

## X.17 Hydrogen Knowledge and Opinions Assessment

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### Contribution to Achievement of DOE Education Milestones

This project will contribute to achievement of the following DOE milestones from the Hydrogen Education section (Section 3.9) of the *Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan*:

- **Milestone 28:** Complete baseline assessment knowledge and opinion of hydrogen technologies for key target audiences. (4Q, 2004)
- **Milestone 29:** Evaluate knowledge and opinion of hydrogen technology of key target audiences and progress toward meeting objectives. (4Q, 2009)
- **Milestone 30:** Evaluate knowledge and opinion of hydrogen technology of key target audiences and progress toward meeting objectives. (4Q, 2012)
- **Milestone 31:** Evaluate knowledge and opinion of hydrogen technology of key target audiences. (4Q, 2015)

### Objectives

- To measure the current (2008/2009) level of awareness and understanding of hydrogen and fuel cell technologies in five target populations:
  - General public
  - Students
  - State and local government agencies
  - Potential end users
  - Safety and codes officials
- To compare the current (2008/2009) level of awareness and understanding to results of the 2004 baseline.
- To analyze and summarize results for use in developing strategies and tactics for the Hydrogen Education subprogram.

### Technical Barriers

This project addresses the following technical barriers from the Education section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- (B) Mixed Messages
- (E) Regional Differences
- (F) Difficulty of Measuring Success

### Accomplishments

- 2008 surveys of state and local government officials, end users, and students completed (July 2008).
- Analysis of survey results of the general public, state and local government officials, end users, and students completed (January 2009).
- Office of Management and Budget (OMB) approval to conduct the survey of safety and codes officials received (March 2009).
- Survey of safety and codes officials completed (June 2009).
- Analysis of survey results of safety and codes officials initiated (July 2009).



### Introduction

Designing and maintaining an effective education program entails measuring baselines and periodically measuring what has been learned. The purpose of the Hydrogen Knowledge and Opinions Assessment project is to collect and analyze statistical data to establish baselines and changes in understanding and awareness about hydrogen, fuel cells, and the notion of a hydrogen economy. Statistical surveys that were conducted in 2004 are being conducted again in 2008/2009, and are envisioned to be fielded yet again in approximately 2011/2012. Scientific sampling is used to survey five populations: (1) the general public, ages 18 and

over (sample size = 1,000); (2) students, ages 12-17 (sample size = 1,000); (3) state and local government officials from state departments of transportation and environmental protection, state energy offices, and functionally similar personnel from cities and counties (sample size = 220); (4) potential hydrogen end-users in three business categories: transportation, businesses requiring uninterrupted power supplies, and industries with large power requirements (sample size = 601); and (5) safety and codes officials (sample size = 193).

The surveys are designed to accomplish specific objectives. Technical questions are posed to measure technical understanding and awareness of hydrogen technology. Opinion questions measure attitudes about safety, cost, the environment, performance, and convenience. Questions are posed to assess visions about the likelihood of various future applications of hydrogen technology. For most of the questions, “I don’t know” or “I have no opinion” are perfectly acceptable answers. Questions about information sources (teachers, friends, government, etc.) and media (radio, Internet, magazines, etc.) are posed to assess how energy technology information is received.

## Approach

The approach to the current survey work is essentially the approach taken to the 2004 surveys. Current literature on hydrogen and fuel cell knowledge and attitudes was first reviewed to update a previous (2003) literature review [1]. The 2004 survey questionnaires were also reviewed and revised slightly for use in the 2008 surveys. With only a few exceptions, consistency was maintained across the years to facilitate unbiased comparisons with the previous surveys. A separate questionnaire for the safety and codes officials survey was developed. All of the surveys have similar but slightly different questionnaires, which include (in addition to routine demographic questions) a mixture of technical, opinion, and information resource questions. An example of one of the technical questions is “Hydrogen gas is toxic [true/false]?”. An example of an opinion question is “How would you feel if your local gas station also sold hydrogen? [Answers: frightened, uneasy, at ease, pleased, don’t know/no opinion.]” An example of an information resource questions is “How often do you get energy information from different types of mass media (never, sometimes, frequently, don’t know)? [Answers: television, radio, Internet, newspapers, etc.]”

A plan for quality assurance and data analysis was designed [2], and contracts were arranged with Opinion Research Corporation to conduct the survey interviews. A compendium of source materials was compiled [3]. Each survey component required the Paperwork Reduction Act approval by OMB. OMB approval was received in July 2007 to conduct the 2008

editions of the previously conducted survey components (general public, student, state and local government, and end-user surveys). Approval for the safety and codes component was received in March 2009. All survey components are conducted using computer assisted telephone interviewing. After the survey data has been collected and analyzed, a report will be prepared similar to the report for the 2004 surveys [4].<sup>1</sup>

## Results

Telephone interviewing for all five population groups of the 2008 survey is complete. A preliminary report providing draft analyses of the survey results for the first four surveys was provided to DOE in January 2009. A complete analysis will be performed on the results of all five surveys and documentation of the analysis will be provided by September 2009.

Overall, the average technical scores for the general public and government officials were remarkably similar to the 2004 results. The percentages of correct answers to eight core technical questions differed somewhat for individual questions, but the overall average percentage of correct answers was very similar. The average technical score for the student population increased by 4.5 percentage points. Average technical scores for the four surveys are shown in Table 1.

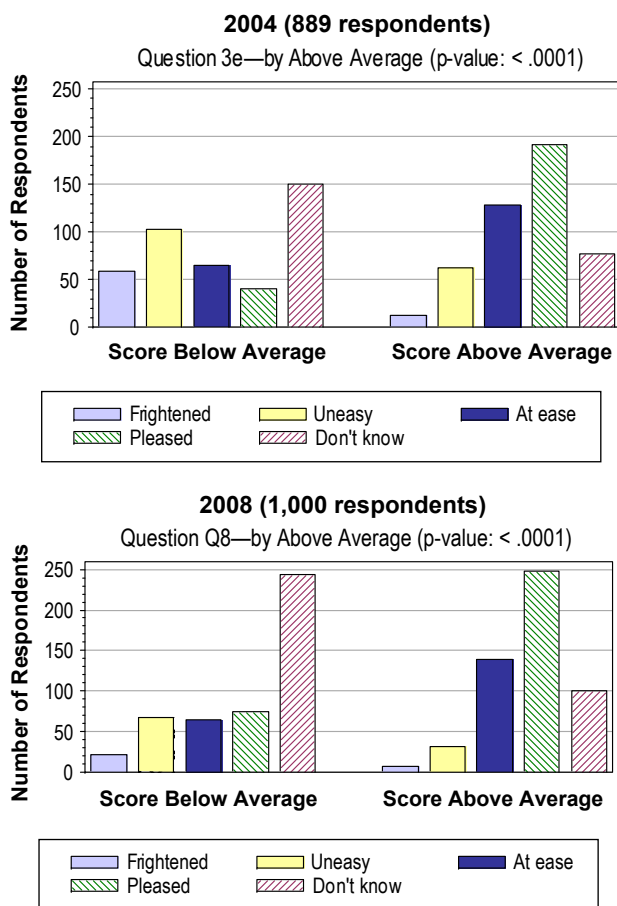
**TABLE 1.** Average Technical Scores by Population

Population	Sample size		Technical score (% correct)		Score difference (percentage points)
	2004	2008	2004	2008	
General public	889	1,000	35.2	35.2	+0.0
Students	1,000	1,004	35.3	39.8	+4.5
Government agencies	236	220	66.6	66.6	+0.1
End users	99	601	46.3	47.9	+1.6

Based on a draft analysis of results of the first four surveys (general public, students, state and local officials, and end users), technical understanding appears to influence opinions about safety. For all four survey groups, respondents with above-average scores on the technical questions were more likely to have an opinion (i.e., fewer “don’t know” responses), and for those respondents who expressed an opinion, their opinion was more likely to be positive. This relationship is shown for the general public in Figure 1.

Respondents to the general public survey were also more concerned about safety and cost than the environment, but more concerned about the environment than convenience or performance.

<sup>1</sup> See [http://www1.eere.energy.gov/hydrogenandfuelcells/hydrogen\\_publications.html](http://www1.eere.energy.gov/hydrogenandfuelcells/hydrogen_publications.html).

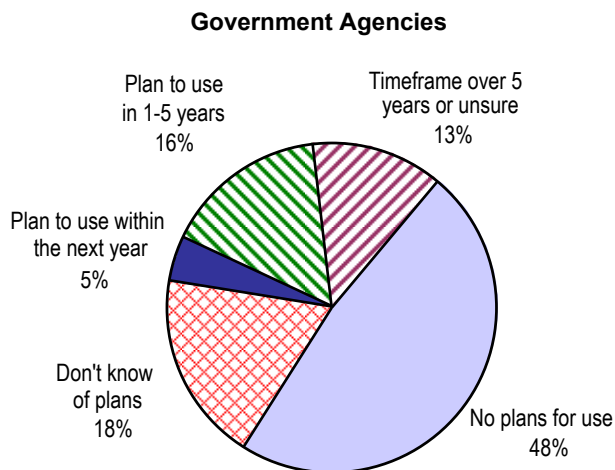


**FIGURE 1.** Positive association of technical understanding and opinions about safety, General Public Survey. Question Q8 (Question 3e in 2004): “How would you feel if your local gas station also sold hydrogen?” Respondents with above average technical scores are more likely to feel good (“at ease”; “pleased”) about it.

Student responses to statements about the potential benefits of hydrogen usage indicated that they generally agreed that the use of hydrogen would reduce emissions, improve air quality, and reduce U.S. dependence on foreign oil.

The state and local government survey indicated that over 60% of government officials and over half of end user respondents believe that hydrogen is as safe as gasoline or diesel fuels. Almost half of the government officials who were surveyed indicated that they had no plans for use of hydrogen or fuel cell technologies. Only 5% had plans to use hydrogen or fuel cell technologies within the next year. About 21% have plans for use in the next five years. These results are shown in Figure 2.

When asked about plans for using hydrogen and fuel cell technologies to meet their organizations’ energy needs, most end users responded that they plan to wait to see how the market develops before considering the use of hydrogen and fuel cells.



**FIGURE 2.** Plans to use hydrogen and fuel cell technologies, 2008 state and local government survey. Corresponding results for 2004 were similar.

The Internet is an important source for obtaining energy information for state and local officials as well as end users. Television remains a frequent source of energy information for the general public and students.

Additional results will be provided in the final report.

### Conclusions and Future Directions

The hydrogen knowledge and opinions survey data collected for the five component populations will serve as reference points for (1) designing the Hydrogen Education subprogram, and (2) measuring changes in knowledge and opinions over time. As with the 2004 survey results, the results of the 2008/2009 surveys (including comparisons with the 2004 results) will be compiled into a data book or digest of the data, ultimately to serve in developing and adapting the Hydrogen Education subprogram. Designing the Education subprogram itself, however, is beyond the scope of the survey work.

Future work will include

- Analyzing and reporting on all survey findings (Fiscal Year 2009).
- Preparing presentations and other publications about the survey results.

### References

1. Tykey Truett. *Literature Review for the Baseline Knowledge Assessment of the Hydrogen, Fuel Cells, and Infrastructure Technologies Program*, ORNL/TM-2003/258 (October 2003).

2. Rick Schmoyer and Tykey Truett. *Data Collection, Quality Assurance, and Analysis Plan for the 2008 Hydrogen and Fuel Cells Knowledge and Opinion Surveys* (September 2008).
3. Tykey Truett, Rick Schmoyer, and Christy Cooper. *Compendium: Surveys Evaluating Knowledge and Opinions of Hydrogen and Fuel Cell Technologies, ORNL/TM-2008/151* (October 2008).
4. Rick Schmoyer, Tykey Truett, and Christy Cooper. *Results of the 2004 Knowledge and Opinions Surveys for the Baseline Knowledge Assessment of the U.S. Department of Energy Hydrogen Program, ORNL/TM-2006/417* (April 2006).