

Enabling Technologies Development ETD-13-01 Solicitation Proposed Awards Back Up for 9/11/13 Business Meeting

Issue

The California Institute for Energy and Environment (CIEE) held a solicitation under ETD Contract No. 500-01-043 in the Distribution Grid, Transmission Grid, and Smart Home Research Areas. Three projects were chosen for funding and need approval at an Energy Commission Business Meeting.

Background

In 2002, the Energy Commission awarded Contract No. 500-01-043 to the University of California, CIEE for the technical expertise, project management, and administrative duties needed to implement the Demand Response Enabling Technologies Development (DR ETD) Grant Program.

In December 2007, the Energy Commission amended the contract with CIEE to expand the areas of research beyond DR. The new areas are enabling technologies research in electric distribution grid and energy efficiency in legacy buildings. With the amendment, the project name was changed to Enabling Technologies Development (Demand Response was dropped from the original name).

Between January and April of 2013, three Research Opportunity Notice (RON) solicitations, Distribution Grid, Transmission Grid, and Smart Home, were offered by the Enabling Technologies Development Grant Program. The abstract and proposal solicitation, submittal, review, and award selection process is documented in the ETD Project Program Management Manual. The Transmission Grid, Distribution Grid, and Smart Home RONs received three, thirteen, and seventeen abstracts, respectively, with three additional abstracts that crossed multiple disciplines. CIEE invited the top 15 abstracts to submit full proposals. The top three proposals, the highest scoring from each RON, are recommended for funding.

Proposed Work

The three proposals that are being recommended for funding will improve the reliability, energy cost, and energy value of California's electricity. These proposals will also maximize the market connection by reducing the information, communication and control technologies installation cost. The proposed projects are as follows:

Transmission Grid Solicitation:

1. Title: Repetitive & Adaptive Control of Distributed Generation for Seamless Transition Between Grid-tied & Off-grid Modes

Bidder: Tsu-Chin Tsao, University of California, Los Angeles

Amount: \$150,000

Term: 12 months

This research will focus on developing the control system for microgrids to safely and efficiently operate in all operation modes. The proposed control system objectives are to provide seamless transition between grid-tied and off-grid modes and guarantee superior power quality in all operation modes. The proposed control system will be able to improve the voltage control at the distribution level and also mitigate the variable distributed energy resource impacts. The proposed control approach has the potential to improve the transient performance, efficiency, and power quality compared to the current methods and practice. Hardware-in-the-loop simulations to compare the proposed control methodology with benchmark performance will be performed.

Distribution Grid Solicitation:

1. Title: Porous Silicon-based Lithium Ion Anodes for Secondary Batteries

Bidder: Michael Sailor, University of California, San Diego

Amount: \$150,000

Term: 18 months

The research objectives are to optimize the silicon etching process for lithium ion battery anodes, connections through which electric current flows in or out of a rechargeable battery, to increase the battery cycle life and capacity. The research team aims to tailor the porous silicon etch process to enable the structure to withstand the repeated volume changes and stresses associated with charging and discharging the battery. The research team also aims to develop a new method to chemically tailor a carbon-based coating on the porous silicon anode for optimal electrical conductivity and enhanced structural stability. The team will then construct and test the performance of the anode materials and evaluate their behavior.

Smart Home Solicitation:

1. Title: Arc Fault Circuit Interrupter Development for Residential DC Electricity

Bidder: Andrew Kean, California Polytechnic State University, San Luis Obispo

Amount: \$149,808

Term: 18 months

This research will develop an Arc Fault Circuit Interrupter (AFCI) for a DC-powered house. This project will focus on increasing California's electric power supply efficiency with safety as the primary objective. Arcing events in which there is an electrical breakdown in the circuits are a significant fire risk, and AFCIs can significantly reduce this risk. AFCIs are currently in development for 80V or higher photovoltaic circuits, but this research will develop a prototype

AFCI for DC household plug circuits operating at 24-48V and integrate this technology into a Smart DC Wall Plug.

The AFCIs required in residential AC wiring cannot detect arcing downstream of any AC-DC converters. The project will develop a system which is able to detect arcing downstream of a DC-DC converter to provided added safety over what is currently required by most electrical codes in the U.S.

Justification and Goals

- Improving the reliability/quality of California's electricity by reducing service interruptions through expanded service options and new system-wide capabilities.
- Improving the energy cost/value of California's electricity by providing real-time information and a means to automatically respond to supply-side problems.
- Maximizing market connection by reducing the installed cost of energy-related information, communication, and control technologies.