U.S. DEPARTMENT OF ENERGY

Summary of Input to DOE Request for Information DE-PS36-08GO38002

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Fuel Cell Pre-Solicitation Workshop

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Purpose

- Release date: 11/20/07; Close date: 1/14/08
- Obtain feedback from the fuel cell community.
- Planned Funding Opportunity Announcement for RD&D of fuel cell technologies for automotive, stationary, portable power and early market applications
  - Tentative Release: Spring ’08
  - Tentative Awards Made: FY09

Response Areas

- Technical topic areas
  - Catalysts (durability and reduced loading) and supports.
  - Catalyst layer.
  - Water management.
  - Membrane electrode assembly (MEA) optimization.
  - Accelerated durability testing.
  - Balance of plant component development.
  - Impurity effects.
  - Fuel cell power plant demonstrations.
  - Durability and reliability of portable power systems.
  - Innovative concepts.
  - Suggestions for other fuel cell RD&D Topic Areas
- Programmatic considerations
  - Relative importance and priority DOE should place on the technical topic areas and the different fuel cell application areas (transportation, stationary, etc.).

RFI Statistics

- 94 individual comments
- 36 entities responded
- Responses included input from industry, universities, national labs, and state partnerships

Breakdown by Topic Area

Catalysts and supports (incl. Catalyst layer)	15
Water management	4
MEA Optimization	9
Accelerated durability testing	5
Balance of plant component development	6
Impurity effects	2
Fuel cell power plant demonstrations	11
Portable power systems	6
Innovative concepts	7
Other fuel cell types	9
Additional topics/miscellaneous	16
Programmatic considerations	4

Catalysts and Supports

- Catalysts
  - Non-precious metal catalysts
  - Require sufficiently low loading of precious metals
  - Anode catalysts
  - Fundamental studies: 1) on catalyst degradation mechanisms and 2) relating enhanced O2 reduction/ side reaction activities to specific physical properties
- Supports
  - Non-carbon based supports (metal oxides)
  - Stabilized carbon supports

Catalyst Layer

- Novel electrode fabrication techniques
- Optimization of electrode structure
- Catalyst layer topic should be combined with the MEA optimization topic

Water Management

- Extreme conditions (freezing)
- Gas diffusion layer as pertains to water transport
- Self humidifying stack designs
- Development of characterization methods
  - Gas and water transport through the GDL and flow fields
  - Water content and phase as function of position

MEA Optimization

- Undertake basic study of effect of MEA structure/ property relationships on fuel cell operation to provide insight into the proper design of MEAs.
- Encourage appropriate teaming to ensure relevancy for high volume manufacturing.
- Include newer technologies/developments.
- Optimization under hotter, drier conditions can be different than for cooler, more humid conditions.
- Study of conditioning mechanisms to decrease conditioning time to several minutes.

Accelerated Durability Testing

- Focus on obtaining the correct “transfer function” for correlating real-world fuel cell performance and lifetime with laboratory accelerated durability tests.
- Include this topic as part of the fuel cell demonstration topic.
  - Limited public disclosure on observed failure modes adds risk to design of accelerated tests.
- Need to better understand effects of inter-relation between fuel cell components and system operational variables on overall durability.
- Build on existing knowledgebase in three key areas: mechanistic studies, lifetime modeling, and operation uniformity.

BOP Component Development

- Consider only generic component development
- Low cost
- Membrane humidifier
- Vapor phase water recovery device
- High-turndown gas recirculation device
- Ambient pressure air handler
- DC regulator
- Water/ice robust RH and pressure sensors
- Industry standard safety controllers
- Integrated systems which reduce component count

Impurity Effects

- Focus on impurities that are difficult to recover from or to filter out
- Air side contamination is important for vehicle applications
- Effect of drive cycle on impurity tolerance
- Contaminants resulting from stack and BOP materials

PEMFC Demonstrations

- Focus on demonstrating that cost, durability, and reliability can be met for early markets
- Determining failure modes should be included in the scope
- Back up power - Further lab and field testing required for durability and reliability validation
- Material Handling – Development and demonstration of next generation systems, including hybridized forklifts
- Transportation - Advanced automotive systems and bus fleet-reliability demo
- Diesel-fueled APU – Focus on cost reduction and improved reliability
- Hybridize fuel cell systems with other alternative energy sources
- For larger scale distributed applications, performance and functionality requirements should be consistent with efforts of other DOE organizations, such as OE
- Include policy-oriented information sharing among states, federal agencies, and local communities

Portable Power Systems

- Durability and Reliability
  - Effect of fuel cell storage, prolonged exposure to extreme ambient temperatures, and fuel cell orientation.
  - Examine degradation mechanisms via combinatorial study of membrane and catalyst failure followed by developing mitigation strategies.
- Materials, subsystems, and manufacturing technologies are different for portable and stationary systems – separate development efforts are required in these areas.
- Not clear if portable power is a strategic early market entry relative to DOE's core technology program.

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Other Fuel Cell Types

- Direct borohydride – feasibility study
- Bio-fuel – direct oxidation catalysts
- Alkaline – anion exchange membranes and alternative fuels
- Molten carbonate – BOP, H2O management
- Solid oxide fuel cells
  - Component and system development for truck APUs and continuous duty stationary applications
  - Reconsider for transportation applications
  - Other applications: marine, RVs, remote, CHP
  - Validation of analysis/design capabilities

Innovative Concepts

- Approaches should address cost, performance, durability, and path to market
- Appropriate teaming in place to evaluate feasibility
- Novel stack designs
- Tri-generation system
- “Innovative materials development for fuel cells” topic
- Increase current density operating range
  - Requires overcoming engineering challenges related to flow fields, thermal management, etc.

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Other Suggested Topic Areas

- Metallic bipolar plates
- Membranes
- Seals
- Fuel cell stack
- Advanced imaging techniques to identify the initial causes of cell failure

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Comments/Recommendations/ Programmatic Considerations

- Draft topics show strong bias toward enabling materials and systems and away from stacks.
- Roughly balance near term and long term applications.
- Consider broader metrics for whether an early market is strategically aligned with core program goals.
- Require proposed approaches for component development to address meeting multiple properties simultaneously.
- Encourage teaming to ensure feasibility/ practicality of a given approach.
- For material and component development, require delivery of sample/hardware for independent evaluation

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