Gas Clean-Up for Fuel Cell Applications Workshop Report
DE-FOA-0001331 / Modification 000001

DATE: June 12, 2015

SUBJECT: Request for Information (RFI)

DESCRIPTION: Request for Information on *Gas Clean-Up for Fuel Cell Applications* Workshop Report

BACKGROUND: The U.S. Department of Energy's (DOE) Fuel Cell Technologies Office (FCTO) in the Office of Energy Efficiency and Renewable Energy (EERE) seeks to advance the development and deployment of fuel cells for power generation in a variety of applications. In support of this goal, EERE funds a broad range of fuel cell research, development, and demonstration activities.

The Gas Clean-up for Fuel Cell Applications Workshop was held at Argonne National Laboratory on March 6-7, 2014, and featured 43 participants from industry (fuel cell, process solution providers, and material suppliers), government agencies, advocacy groups, universities, and national laboratories with expertise in the relevant fields. The objective of the workshop was to identify and prioritize:

- The impurities that have the greatest impact on the complexity and performance of a fuel cell plant;
- The Research and Development (R&D) strategies that can alleviate the cost for onsite removal of impurities;
- The R&D strategies that will simplify a plant and reduce product cost (heat, power, hydrogen); and
- The fuel processors and gas clean-up systems that facilitate modularity and fuel flexibility for a range of fuel cell technologies.

The main activities of the workshop were arranged in three sessions to (i) discuss the impurities, (ii) discuss the clean-up technologies, and (iii) discuss the R&D needed to advance the clean-up technologies.

PURPOSE: The purpose of this RFI is to obtain feedback and opinions from industry, academia, research laboratories, government agencies, and other stakeholders on the report findings from the *Gas Clean-up for Fuel Cell Applications Workshop* held at Argonne National Laboratory in 2014. The report can be found on the Exchange website at https://eere-exchange.energy.gov/.

Key conclusions of the workshop include:

- The sensitivity of the fuel processor and fuel cells to the impurities present in fuels of interest imposes a clean-up cost that adds to the burden of fuel cell systems in stationary

applications. Estimates showed the clean-up of biogas costs ~2 cents per kWh of electricity, and 30% of the O&M costs.

- Sulfur, siloxanes, and halogens were identified as the impurities that are most damaging or difficult to remove. Sulfur has an immediate detrimental effect on the fuel cell and reforming catalyst performance. Siloxanes have a slower effect by depositing a glassy layer on active surfaces. Halogens can form acid gases and can increase electrolyte loss rates in MCFCs, while other contaminants such as moisture and heavy hydrocarbons interfere with impurity removal because of their greater affinity for the sorbents.

- The severity of the detrimental effects on the fuel cell system requires some impurities to be reduced to the parts per billion level, which adds to the cost of clean-up as well as fuel quality monitoring.

- Uncertainties and variations in the impurity levels and the lack of affordable sensors for the impurities at low detection limits leads to overdesign and underuse of the sorbent capacities, which increases costs.

- Short-term R&D is needed in the following areas:
  - affordable analytical equipment and methods suitable for rapid onsite analysis
  - higher capacity sorbents that are unaffected by moisture and hydrocarbons
  - impurity specifications for fuels
  - fuel flexible reforming catalysts
  - accelerated test protocols to evaluate effective clean-up systems

- Long-term R&D is needed in the following areas:
  - methods to convert fuel impurities or spent sorbents into useful byproducts – this would convert a disposal problem to a revenue source and improve economics
  - scalable, modular, environmentally friendly, portable, low cost cleanup systems so that the clean-up system can benefit from volume production
  - additional studies and plant demonstrations to provide much needed data for the industry
  - replacement of fuel odorants with non-sulfur containing odorants

REQUEST FOR INFORMATION QUESTIONS:
Upon reading the Workshop Report, do you agree with the findings? Why or why not? What is the basis of opinion? Are there other findings that are considered critical but were not included in this report? If so, please list them. Please prioritize challenges and needs, if different from those in the report.

DISCLAIMER AND IMPORTANT NOTES: This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to

potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

PROPRIETARY INFORMATION: Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, **respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit business sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [list applicable pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0001331. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure” and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

EVALUATION AND ADMINISTRATION BY FEDERAL AND NON-FEDERAL PERSONNEL: Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

REQUEST FOR INFORMATION RESPONSE GUIDELINES: Responses to this RFI must be submitted electronically to fuelcellresearchneeds@ee.doe.gov no later than 5:00 pm (ET) on July 24, 2015. Responses must be provided as attachments to an email. EERE recommends that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Only electronic responses will be accepted.

Please identify your answers by responding to a specific question or topic if possible. Respondents may answer as many or as few questions as they wish.

EERE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address.