



## Request for Information DE-FOA-0000111

**Date:** 05/28/2009

**Subject:** Request for Information (RFI) on performance, durability, and cost targets for fuel cells designed for Combined Heat and Power (CHP) and Auxiliary Power Unit (APU) applications.

**Description:** The U.S. Department of Energy (DOE) has issued a Request for Information seeking input from stakeholders and the research community on proposed technical and cost targets for fuel cells designed for residential CHP and APU applications.

**Program Manager / Area:** Dr. Sunita Satyapal, Acting Program Manager / Fuel Cell Technologies Program.

### **Background:**

The DOE Fuel Cell Technologies Program seeks to advance the development and deployment of fuel cells for power generation in a variety of stationary, portable, and transportation applications. In support of this goal, DOE funds a broad range of fuel cell research and development (R&D) activities. A detailed description of the program, including technical and cost targets, can be found in the Multi-Year Research, Development and Demonstration Plan at: [http://www1.eere.energy.gov/hydrogenandfuelcells/mypp/pdfs/fuel\\_cells.pdf](http://www1.eere.energy.gov/hydrogenandfuelcells/mypp/pdfs/fuel_cells.pdf).

High-temperature fuel cells, including (but not limited to) solid oxide fuel cells, are a key focus area of DOE's R&D activities for stationary power generation because of their fuel flexibility, high efficiency, and potential for use in CHP applications. It is anticipated that residential CHP fuel cells will use primarily natural gas fuel to provide electrical power, heating, and hot water.

APUs for heavy duty vehicles/trucks represent a potential early market opportunity for fuel cell deployment. Significant fuel savings, as well as reduction in CO<sub>2</sub> and criteria pollutant emissions, may be achieved through more efficient fuel conversion and reduction in engine idling time. Truck APU fuel cells are expected to use primarily diesel fuel to power environmental controls and peripheral electrical devices.

DOE is currently working to identify appropriate technical and cost targets for fuel cells for residential CHP and APU applications. The targets are driven by consumer expectations for the various applications, rather than by the operating parameters or constraints of specific technologies. Targets are generally set with industry and market input and help drive the R&D required for improvements in materials, designs, and systems. The preliminary targets included in

this RFI were developed with stakeholder input, including a workshop in June 2008 at the Program’s Annual Merit Review and Peer Evaluation meeting.

**Purpose:**

The purpose of this RFI is to solicit feedback from stakeholders and the research community on proposed performance, durability, and cost targets for CHP and APU fuel cell applications. The proposed targets are summarized in Tables 1 and 2. Responses to the RFI should address one or more of the following:

- Relevance of the proposed targets
- Probability that the proposed targets could be achieved as scheduled
- Recommendations for testing conditions and protocols
- Adequacy of target table footnotes and/or need for additional supporting information
- Need for thermal cycling or on/off cycling durability targets
- Apportionment of CHP energy between electrical and thermal energy
- Recommendations for additional targets
- Status of fuel cell technologies in comparison to targets and potential areas of R&D

**Table 1.** Proposed performance, durability, and cost targets for fuel cell systems for residential CHP using natural gas.

	Estimated 2008 Status	2012	2015	2020
Power output	1 - 10 kW	1 - 10 kW	1 - 10 kW	1 - 10 kW
Energy efficiency at rated power <sup>1</sup>	~38% DC	42.5% DC	42.5% AC	47.5% AC
CHP energy efficiency	> 75%	80%	85%	90%
Cost <sup>2</sup>	~ \$750/kW	\$550/kW	\$500/kW	\$350/kW
Transient response (10 - 90% rated power)		< 1 min	20 s	5 s
Start-up time from 20°C ambient	720 min	240 min	60 min	30 min
Average steady-state degradation	< 2%/1000 h	1%/1000 h	0.5%/1000 h	0.25%/1000 h
Transient power degradation	< 1%	0.50%	0.25%	0.10%
Operating lifetime	~5900 h	16,650 h <sup>3</sup>	24,975 h <sup>4</sup>	49,950 h <sup>5</sup>
System availability	97.00%	97.5%	> 97.5%	> 97.5%

<sup>1</sup> DC net/LHV or AC net/LHV. 2015 and 2020 targets include DC-AC conversion efficiencies.

<sup>2</sup> Factory cost defined at 50,000 unit production (250 MW in 5-kW modules).

<sup>3</sup> Approximate hours in 2 yrs of operation at 95% availability.

<sup>4</sup> Approximate hours in 3 yrs of operation at 95% availability.

<sup>5</sup> Approximate hours in 6 yrs of operation at 95% availability.

**Table 2.** Proposed performance, durability, and cost targets for fuel cell systems for APUs using diesel fuel.

	Estimated 2008 Status	2012	2015	2020
Power output	1 - 10 kW	1 - 10 kW	1 - 10 kW	1 - 10 kW
Energy efficiency at rated power <sup>1</sup>	~16% DC	25% DC	30% DC	37.5% DC
Power density	17 W/L	25 W/L	30 W/L	35 W/L
Specific power	12 W/kg	15 W/kg	25 W/kg	35 W/kg
Factory Cost <sup>2</sup>	~ \$750/kW	\$550/kW	\$450/kW	\$300/kW
Transient response (10 - 90% rated power)		< 1 min	20 s	5 s
Start-up time from 20°C ambient	720 min	90 min	45 min	10 min
Average steady-state degradation	2.6%/1000 h	1.5%/1000 h	1%/1000 h	0.5%/1000 h
Transient power degradation	~ 1%	0.75%	0.5%	0.25%
Operating lifetime	~3000 h	12,480 h <sup>3</sup>	18,720 h <sup>4</sup>	31,200 h <sup>5</sup>
System availability	97%	97.5%	> 97.5%	> 97.5%

<sup>1</sup> DC net / LHV.

<sup>2</sup> Factory cost defined at 50,000 unit production (250 MW in 5-kW modules).

<sup>3</sup> Approximate hours in 2 yrs of operation at a weekly cycle of 5 days on and 2 days off.

<sup>4</sup> Approximate hours in 3 yrs of operation at a weekly cycle of 5 days on and 2 days off.

<sup>5</sup> Approximate hours in 5 yrs of operation at a weekly cycle of 5 days on and 2 days off.

### RFI Guidelines:

Comments in response to this RFI must be provided as an attachment to an e-mail message addressed to *FCRFItargets@go.doe.gov*. All responses to this RFI must be delivered electronically to the aforementioned e-mail address using Microsoft Word (.doc) format. DOE would prefer that responses to this RFI be no more than 5 pages in length per topic (i.e., CHP or APU application). Please do not provide any information which may be considered proprietary or confidential. DOE will not reimburse costs associated with preparing any documents for this RFI. Note that the intent of this RFI is to provide an opportunity for stakeholders to submit feedback on targets, and will not lead directly to a Funding Opportunity Announcement. Technical questions may be addressed to Dimitrios Papageorgopoulos (*dimitrios.papageorgopoulos@ee.doe.gov*) or Nancy Garland (*nancy.garland@ee.doe.gov*). Comments must be provided by no later than 11:59 PM EDT on June 30, 2009.