

*In fiscal year 2009, the Education; Safety, Codes and Standards; and Technology Validation subprograms were funded through the DOE Vehicle Technologies Program. Complete detailed reports from the Annual Merit Review and Peer Evaluation meeting for these three subprograms can be found on the DOE Vehicle Technologies Program Web site: [http://www1.eere.energy.gov/vehiclesandfuels/resources/fcvt\\_reports.html](http://www1.eere.energy.gov/vehiclesandfuels/resources/fcvt_reports.html).*

*The following section includes summary overview reports for each of these three subprograms.*

## **Education**

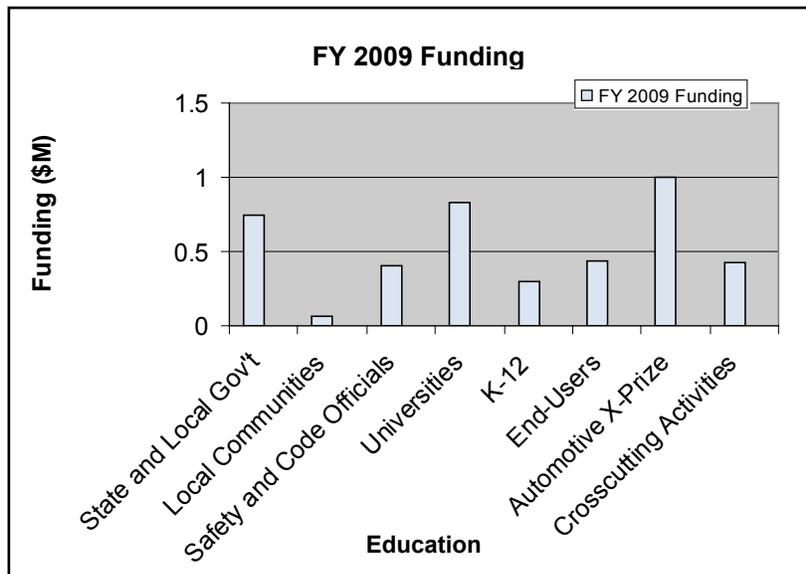
### **Summary of Annual Merit Review Education Subprogram**

#### **Summary of Reviewer Comment on Education Subprogram:**

Reviewers emphasized the importance of a comprehensive education and outreach effort in advancing the adoption of hydrogen and fuel cell technology. The challenges, goals, and objectives were considered to be well met by the structure of the subprogram; and the target audiences and corresponding outreach activities were considered to be well chosen, well defined, and appropriate to the goals of the program. Comments noted that progress has been demonstrated clearly, but more work is needed to reach out to the safety community and potential adopters. Reviewers underscored the importance of the survey in measuring progress, increased coordination among the different projects and across the country, ongoing communication with principal investigators, and the use of social media and multimedia to reach out to target audiences. The subprogram was commended for the excellent use of limited, inconsistent funding, and reviewers stressed the critical need to sustain education activities in the future.

#### **Hydrogen Education Funding:**

The Education subprogram efforts are prioritized to focus on the target audiences involved in facilitating the near-term use of hydrogen and fuel cell technology. With funding at the request level, the FY 2009 budget allowed for support of projects across the education portfolio, including new competitively awarded projects focused on outreach to state and local government officials and potential end users, as well as projects to develop and expand university hydrogen and fuel cell education programs. FY 2009 funds also supported ongoing efforts to educate first responders and code officials, local communities, and teachers and students at the middle and high school levels. The following chart indicates the FY 2009 Education subprogram funding.



**Majority of Reviewer Comments and Recommendations:**

Education projects scored 3.64, 3.15, and 2.63 for the highest, average, and lowest scores, respectively. Scores reflect progress made over the last year and reported plans for future activity. Key comments and recommendations are summarized below. DOE will act on reviewer recommendations as appropriate to the overall scope, direction, and coherency of the Education effort.

**First Responders:** Reviewers recognized the need to enhance safety community confidence in hydrogen and fuel cells through training and familiarity as a first step in widespread hydrogen and fuel cell adoption. The use of online learning tools and hands-on training were commended for enhancing learning effectiveness. Reviewers thought that feedback from technical experts and first responders in the steering committee were essential to quality course development and suggested extending collaboration to include more input from energy companies and other Federal agencies. Coverage of stationary and vehicle applications was considered to be comprehensive and reviewers recommended a greater focus on near-term fuel cell applications such as forklifts.

**Code Officials:** Reviewers felt that educating code and permitting officials is essential and highly relevant to market transition of fuel cell and hydrogen technology. They felt that collaboration and feedback at the national and state level from the codes and standards community and the first responder education program ensured relevancy of course content and recommended extending collaboration to other Federal agencies. Comments commended direct linking to the updated permitting and codes database and suggested adding links to local jurisdiction codes. Reviewers suggested expanding the course to include parking facilities, repair facilities, and indoor fueling.

**Universities:** Reviewers recognized the need for a well-trained technical professional workforce to support the growing hydrogen and fuel cell industry. The university programs were cited for the breadth and quality of activities including courses, curriculum, textbook chapters, lab activities, internships, seminar series, and programs. They specifically appreciated the integration of real-world research, demonstration, deployment, and hands-on experience into these education programs. Reviewers thought the projects effectively leveraged existing university programs by integrating specialized modules into curriculum and classes for lower- level and upper-level engineers, as well as non-engineers. Collaboration with industry, junior colleges, and other stakeholder groups was viewed as adequate, and

reviewers encouraged several projects to expand their partnerships. Comments underscored the importance of accessibility to the wider student population and called for deployment to other departments, universities, and on-line. Although outreach material development had not yet been completed for most projects, reviewers emphasized the need for outside technical feedback and review. Reviewers stated that projects should be able to continue deployment after funding ends.

**End-Users:** Reviewers emphasized the importance of using real-world deployments to build the business case for early adoption of hydrogen and fuel cells. They felt that the integration of an education seminar with a trial deployment was especially effective in introducing the technology and showing the benefits of using fuel cell forklifts to potential adopters. Collaborators were considered to be well chosen with representation from many industries. Although the project had just started, reviewers thought that progress was reasonable but future plans were unclear. Reviewers encouraged the continuation of the deployments and workshops and recommended the development of a final business case with aggregate performance results for use as an outreach tool to potential customers.

**State and Local Government Officials:** Reviewers see education of state and local leaders as essential to the future formation of hydrogen and fuel cell initiatives. Reviewers thought that projects were well chosen to represent states active in hydrogen and fuel cell activities across the nation, and national groups working with all states. Collaboration was considered to be comprehensive with other state groups, industry, the safety community, academia, and government. Reviewers thought that the material developed was audience appropriate and commended the varied delivery mechanisms including workshops, magazine articles, Web sites, Webinars, social media, and train-the-trainer programs. Reviewers underscored the importance of metrics to measure accomplishments and encouraged increased communication among the projects to ensure consistency in content and delivery of information in different regions.

**Knowledge and Opinions Assessment:** Reviewers noted the importance of the Knowledge and Opinions Assessment for measuring progress. They felt the survey's statistical analysis is proficient and well thought-out, although for the public survey, many viewed the selected methodology of computer assisted telephone interviewing as being limited to a certain segment of the population. To remain statistically valid and adequately compare results over time, the follow-up survey methodology and survey instruments must remain the same as what was used for the baseline survey. Reviewers suggested the use of Web-based surveys, more frequent surveys, and coordinating the survey to align with other outreach projects.

**Automotive X Prize:** Reviewers stressed the importance of educating students about advanced transportation technologies in ensuring long-term changes in vehicle use and adoption. The Automotive X-Prize was commended for the creative use of a wide-range of outreach tools such as competitions, national events, Web sites, and design competitions in engaging the general public, teachers, students, and industry stakeholders. Reviewers saw the project as an effective campaign to educate and inspire students to learn more about vehicle efficiency and sustainability, and pursue education and careers in the transportation sector. They felt the project was well planned, with appropriately scheduled milestones, and well funded. Reviewers considered collaboration with education providers, science centers, and Discovery Education to be appropriate but questioned the level of funding leverage from partners. Reviewers underscored the importance of metrics in tracking future success.

## Safety, Codes and Standards

### Summary of Annual Merit Review Safety, Codes and Standards Subprogram

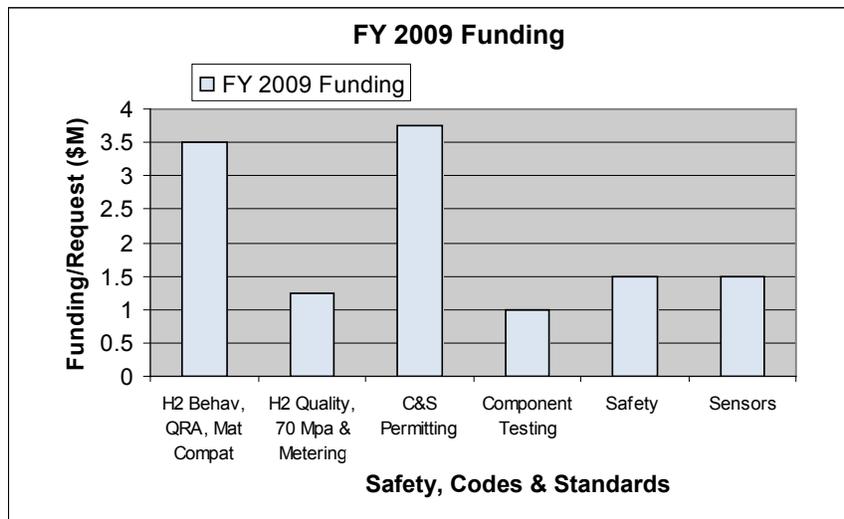
**Summary of Reviewer Comments on Safety, Codes and Standards Subprogram:**

The Safety, Codes and Standards subprogram reviewers stated that the projects were productive, well coordinated and organized. The reviewers were impressed by the breadth of activities and the ongoing commitment to safety, codes, standards, and information-sharing activities. They stressed that successes in this subprogram touch every other DOE hydrogen-related activity by fostering acceptance, collaboration and communication with critical stakeholders.

Reviewers stressed the importance of continuing efforts in critical areas such as hydrogen materials research, hydrogen codes, standards and permitting coordination efforts, hydrogen fuel quality, the Safety Panel, safety incident reporting and continuous updating of best practices. Reviewers complimented the projects' efforts for maximizing progress including leveraging the efforts of universities, standards development organizations, national laboratories, government agencies, and industry, as well as other subprograms.

**Safety, Codes and Standards Funding:**

The Safety, Codes & Standards funding for FY 2009 allowed for a strong domestic and international collaboration, as well as national development and coordination between national laboratories, government agencies and standards organizations. With FY 2009 funding at the request level, it allowed for sustained progress on hydrogen release behavior, hydrogen fuel quality, quantitative risk assessment, and leak detection research to continue the development of technically sound codes and standards for hydrogen and fuel cell technologies. The following chart indicates FY 2009 funding for Safety, Codes & Standards.



**Majority of Reviewer Comments and Recommendations:**

In FY 2009, nine Safety, Codes and Standards projects were reviewed, with good scores from the reviewers for the majority of the projects. The reviewers scored Hydrogen Codes and Standards and Permitting with the highest marks this year. Projects scored a high, low, and average score of 3.9, 3.0, and 3.5 respectively. Scores reflect progress made over the last year and the reported plans for future activity. Key comments and recommendations are summarized below and DOE will act on reviewer recommendations as appropriate to the overall scope, direction, and coherency of the subprogram's efforts.

**Hydrogen Codes and Standards and Permitting:** Reviewers praised the work for its varied engagement with industry, government, and researchers, particularly national laboratories. This work is seen as essential to the adoption and development of critical codes and standards. However, reviewers felt that a better explanation of the project direction for electric vehicle codes and standards was needed.

**Hydrogen Materials Compatibility:** This project is focused on materials research to support the development of technically sound codes and standards to ensure the safe design of infrastructure for the storage and transport of high-pressure hydrogen. The project was praised for its highly relevant technical accomplishments and careful planning. The reviewers noted it is an excellent example of how technical expertise and state-of-the-art equipment at DOE national laboratories can be applied to address gaps and obtain critical data needed to develop requirements for hydrogen codes and standards. Reviewers suggested that materials science expertise should be applied to composite materials and that the Technical Reference Manual should be expanded to include chapters on these materials, particularly for hydrogen storage tank standards for portable and vehicular use.

**Hydrogen Safety Knowledge Tools:** Reviewers considered this project to be valuable in terms of outreach to relevant groups and an excellent source of information for industry. Reviewers noted that both Web sites provide important information in an accessible and searchable way and are valuable tools in making this information available to the hydrogen community and the public. Reviewers also thought as projects mature, more effort should be concentrated on analyzing lessons learned from the Incidents Database and then integrated into the Best Practices Manual.

**Hydrogen Fuel Quality:** Reviewers said the work should earn praise for its sound approach and progress, rigorous methodology and excellent data exchange between national laboratories, international groups and standard development organizations. Some reviewers wondered how this data was going to be incorporated into hydrogen materials development and engineering.

**Hydrogen Safety Panel:** Reviewers considered the panel to be an important activity, which is essential to the program and is a key component to the safety, codes and standards work. The reviewers also thought there was an excellent mix of expertise and experience on the panel and were impressed with their accomplishments thus far. Reviewers also stated that the panel should have a method to integrate lessons learned from the plan reviews into an overall guidance document of principles for safety in hydrogen projects. Reviewers commented that the panel should take a more proactive approach when selecting projects to provide its expertise and review.

**Safe Detector System for Hydrogen Leaks:** Reviewers deemed this project as a critical activity and thought that it aligned well with the program's goals and objectives. They praised it for its technical approach and accomplishments, as well as its potential for developing a low cost and high accuracy sensor. It was suggested that the project should collaborate with national laboratories and other sensor experts.

**Hydrogen Release Behavior:** Reviewers viewed this project as valuable experimental work with lean ignition limits, auto ignition, and the separation distance work. The reviewers were impressed with the researchers' expertise in experimental design and engineering modeling to increase the understanding of hydrogen behavior. Because of its value, they suggested that this data should be disseminated to the industry when it becomes available.

**Hydrogen Safety Sensors:** Reviewers thought this project was a valuable contribution to the codes and standards development. The reviewers approved of the project's clear approach to identifying needs and gaps. However, they did suggest that there should be better communication with sensor manufacturers to address the issues of wide area sensing technologies.

**Codes and Standards for the Hydrogen Economy:** Finally, reviewers thought this project, which is not a research and development activity, played an important management and support role to codes and standards development organizations. The reviewers noted a need to improve its efficiency in delivering funds to projects. Reviewers also felt it would be beneficial to provide more information on how this project plans to overcome its barriers.

## **Technology Validation**

### **Summary of Annual Merit Review Technology Validation Subprogram**

#### **Summary of Reviewer Comments on Technology Validation Subprogram:**

Reviewers continue to consider the learning demonstration project to be a key element in determining whether the program's hydrogen fuel cell activities are on course to achieve established research and development targets. The comments seemed to be primarily favorable. Reviewers from the auto industry gave the impression that the key players can envision the ability to commercialize these products.

Comments tended to demonstrate consistent themes. Several reviewers mentioned their perception that the subprogram overview was adequately presented with the challenges and focus of work clearly identified. Others mentioned that there do not seem to be any gaps in the project portfolio. Multiple reviewers commented that the subprogram was well-organized, carefully planned, focused, and appeared to be effective in supporting the DOE Program and its goals.

Overall progress was well outlined (total miles traveled, fuel dispensed, etc.), and over a million miles of travel is a significant accomplishment. Progress on durability also appears good (60,000 miles). Progress in the data collection aspect since 2008 is very good. Future projects, including the project at the Volcano National Park were discussed.

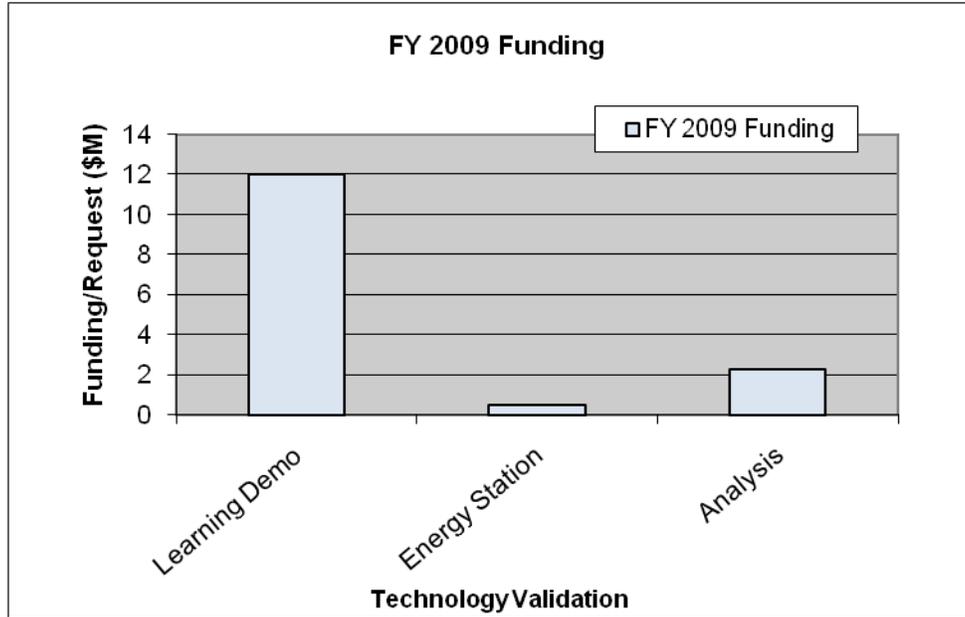
Reviewers commented on the progress that has been made including that the targets are being met with impressive numbers of vehicles/stations, and that the cost is dropping substantially on fuel cell stack and hydrogen cost. Comments noted the performance of fuel cell vehicles under real world conditions, and the documentation and analysis of results are very important activities.

The data collection and analysis portion of the program is very carefully planned, and provides adequate safeguards against distribution of proprietary data while giving more than adequate information for the public to be used in the DOE program activity. Data collection and dissemination is an effective and transparent process. A well-designed data matrix was developed.

The major concern among the reviewers seemed to be that if the 2010 budget holds, and hydrogen fuel cell vehicles are eliminated, future program goals will be abandoned.

#### **Technology Validation Funding:**

The funding portfolio for Technology Validation reflects the continuation of the Learning Demonstration project as it enters its fifth and final year. The Technology Validation activity was transferred to the Vehicle Technologies Program for FY 2009 only. The following chart indicates the FY 2009 funding for the Technology Validation subprogram.



**Majority of Reviewer Comments and Recommendations:**

The reviewer scores for the Technology Validation subprogram were a maximum of 3.78 and minimum of 2.03 with an average score of 3.16. Only three scores were below FY 2008's average score of 2.5. DOE will act on reviewer comments as appropriate for future planning.

Although the reviewers did not provide major redirection recommendations, they did provide key comments in each of the task areas.

- **Learning Demonstration** - Although the subprogram is focused on transportation and fuel cell vehicles, one reviewer mentioned he would like to see more effort applied to production and storage infrastructure.
- **Energy Station/Power Parks** - One reviewer asked how the DOE program could justify the cost of continuing data collection in the fleet vehicles and new construction at the Hawaiian power park at this time.
- **Analysis** - Analysis of the greenhouse gas emissions (W-T-W) is a very important addition to address objections, especially regarding hydrogen production via electrolysis.

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