

# Inventions & Innovation Project Abstract

## A Novel Bidirectional Power Controller for Regenerative Fuel Cells

Hydrogen fuel-cells (FC) are one of the front-runner alternative-energy solutions proposed by EERE to address and alleviate the imminent and critical problems of existing fossil-fuel-energy systems: environmental pollution due to high emission level and rapid depletion of fossil fuels. The framework for integrating these “zero-emission” alternative-energy sources to the existing energy infrastructure has been provided by the concept of distributed generation (DG), which provides an additional advantage: reduced reliance on existing and new centralized power generation, thereby saving significant capital cost. Two key application areas of FC energy systems (FCES) are in residential and commercial power systems, where the projected worldwide market is \$50 billion by 2015. However, to achieve this projected target, the FCES have to address three key issues: cost, durability and reliability, and energy efficiency. Currently, the higher costs for FCES (as compared to conventional energy systems) are primarily due to the energy sources (FCs) and the power systems. A big part of the power-systems cost is due to the power-electronics technology.

Ceramatec, Inc. is building a 5 kW prototype regenerative FCES (RFCES) to demonstrate the concept feasibility and compare the experimental and projected performances. Subsequently, the RFCES will be tested with the stack and the power-conditioning unit will be exercised throughout the full operating range, from full forward (power generation) current density to full negative (electrolysis mode) current density.



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