CONCEPT PAPER DETAILS FOR FOA# DE-FOA-0001261

1261-2649: Methanol Fuel Cell Enabled Hybrid Power System

Concept Paper Response

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Submission Details

Abstract: A hybrid direct methanol fuel cell/all solid-state lithium ion battery power system is necessary to power next generation portable electronics. Among many others, cellular phones, tablets, laptop computers, and continuous monitoring systems for mobile and/or remote assets will increasingly require always-on technologies – such as powered sensors, continuous data acquisition, on-chip data analytics and communication – to both improve functionality and extend into applications currently prohibited by their relatively high energy demands. Although lithium ion batteries are sufficient to power existing portable systems, energy densities below 100 Wh/L place prohibitive limits on technologies with these always-on energy requirements. In contrast, direct methanol fuel cells have theoretical energy densities in excess of 3000 Wh/L, but suffer from chemical-, mass transport-, and ohmic-polarization losses that impede their ability to promptly respond to changes in power demand, resulting in a prohibitively narrow efficient operating range. This project will, over three years, address the three challenges facing direct methanol fuel cells that hold their efficiencies below our 35% target: high methanol crossover, high anode polarization due to low catalyst activity, and high cathode polarization due to mixed potential losses. Additionally, this project will pursue improvements to all solid-state battery chemistries that would significantly improve energy density and operational safety. The resulting hybrid power system would represent a step-change in portable power with a goal to increase the energy density of portable power systems by more than a factor of two. To accomplish this, we have assembled a team of experts in materials modeling, synthesis and characterization and system engineering and manufacturing from organizations with well-established capabilities in energy generation, storage, and application.

Applicant: Dr. Branden Kappes (branden.kappes@gmail.com)

Lead Organization: Process Global Incorporated

Organization Type: Business < 500 Employees

Lead Organization Percent Effort (1-100): 30 %

Primary Technical Area: **Other**
- Portable Power

Additional Technical Areas: **Transportation**
- Fuel Cells - Transportation

Team Members:

- National Renewable Energy Laboratory - Federally Funded Research and Development Center (FFRDC) (60%)
  Dr. Steven Christensen
  15013 Denver West Pkwy, Golden, CO 80401
  (720)938-8022 | Fax not listed
- Colorado School of Mines - Academic (10%)
  Prof. Cristian Ciobanu
  1500 Illinois St., Golden, CO 80401
  (720)290-8173 | Fax not listed

Key Participants:

Organization Name	Title	Salutation	First Name	Last Name
Colorado School of Mines	Full Professor	Prof.	Cristian	Ciobanu
National Renewable Energy Laboratory	Staff Scientist	Dr.	Chunmei	Ban
National Renewable Energy Laboratory	Staff Scientist	Dr.	Steven	Christensen
National Renewable Energy Laboratory	Staff Scientist	Dr.	Katherine	Hurst

Funds and Costs:

Phase	Federal Share (DOE)	Non-Federal Share	Total Projected Costs	Proposed Cost Share Percentage
Phase 1	$2,880,000	$720,000	$3,600,000	20.00%

Proposed Period of Performance (months): 36

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