

MODIFICATION

All modifications to the Request for Information (RFI) are highlighted in yellow in the body of the RFI.

Mod. No.	Date	Description of Modifications
000001	08/07/2014	Change the submission deadline for responses to this RFI from 08/07/2014 to 09/02/2014.

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Fuel Cells for Continuous On-Board Recharging Application for Battery Electric Light-Duty Vehicles

DE-FOA-0001145 **Amendment 000001**

DATE: 07/02/14

SUBJECT: Request for Information (RFI)

DESCRIPTION: Request for Information (RFI) on fuel cell technology validation, commercial acceleration, and potential deployment strategies for continuous fuel cell rechargers on board light-duty electric vehicles in fleets.

BACKGROUND: U.S. commercial fleets are a large automotive market segment, with vehicle inventories totaling about 11.7 million vehicles and new car and light truck sales of about 2.6 million vehicles annually.¹ Commercial fleets include government-owned vehicles (e.g., police cars), company-owned vehicles, rental fleets, taxis, and delivery vehicles.

Extended driving range and other benefits provided by on-board fuel cell range extenders may offer the potential for electric drive transportation technologies to respond to the growing demand for longer range by commercial fleet customers that have purchased Battery Electric Vehicles (BEVs). In a survey of vehicle fleet operators, fleet managers indicate that right-sizing vehicles to the job is the top priority in their efforts to reduce greenhouse gas emissions.² In another survey, the majority of fleet managers state that costs, range capabilities, and charging times were their main concerns with electric vehicles³.

A study conducted by Argonne National Laboratory (ANL) for the U.S. Department of Energy (DOE), "The Benefits of Using a Fuel Cell Auxiliary Power Unit to Double the Range of Current Battery Electric Vehicles,"⁴ has evaluated the fuel consumption, cost trade-offs, and other impacts of using a small fuel cell to extend the driving range of a Battery Electric Vehicle, assessing the benefits for different fuel-cell-rated power and battery power ranges on both standard and real-world drive-cycles for a medium-duty electric truck. Also, in France, the Franche-Comté Regional Council and La Poste (French postal service) have begun testing hydrogen-based range extender kits from Symbio FCell in Renault's Kangoo Z.E. electric mail

¹ "Automotive Fleet" statistics: <http://www.automotive-fleet.com/statistics/>

² Survey:

http://fleetanswers.com/sites/default/files/Corporate%20fleet%20emissions%20survey%20report_0.pdf

³ Survey: <http://news.fleetcarma.com/2011/10/31/fleets-become-the-gateway-for-electric-vehicle-adoption-in-north-america/>

⁴ ANL presentation: http://www.hydrogen.energy.gov/pdfs/review13/mt012_rousseau_2013_o.pdf

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delivery vehicles⁵. The system being demonstrated is expected to double the range of the electric vehicles used for postal delivery. In addition, new DOE projects for extending the range of all-electric medium-duty trucks for parcel delivery are getting underway.

Commercially available all-electric light-duty vehicles with Polymer Electrolyte Membrane (PEM) fuel cell range extenders for commercial fleet vehicles could potentially have comparable or better performance than internal combustion engine propulsion systems or BEVs alone. Electric drivetrains may be able to take advantage of the benefits of batteries for delivering power and fuel cell systems for energy storage and peak power needs.

Taxis, delivery vehicles, and light-duty commercial vans and multi-purpose vehicles may represent attractive opportunities for light-duty PEM fuel cell range extenders because these vehicles typically return to central depots on a daily basis (thus minimizing the need for expansive refueling infrastructures), experience heavy stop-start operations especially in densely-populated urban service areas, and typically are heavily used. As an example, a taxi in the New York City fleet (13,437 medallion taxis) typically travels 70,000 miles annually, and the typical driver shift is 9.5 hours⁶. Vehicle operators of light-duty commercial vans may also need auxiliary power to support delivery of services, such as refrigeration for perishables or operation of power equipment during service calls. The U.S. commercial fleet includes 338,000 light-duty commercial vans and multi-purpose vehicles and 154,600 taxis⁷.

PURPOSE: The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on issues related to the technical and economic feasibility of commercializing fuel cell range extenders for available BEVs in the United States market. EERE is specifically interested in information on BEV makes and models where an after-market modification to extend the vehicle range using a PEM fuel cell system would be most feasible. This is solely a request for information and not a Funding Opportunity Announcement (FOA). EERE is not accepting applications.

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

⁵ LaPoste project: <http://www.businesswire.com/news/home/20131210005828/en/La-Poste-UTBM-Testing-Hydrogen-Range-Extender#.Uupl19JDsk0>

⁶ New York City Taxi & Limousine Commission fact sheet: http://www.nyc.gov/html/tlc/downloads/pdf/2014_taxicab_fact_book.pdf

⁷ “Automotive Fleet” statistics: <http://www.automotive-fleet.com/statistics/>

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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-0001145. 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

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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 CATEGORY AND QUESTIONS:

In addition to the specific numbered questions listed under the category title below, please comment on the following five key general issues for the category identified. More detailed questions about each issue are provided below to frame your response:

- a. Impact: What is the battery and fuel cell electric vehicle hybridization challenge to be solved? If solved, how would this development challenge affect clean energy technology? If solved, what organizations or groups will care in the public and/or private sectors? What would be the potential quantitative impacts on energy efficiency, life-cycle energy benefits, greenhouse gas reductions (GHG), and/or related environmental impacts in use?
- b. Additionality: Who supported the fundamental low- and mid-Technology Readiness Level (TRL) research and development and why wouldn't they support high-TRL development? Who else might co-fund this high-TRL advanced engineering development? How might DOE support best catalyze co-funding of high-TRL investment? What key knowledge or capability is missing, unknown or uncertain, which prevents private sector development and commercialization of this technology today without further public sector investment?
- c. Openness: Can this high-TRL advanced engineering development and demonstration challenge be stated more broadly, without loss of potential impact? Is there a fertile low and mid-TRL scientific and engineering base which is ready to address this advanced development challenge? What broad set of public and private sector stakeholders need to be engaged in addressing this advanced development challenge and how would they be best engaged?
- d. Proper Role of Government: Why specifically would addressing this advanced development and demonstration challenge through an institute be in the public sector national interest now? What are the potential market failures and why wouldn't the private sector address this development challenge by itself in the absence of public sector investment? Is there a pathway for public sector and DOE support to that end and what metrics would provide short-term indicators of success along this pathway? Are there supply chain issues where multiple organizations would need to simultaneously change technology approaches or practices for this

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clean energy technology to be manufactured? What non-technology development issues need to be addressed (workforce development, unique vehicle technology, user knowledge dissemination, etc.) for this clean energy technology to be adopted?

e. Enduring Economic Benefit: Is there large potential for follow-on funding and what are the potential stage-gate metrics to be achieved before that follow-on support could be harnessed? Is industry currently trying to address solutions to this high-TRL challenge and what achievement limitations have they met? Would this high-TRL advanced engineering challenge impact more than one clean energy (or non-clean energy) application?

CATEGORY: PEM Fuel Cell/Battery Hybrid Platforms for Light Duty Electric Vehicle Fleets

1. What would constitute a business case (including capital/operating cost reductions) for light-duty vans or delivery vehicles used to deliver parcels, to dispatch service technicians, or to shuttle individuals or small groups of people within service territories using prime battery propulsion with fuel cell range extenders? What are potential vehicle technical performance improvements for an on-board PEM fuel cell range extender supporting prime battery propulsion [for example: battery durability, productivity improvements (e.g. low downtime for refueling), or vehicle torque]?
2. How would an increase in all-electric driving range attract additional commercial fleet customers? (Please include needed driving range, market share, or sales volume estimates where possible.)
3. What is the potential to reduce the manufacturing cost, weight, and volume of the electric drivetrain by reducing the size of the battery and offsetting with the PEM fuel cell and energy storage? What are the key metrics and current status relative to requirements?
4. What are the key air emissions advantages of fuel cell range extenders as compared to other technologies shown in the table below?
5. Other than those for air emissions, what regulations are important considerations in terms of a value proposition such as compliance with noise and anti-idling laws?
6. How would a government-supported light-duty vehicle deployment accelerate the commercialization of this technology application? Could this be accomplished without government intervention?
7. What would be the smallest number of vehicles (deployed with government support) needed to: (1) provide enough data and analysis for industry acceptance and (2) enable further deployments without government assistance?
8. What are present economic and non-technical barriers to commercializing the technology application?

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9. What are the concerns (if any) with regulation or permitting issues in locating a suitably sized technology deployment project?
10. What are the challenges in providing refueling infrastructure and how would new deployment projects address these challenges?
11. Are there technical advantages making fuel cell range extenders more viable than BEVs or Plug-in Hybrid Electric Vehicles (PHEVs)?
12. What technology advances for PEM fuel cell range extenders would make them more commercially viable?
13. Would a fuel cell range extender added to a commercial BEV make that vehicle platform more viable?
14. If DOE was to consider a Funding Opportunity Announcement in this area, what should the key topics, deliverables, and funding levels be?

2015 Technology - Compact Cars							
	BEV - U.S. Grid	FCEV - SMR H2	BEV with FC charger & SMR H2	Gasoline/US Grid EREV40	Gasoline HEV	Gasoline ICEV	Diesel ICEV
Electric Drive Wh/mi	300		300	278			
Gasoline Engine or Fuel Cell, mpgge		61		43	41	32	38
Maximum Range, miles	80 (24- kWh batteries)	300	40 (12-kWh batteries) + 180 (3 kg H2)	500	500	400	450
Grams GHG/mile	210	250	240	220	270	340	300

REQUEST FOR INFORMATION RESPONSE GUIDELINES: Responses to this RFI must be submitted electronically to FuelCellCOBRA@ee.doe.gov no later than 5:00 pm (EDT) on **September 2, 2014**. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Only electronic responses will be accepted.

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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.

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