensive and too cycle limited to be considered for reliable deployment as a grid asset. Short duration (under 15 minutes) energy storage in the form of lithium ion batteries and flywheels has begun to be used to perform fast regulation, but such storage is only economical because fast regulation only requires 15 minutes of storage duration. Recent introductions of flow battery technologies have begun to pave the way for grid-scale energy storage, but their costs are too high to permit anything other than a small number of demonstrations.

Due to the unavailability of battery systems capable of meeting the functional and economic requirements, utilities have not been able to purchase, test and validate the value of advanced battery systems such as those of EnerVault. As a result, utilities are unable to recommend their consideration by regulatory authorities. As a result, they are unable to include such advanced energy storage systems within their rate setting and rate recovery mechanisms. Also, until such battery systems and their economic benefits are validated and verified, project financing is not available.

Background

The novel and proprietary redox flow battery systems developed by EnerVault is a 250 kW Beta system (Vault-20) with 77% net efficiency and a high volume production cost of less than \$90/kWh when manufactured in the U.S. The combination of low installed price, high energy efficiency, and long cycle and calendar life provide system owners with internal rates of return above 20%. A consortium consisting of EnerVault, Ktech Corporation, Poly-Flow Engineering, LLC, Montpelier Nut Company, and JKB Energy received an award from the Department of Energy requesting ARRA funding (DE-FOA-0000036 (Smart Grid Demonstrations)) to support a demonstration project for EnerVault's redox flow battery system.

Federal Funding

Under the provisions of ARRA and the DOE-NETL Grant Funds DE-FOA-0000036, Ktech Corporation, along with EnerVault as a key partner, was awarded \$4,764,284 in DOE-NETL ARRA funds for this project. EnerVault will use ARRA funds along with significant match funds of its own and other key partners to demonstrate the commercial viability of a novel redox flow battery energy storage system along with a dual-tracking photovoltaic system; and to develop EnerVault's promising, patented redox-flow battery technology into a full product scale Beta unit.

Energy Commission Cost Share

The total DOE-ARRA project budget is \$9,528,567 of which \$4,764,284 is from DOE-NETL ARRA stimulus match awarded to Ktech. EnerVault and Ktech will provide \$4,287,855 as match for the EnerVault project. The amount of funds requested from the Energy Commission is \$476,428. As EnerVault will receive from DOE-NETL ARRA award \$4,764,284 for this project, EnerVault is eligible for \$476,428 in accordance with the terms of PON-09-002. Cost share of the project team members.

Team Member	Cost Share
EnerVault	\$4,287,855
Energy Commission	\$476,428
DOE	\$4,764,284
Total	\$9,528,567

Relationship to Energy Storage and Smart Grid Initiatives

This research effort is in synch with the Energy Commission's Energy Storage and Smart Grid Initiatives. Success in this effort could provide a unique solution for addressing critical needs for grid and large-scale renewable energy storage as well as for improving grid performance using grid-scale energy storage in California.

Proposed Work

The proposed project will demonstrate the commercial viability of EnerVault's novel redox flow BESS. This demonstration comprises of integrating EnerVault's Vault-20 BESS (250kW, 1MWh) with an intermittent renewable energy source - a dual-axis photovoltaic (PV) system. The 36 month project will culminate in the deployment of a Vault-20 Beta system in conjunction with a 150kW PV system at a site in California's Central Valley. In Phase I, site assessment and compliance will be completed as well as development and demonstration testing of a Vault-20 Alpha system. In Phase II, lessons learned from the Alpha system evaluation will be used to complete the development, design, and construction of a Vault-20 Beta system. Phase III comprises commissioning the Beta system at a customer site and

operating the system for 6 months. Additionally, the operating results will be analyzed and compared to the baseline for final quantification of benefits and operating costs. The capital costs, operating costs, and benefits will be used to determine a Total Cost of Ownership.

Project Team

EnerVault, the prime applicant, has expertise in electrochemical engineering, battery design, and electrochemical systems development. Ktech Corporation is a premiere technical services, products and manufacturing company based in Albuquerque, New Mexico and will act as the prime contractor for the DOE program. Ktech's subsidiary, Poly-Flow Engineering, LLC, will do the fabrication and manufacturing. Montpelier Nut Company will provide the demonstration site and JKB Energy will commission the project.

Project Budget

EnerVault project's total budget is \$9,528,567 of which \$4,764,284 is from DOE -NETL ARRA stimulus match awarded to Ktech. The remaining funds are from EnerVault (\$4,287,855). The total PIER budget for this project is \$476,428 which leverages \$4,764,284 in DOE- NETL ARRA grant funds. In general, the PIER budget can be broken down as follows:

- 78% - Direct Labor (60%) and Fringe Benefits (18%)
- 22% - Overhead

Project Benefits

Numerous benefits, such as energy efficiency savings, integration with renewables, peak load management, and renewable intermittency management, will be garnered from broad deployment of electrical energy storage as enabled by EnerVault's technology..

Additionally, this project will improve grid reliability, facilitate integration of renewable resources, and improve the use of existing transmissions assets.

Justification and Goals

This project "[has] the potential to enhance transmission and distribution capabilities" (Public Resources Code 25620.1.(c)(3)).

This will be accomplished by:

- Energy-efficiency Savings from Electricity Storage Systems,
- Integration with Renewable Energy Production Source, at or away from the Source,
- Use of Advanced Energy Storage for Peak Load Management and,
- Store Energy during Non-Peak Generation Periods to Maximize Existing Grid Assets