

**Proposed Agreement between California Energy Commission
and
Amber Kinetics, Inc**

Title: Utility-Scale Flywheel Energy Storage Demonstration
Amount: \$369,466.00
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	\$369,466	\$0	0%

Recommendation

Approve this agreement with Amber Kinetics, Inc. (Amber Kinetics) for 48 months, \$369,466.00 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 2.5 - ARRA Grant Funds DE-FOA-0000036, Amber Kinetics, along with Lawrence Livermore National Laboratory (LLNL) and Stanford University as key partners, was awarded \$3,694,660 in DOE ARRA funds for this project. The project includes an accelerated research, development and demonstration program for the innovative utility-scale flywheel energy storage technology. The total budget for the Amber Kinetics project is \$10,003,015.

Issue

Flywheel storage is too costly. Current flywheels use high-cost carbon fiber flywheel rotors, driven by expensive permanent magnet motors with significant energy losses, and levitated with costly and complex electromagnetic bearing systems. A flywheel employing less costly technology advances in composite flywheel rotor materials, magnetic bearing systems, and high efficiency motor-generators needs to be demonstrated to prove it's cost effectiveness. Wide scale deployment of flywheel energy storage technologies is hindered because of the high cost of the integrated technologies.

Background

Distributed, low cost storage of electricity has been the "holy grail" of technology innovation. Entities actively engaged in the development of flywheel energy storage technology include Beacon Power, Pentadyne, Vycon Energy Storage, and Active Power. None of the currently known flywheel energy storage systems are economical and/or suitable for utility-scale applications. The original, pioneering research for the flywheel energy storage technology was conducted at LLNL in California, and sponsored in part by the DOE. Recent scientific breakthroughs at LLNL could hold the key to cost-effective energy storage and could restore scientific leadership to the United States while laying the foundation for a clean energy economy. The multi-disciplinary approach to flywheel energy storage

development has historically made it more challenging for separate research entities to work together to bring the state-of-the-art to solve a common problem.

Federal Funding

Under the provisions of the ARRA and the DOE-NETL Grant Funds DE-FOA-0000036, was awarded \$3,694,660 in DOE-NETL ARRA funds for this project. Amber Kinetics will use ARRA funds along with significant match funds of its own and other key partners to research, develop, and demonstrate a utility-scale flywheel energy storage technology. Amber Kinetics will conduct this project and concurrently work on the Energy Commission funded part of the DOE-NETL ARRA project.

Energy Commission Cost Share

The total project budget is \$10,003,015. Amber Kinetics received a DOE-NETL ARRA award of \$3,694,660 for this project. Amber Kinetics submitted an application to the Energy Commission for cost share funding under PON-09-002, Addendum 2, for its DOE-NETL ARRA Grant Funds DE-FOA-0000036 project Amber Kinetics requested from the Energy Commission \$400,000, but is eligible for \$369,466 in accordance with the terms of PON-09-002. Cost share amounts of the project team are as below.

Team Member	CASH	IN-KIND	TOTAL
Amber Kinetics	\$4,825,947	\$428,400	\$5,254,347
AFS Trinity	\$0	\$684,542	\$684,542
Energy Commission	\$369,466	\$0	\$369,466 (Phase I - \$185,294)
DOE-NETL-ARRA	\$3,694,660	\$0	\$3,694,660 (Phase I - \$1,852,942)
Total	\$8,890,073	\$1,112,942	\$10,003,015

Currently, DOE -ARRA has made available \$1,852,942 for work to be performed by the recipient (Amber Kinetics) pending receipt of an updated funding plan in 12 months detailing firm commitments for the remaining balance of the full private sector share of the project cost. In the event that the updated funding plan is not received 12 months after the effective date of the award or earlier, and either party elects to declare the award terminated, the maximum DOE liability to the Amber Kinetics is DOE's share of incurred costs up to \$1,852,942 provided such costs are reasonable, allocable to the award, and allowable under the terms of the award and the applicable Federal Cost Principles. In that case, the Energy Commission liability to Amber Kinetics is the Energy Commission share of incurred costs up to \$185,294 (that is up to 10% of the DOE-ARRA funds).

Relationship to Energy Storage and Smart Grid Initiatives

This research effort addresses the recommendations of the 2009 Integrated Energy Policy Report. Success in this effort could provide a solution for improving grid performance using energy storage in California.

Proposed Work

Amber Kinetics proposed a project to demonstrate a prototype flywheel employing technology with advances in composite flywheel rotor materials, magnetic bearing systems, and high efficiency motor-

generators. These new technologies, when integrated into a flywheel system, can prove that flywheel energy storage can be competitive with pumped hydro in terms of cost and efficiency.

The goal of the prototype flywheel system will be to clearly demonstrate the economical and technical viability of bulk flywheel energy storage and renewable energy integration for the electric grid. Concurrent with the DOE-NETL ARRA project over a four year period, this project and the technology validation it supports will result in potential impacts on California industry and markets.

Project Team

Amber Kinetics' project team includes: AFS Trinity, LLNL, and Stanford University. Award-winning researcher, Dr. Richard Post, pioneered the technology at LLNL and is now a partner with Amber Kinetics, Inc. and Stanford University under a technology licensing agreement.

Project Budget

The Amber Kinetics project's total budget is \$10,003,015 of which \$3,694,660 is from a DOE-NETL ARRA stimulus match award to Amber Kinetics. The remaining funds are from Amber Kinetics (\$5,254,347) and AFS Trinity (\$684,542). The total Energy Commission budget for this project is \$369,466, which leverages \$3,694,660 in DOE-NETL ARRA grant funds. The Energy Commission budget for this project can be broken down as follows:

- 48% - Direct Labor (35%), Fringe Benefits (5%) and Indirect Overhead (8%)
- 48% - Contractual
- 4% - Materials & Supply (3%), and Travel (1%)

Project Benefits:

Numerous benefits will be garnered from broad deployment of utility scale flywheel energy storage technology. This project will demonstrate how using flywheel energy storage may 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:

- improving the grid reliability,
- facilitating the integration of renewable resources and,
- improving the use of existing transmissions assets.