

V.E.3 Fuel Cell Technology Status—Cost and Price Status

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Project Start Date: July 01, 2009
Project End Date: Project continuation and direction
determined annually by DOE

- The 2017 transportation fuel cell system cost target is \$30/kW
- The 2020 micro-combined heat and power (CHP) (5 kW) fuel cell system cost target is \$1,500/kW
- The 2020 medium CHP (100 kW–3 MW) fuel cell system cost target is \$1,000/kW for natural gas and \$1,400/kW for biogas

FY 2014 Accomplishments

- Updated and published an information pamphlet with participation request and benefits as well as past fuel cell durability composite data products (CDPs) and example price/cost CDPs,
- Project benefits include
 - Current and accurate cost/price status for DOE to complement the high-volume model cost predictions
 - Realistic expectations for current fuel cell system price at low volume
 - Aggregate and individual benchmarking
 - Supports adoption of fuel cell technology.
- Presented project overview and data request in a DOE webinar on the NFCTEC.
- Created example results to support conversations with developers on how data would be aggregated and published.
- Created generic cost/price data template.
- Published a CDP on low-volume price by backup power, forklift, and prime power applications.

Overall Objectives

- Conduct an independent assessment to benchmark current fuel cell system cost and price in a non-proprietary method.
- Leverage the National Fuel Cell Technology Evaluation Center (NFCTEC).
- Collaborate with key fuel cell developers on the voluntary data share and NFCTEC analysis.

Fiscal Year (FY) 2014 Objectives

- Establish price data templates and pursue gathering current price data for fuel cell developer products.
- Publish aggregated, current fuel cell price by application.

Technical Barriers

This project addresses the following technical barriers from the Fuel Cells section of the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan:

- (B) Cost (Lack of data for current fuel cell costs and status per targets)

Technical Targets

This project is conducting an independent assessment of the current cost and price of fuel cell systems. All results are aggregated to protect proprietary information and reported on by the system application. Per the Fuel Cells section of the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan:



INTRODUCTION

The DOE has funded significant research and development activity with universities, national laboratories, and the fuel cell industry to improve the market competitiveness of fuel cells. System cost is a barrier to widespread market acceptance. There is a lack of data for current, low-volume system cost and price data. NREL is benchmarking the current fuel cell system cost and price through independent assessment of voluntarily supplied data. NREL's data processing, analysis, and reporting capitalize on capabilities developed in DOE's NFCTEC. Fuel cell system cost/price is reported every two years. A key component of this project is the collaborative effort with key fuel cell developers for the available data.

APPROACH

The project involves voluntary submission of data from relevant fuel cell developers. NREL is contacting fuel cell developers for cost and price data for multiple fuel cell types to either continue or begin a data sharing collaboration. A continuing effort is to include more data sets, types of fuel cells, quantity of units sold, and developers.

Raw and processed data are stored in NREL's NCFTEC. The NCFTEC is an off-network room with access provided to a small set of approved users. Processing capabilities are developed or modified for new data sets and then included in the analytical processing of NREL's Fleet Analysis Toolkit. The incoming raw data may be new or a continuation of data that have already been supplied to NREL. An internal analysis of all available data is completed annually and a set of technical CDPs is published every other year. Publications are uploaded to NREL's technology validation website [1] and presented at industry-relevant conferences. The CDPs present aggregated data across multiple systems, sites, and teams in order to protect proprietary data and summarize the performance of hundreds of fuel cell systems and thousands of data records. A review cycle is completed before the CDPs are published. This review cycle includes providing detailed data products (DDPs) of individual system- and site-performance results to the specific data provider. DDPs also identify the individual contribution to the CDPs. The Fleet Analysis Toolkit is an internally-developed tool for data processing and analysis structured for flexibility, growth, and simple addition of new applications. Analyses are created for general performance studies as well as application- or technology-specific studies.

RESULTS

The past years of this project aimed to gather, analyze, and report on state-of-the-art fuel cell durability. Project direction was modified, per DOE's request, in FY 2014 to focus on cost and then alternate with durability every other year. This enables the project team to report on the current status for the two leading technical barriers per the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan. FY 2014 was the first year for publishing data on the current cost and price of fuel cell systems sold at low volume. A request for both cost and price were made to leading fuel cell developers because it was unclear how the data would be voluntarily supplied. The data that was supplied for the FY 2014 published CDP was price data, as noted in the CDP. Cost will remain in the request in order to gain a better understanding of the system cost without markup.

With the new focus on cost and price data collection in FY 2014, the informational project pamphlet was updated to add examples for cost and price. A data template was also generated (Figure 1). The template includes pricing, product

availability, application, and quantity/type of units sold. The generic data template is available to DOE to collect and deliver data to the NCFTEC. This template was also modified in order to generate specific templates for fuel cell developers per known available systems. Example results (Figures 2 and 3) were created to support conversations with developers on how data would be aggregated and published.

The first CDP was published in June 2014 for backup power, forklift, and prime power applications (Figure 4). Statistical details, specifically the median and 25th and 75th percentile range, were identified for each application in dollars per kilowatt. The data is in 2013 dollars without incentives and is from public information, American Recovery and Reinvestment Act deployments, and voluntarily supplied data from fuel cell developers. This includes more than 20 different data points from more than three fuel cell developers. One of the first trends from Figure 4 worth noting is the large span of data in the prime power category. Prime power price data supplied includes multiple system sizes, types, and fuels. The variety of systems in prime power is an important reason for the need to further breakdown the prime power category (e.g. residential and commercial). The number of data sets and providers did not allow for this breakdown, which is an objective for the next update. Another trend to note is that the 25th percentile value for all three applications is below \$4,000 per kilowatt. While these values are above DOE's cost targets, the system prices have not yet realized cost reduction due to mass production. Figure 4 is the initial price benchmarking and provides a format that can be used to track progress in cost reduction in the next update, expected in FY 2016 per DOE's discretion. Planned updates include more data and new applications, addition of price versus the number of units sold, breakdown of prime power by commercial and residential scales, low-volume cost-reduction trends by time, and system cost status.

CONCLUSIONS AND FUTURE DIRECTIONS

This project has leveraged other technology validation projects and existing industry relationships to report on the current, low-volume fuel cell system price status with a relatively low investment from DOE. The data collection effort includes both domestic and international developers and it is an ongoing task to include new data sets, update data sets already included (if applicable), and include new fuel cell developers, applications, and types. An online interface provides information on the project, contact information for interested collaborators, and all publications [1]. The published CDP from June 2014 is the first publication and will be updated in 2016 per DOE's discretion. Future work includes the following:

- Continue cultivating existing collaboration and developing new collaborations with fuel cell developers

4/7/14

Note: The information you provide here will be shared with the NREL National Fuel Cell Technology Evaluation Center for independent analysis and may be published as composite data products after a 2 stage review and concurrence process with the data providers. The information will be treated as confidential.

Instructions -
Please fill in applicable requested information for each available product, with each product entered as a new column. Some information may have been filled in based on an internet search of your available product. Please correct as appropriate.

System	ProductName1	ProductName2	ProductName3	ProductName4	ProductName5	ProductName6
Current Price (US \$)						
Availability						
Market						
Application						
Fuel Cell Type						
Fuel						
Comments						
Power Rating (kW)						
Other features						
If systems sold to date						
2010 Price (US \$)						
2012 Price (US \$)						
2014 Price (US \$)						
Current system cost (US \$)						
Current fuel cell stack cost (US \$)						
System efficiency						
Cell count						
Active area						
Turndown capability						
Spec sheet link or Product brochure PDF attached						
	Availability	Application	Fuel Cell Type	Fuel	Other features	Markets
	Available	Stationary Prime	DMFC	Hydrogen	CHP	Europe
	Future product	Stationary Residential	PEMFC	Methanol	CHP	Japan
	No longer available	Stationary Backup	SOFC	Reformate	Other (Please specify)	United States
	Other (Please specify)	Forklift	MCFC	Other (please specify)		All
		Automotive	PAFC	Natural Gas		Other (please specify)
		Bus	AEM	Propane		
		Portable	Other (please specify)			
		Auxiliary				
		Other (Please specify)				

FIGURE 1. Generic Cost and Price Data Template

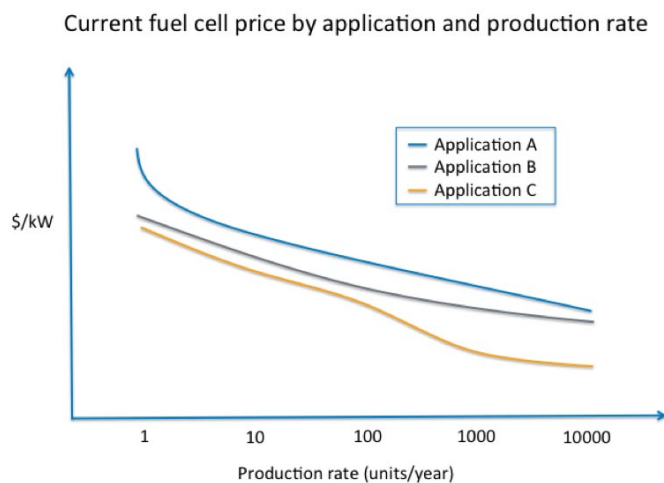


FIGURE 2. Example Result (Fake Data) for Current Fuel Cell Price By Application and Production Rate

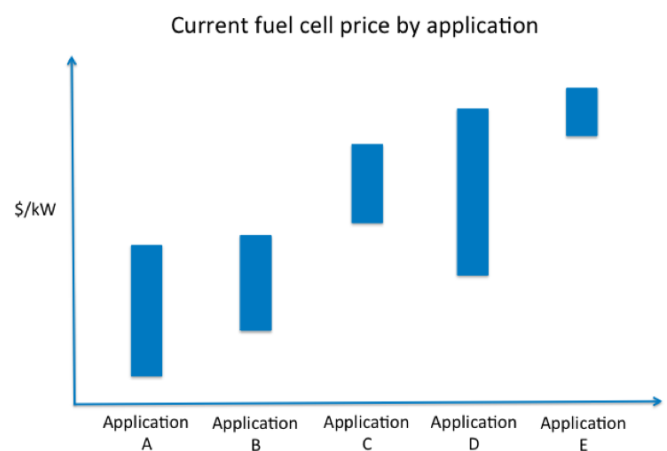


FIGURE 3. Example Result (Fake Data) for Current Fuel Cell Price by Application

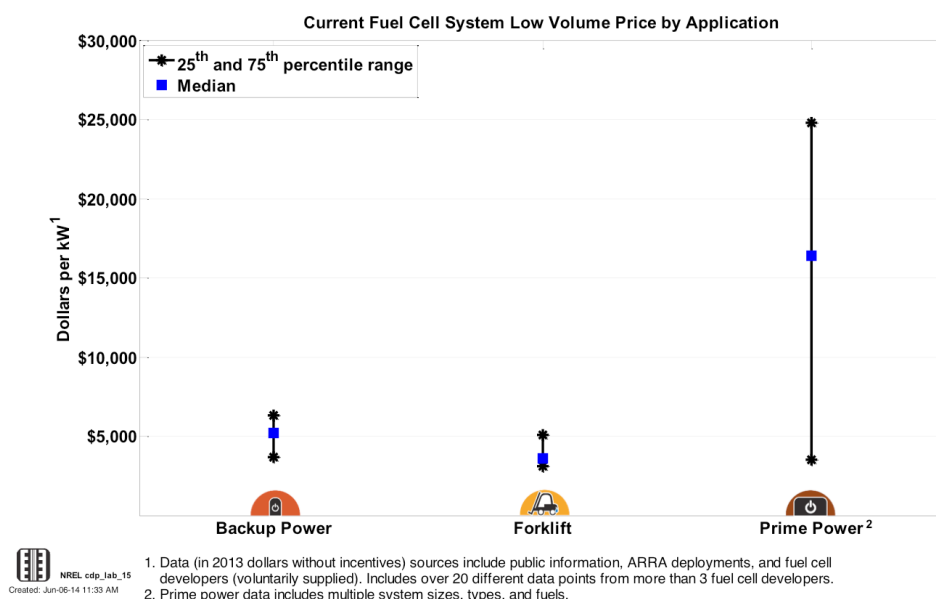


FIGURE 4. Current Fuel Cell System Low-Volume Price by Application (Published June 2014)

- Gathering, processing, and reporting on current fuel cell product cost and/or price
- Focusing on fuel cell durability data for expected publication of status in FY 2015.

REFERENCES

1. http://www.nrel.gov/hydrogen/proj_fc_analysis.html

FY 2014 PUBLICATIONS/PRESENTATIONS

1. Kurtz, J., Dinh, H., “Fuel Cell Technology Status – Cost & Price Status,” Presented as a poster at the 2014 Annual Merit Review and Peer Evaluation Meeting, Washington, D.C. (June 2014)
2. Kurtz, J., Dinh, H., “Current Low Volume Fuel Cell System Price: 2014 Composite Data Product.” (June 2014)
3. Kurtz, J., Sprik, S., “National Fuel Cell Technology Evaluation Centers.” DOE webinar. (March 2014)
4. Kurtz, J., Dinh, H., Sprik, S., Saur, G., Ainscough, C., Peters, M., “Analysis of Laboratory Fuel Cell Technology Status – Voltage Degradation,” Annual Progress Report. (August 2013)