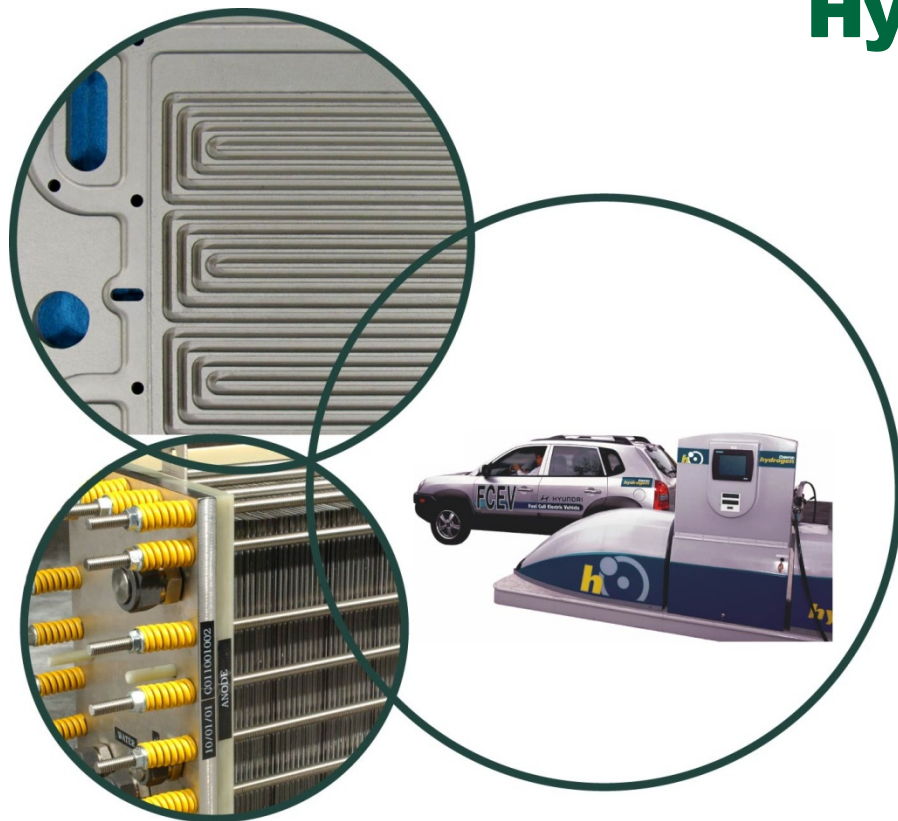




DOE Hydrogen Program

# 2008-2009 DOE Hydrogen Program: Hydrogen Knowledge and Opinions Assessment



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**Project ID # edp\_02\_schmoyer**

This presentation does not contain any proprietary, confidential, or otherwise restricted information

# Overview

## Timeline

- **Start: April 2003**
- **End: 2012 (currently in “Phase II”)**
- **Percent complete: ~75%**

## Budget

- **Total project funding**
  - DOE share: 100%
  - Contractor share: 0%
- **Funding received in FY06-08: \$360,000**
- **Funding for FY09: \$17,600 (through Nov. 08)**
- **Funding for FY10: \$0**

## Barriers

- B. Mixed Messages**
- E. Regional Differences**
- F. Difficulty of Measuring Success**

## Partners

- **Contacts with national and international organizations to obtain clarifications, data, and feedback on survey instruments and samples**
- **Opinion Research Corporation (polling and market research)**
- **Oak Ridge National Lab, project lead**

# Objectives

**To measure the current 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 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 Program**

# Relevance

***Without an understanding of population-specific knowledge levels and opinions about hydrogen and fuel cell technologies, the Hydrogen Education Program may not supply appropriate information to intended audiences. Findings based on statistically designed surveys of targeted population groups provide a critically important measurement of knowledge and awareness for each population.***

# Approach

- Review recent literature on surveys of hydrogen or fuel cell knowledge and attitudes and publish update of earlier literature review
- Review and revise (if necessary) survey instruments used in the 2004 surveys and develop a survey for the safety and codes officials
- Obtain approval from the Office of Management and Budget (OMB) to carry out each survey
- Design and publish a plan for sampling, data quality assurance, and data analysis (all surveys are statistically designed )
- Conduct surveys of the five target populations
- Analyze 2008 survey results and compare with the 2004 baselines for each target population
- Summarize and publish the Knowledge and Opinions Assessment Report for the 2008 surveys

***Summary: A comprehensive approach to this research and analysis ensures that the findings are accurate and scientifically valid, up-to-date, and useful to the Hydrogen Education Program***

# Examples of Survey Questions (All Surveys)

- **Technical Questions**

- Hydrogen gas is toxic (true/false)?
- Hydrogen has a distinct odor (true/false)?
- When using pure hydrogen, fuel cell vehicles generate electricity, water, and what else (multiple choice: carbon dioxide, nitrous oxides, heat, all of these, don't know)?

- **Opinion Questions**

- How would you feel if your local gas station also sold hydrogen? Answers: frightened, uneasy, at ease, pleased, don't know/no opinion.
- Using hydrogen will reduce U.S. dependence on foreign oil—disagree, are neutral, agree, no opinion.

- **Information Resource and Demographic Questions**

- How often do you get energy information from different types of mass media (never, sometimes, frequently, don't know)?: television, radio, internet, newspapers, etc.
- Age, sex, education level, etc. (for statistical purposes)

# Milestones

<b>Month Year</b>	<b>Milestone</b>	<b>Status (% Complete)</b>
<b>September 2008</b>	<b>Complete and publish plan for data quality assurance and data analysis</b>	<b>100%</b>
<b>October 2008</b>	<b>Publish updated literature review</b>	<b>100%</b>
<b>September 2008</b>	<b>Complete all five surveys</b>	<b>80%*</b>
<b>FY09</b>	<b>Analyze survey findings, compare with baseline, and publish results</b>	<b>75%</b>
<b>*Application to OMB for approval to conduct the survey of safety and code officials was submitted in June 2008. OMB approval is pending.</b>		

# Technical Accomplishments—Overview

- **Groundwork**

- Completed and published compendium of related surveys conducted since the 2003 literature review
- Obtained OMB approval to repeat surveys of four populations (general public, students, state and local governments, and end users)
- Developed the survey instrument for the safety and codes officials and prepared/submitted materials for OMB approval

- **Analysis**

- Completed surveys of four populations (FY08)
- Analyzed results of surveys of first four populations and prepared draft report (January 2009)

**Examples of analysis findings are shown in the following slides**

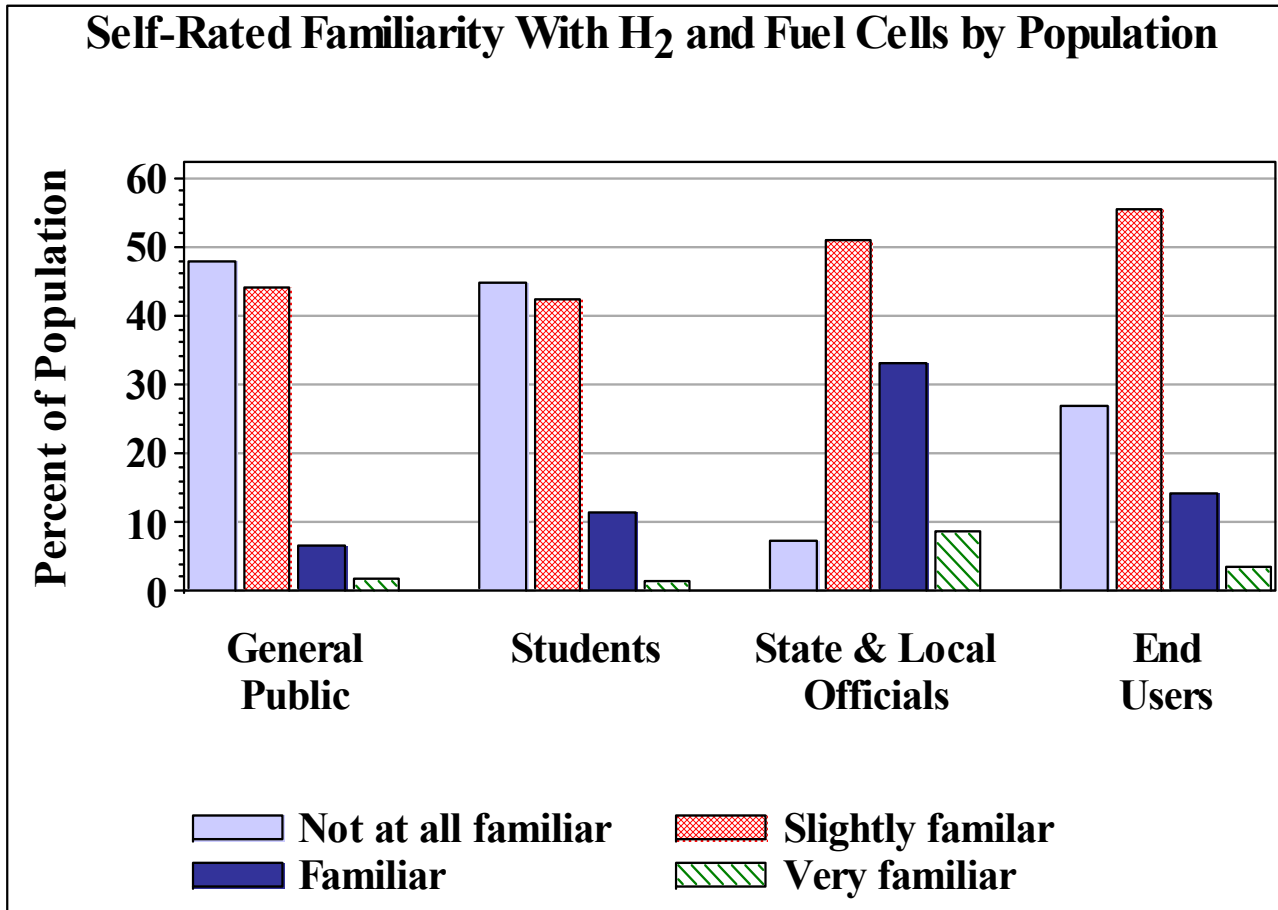


# Sample Sizes and Response Rates (for Completed Surveys)

Population	Sample size		Response rate (%)	
	2004	2008	2004	2008
General public	889	1,000	24.8	23.0
Students	1,000	1,000	27.5	29.5
Government agencies	236	220	95.9	89.4
End users	99	601	29.1	17.0

Response rates are a challenge in all telephone surveys these days, but to some extent nonresponse bias cancels in cross-year comparisons. Another challenge is coverage because of increasing percentages of cell-phone-only households.

# Self-Rated Familiarity with H<sub>2</sub> and Fuel Cells Technologies by Population (2008 only)



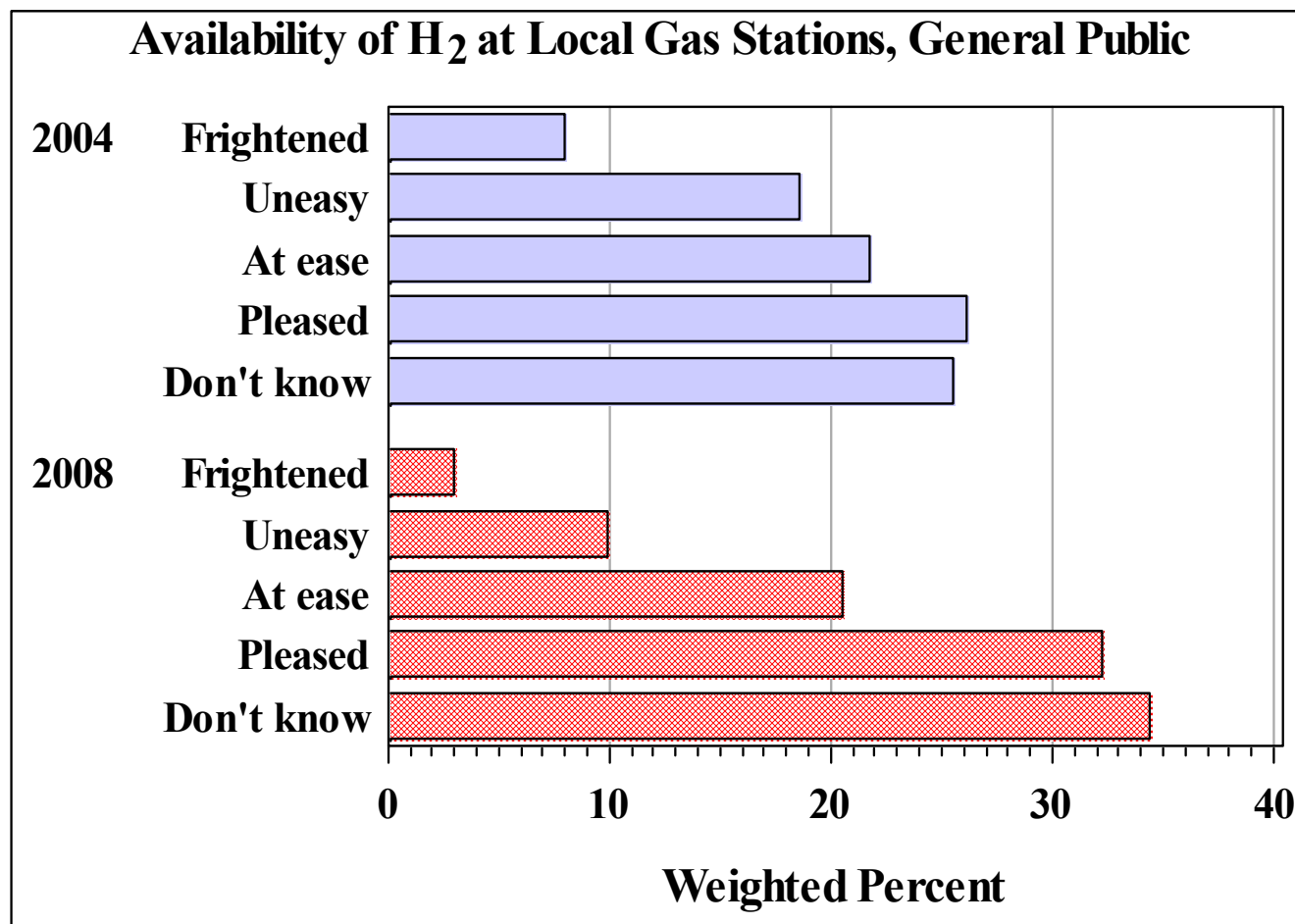
***Of the four groups, the state and local officials claimed the highest level of familiarity with hydrogen and fuel cell technologies.***

# 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

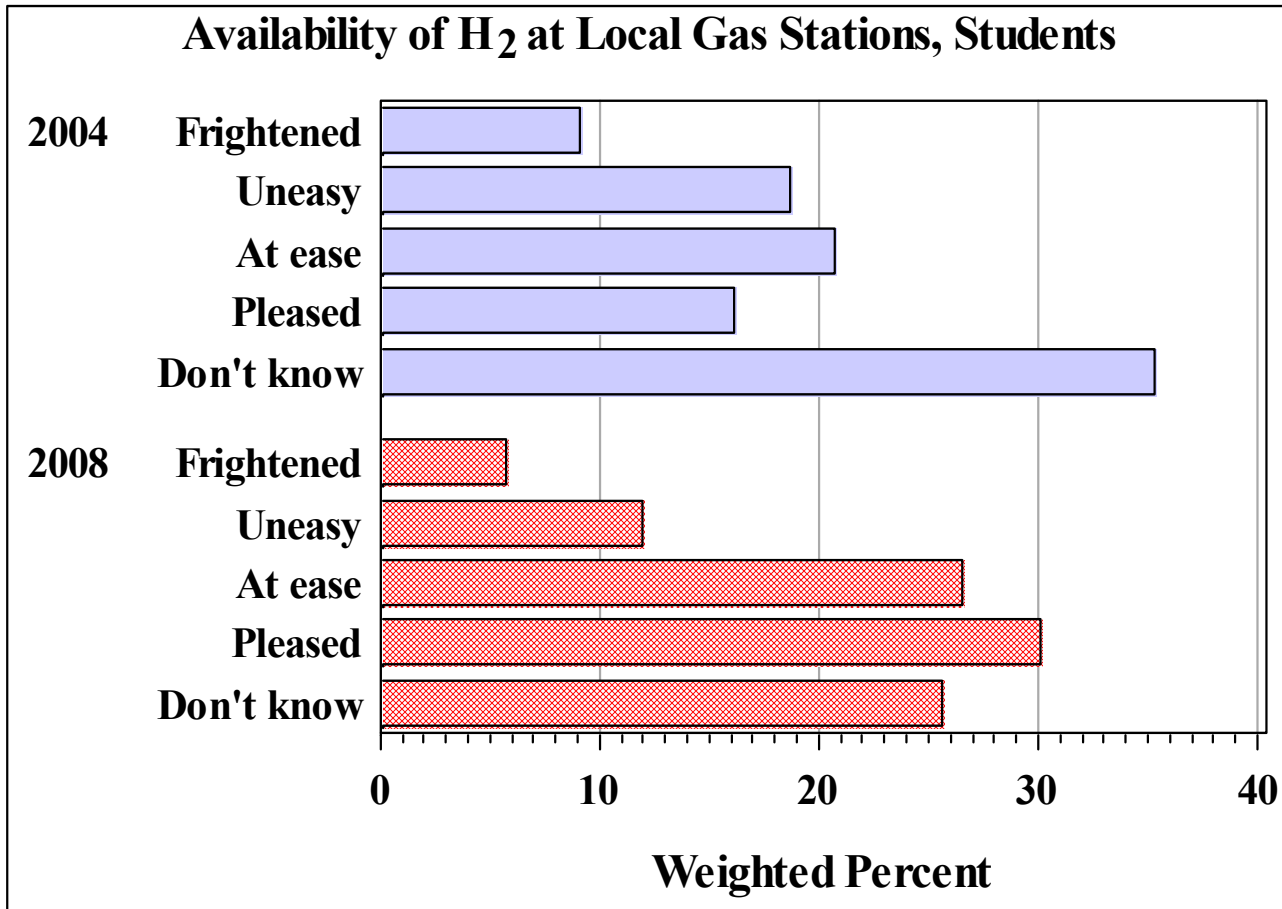
***Although there was very little change in the average technical scores, the scores of all population groups improved slightly. Students showed the greatest improvement in technical scores.***

# Comparison of 2004 and 2008 Survey Results Regarding Opinions about the Availability of Hydrogen at a Local Gas Station, General Public



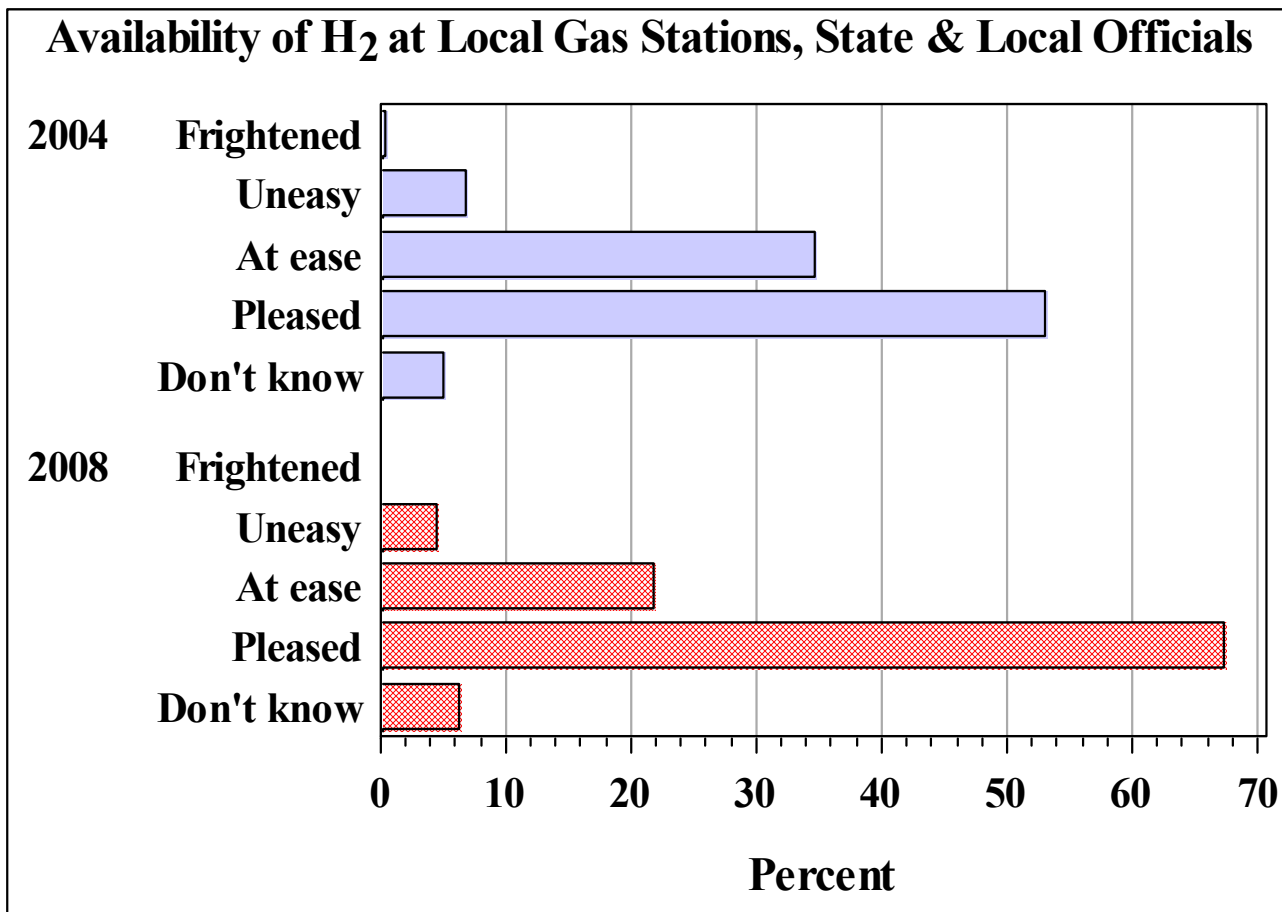
*The proportion of respondents indicating they would be frightened or uneasy by a hydrogen fueling station decreased significantly between 2004 and 2008.*

# Comparison of 2004 and 2008 Survey Results Regarding Opinions about the Availability of Hydrogen at a Local Gas Station, Students



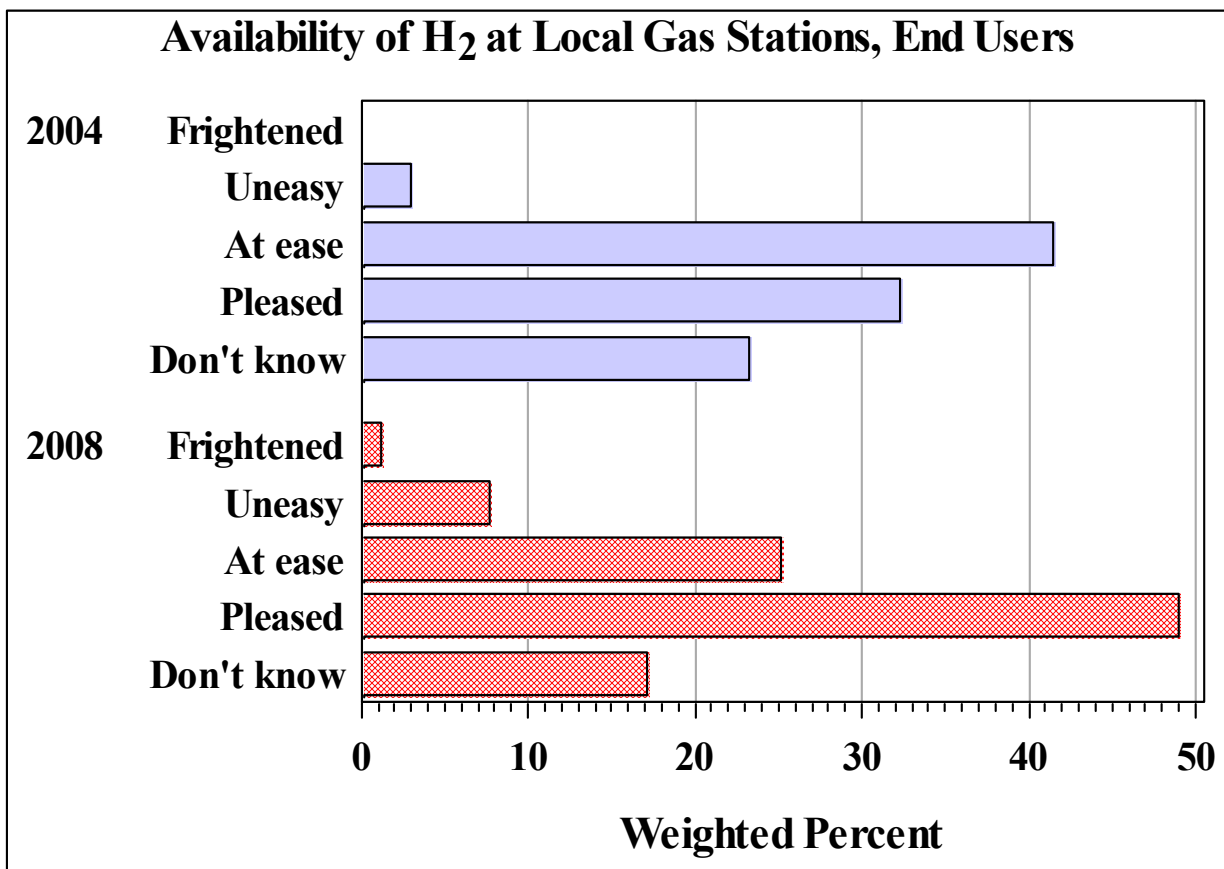
*The proportion of students indicating they would be pleased by a hydrogen fueling station increased significantly between 2004 and 2008.*

# Comparison of 2004 and 2008 Survey Results Regarding Opinions about the Availability of Hydrogen at a Local Gas Station, State and Local Officials



***The proportion of respondents indicating they would be pleased by a hydrogen fueling station increased significantly between 2004 and 2008.***

# Comparison of 2004 and 2008 Survey Results Regarding Opinions about the Availability of Hydrogen at a Local Gas Station, End Users



*The proportion of respondents indicating they would be pleased by a hydrogen fueling station increased significantly between 2004 and 2008; however, the proportion indicating they would be frightened or uneasy increased.*

# **Relationship Between Technical Score and Comfort Level with Hydrogen Technologies**

**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.**

**These differences were statistically significant.**

**These differences were evident in both the 2004 and 2008 survey findings.**

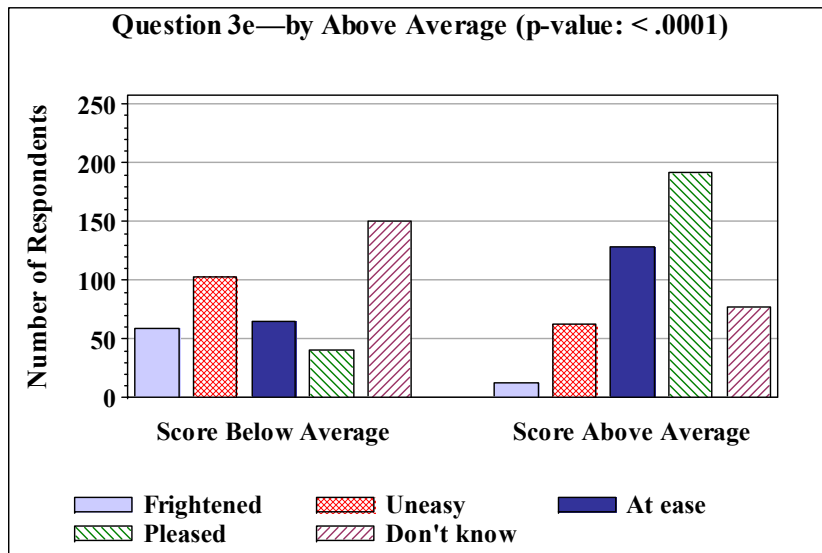


# Positive Association of Technical Understanding and Opinions About Safety, General Public

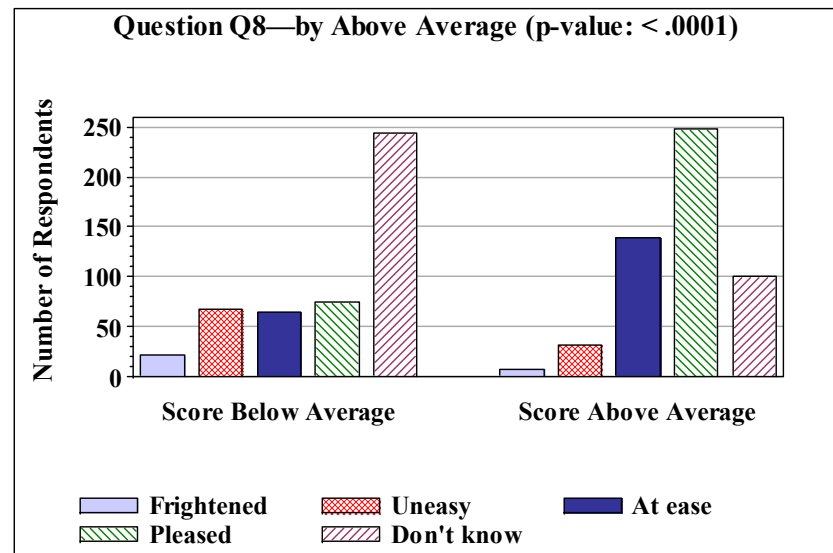
**Question Q8 (Question 3e in 2004): “How would you feel if your local gas station also sold hydrogen?”**

**Respondents with above average technical scores are more likely to feel good (“at ease”; “pleased”) about it.**

**2004 (889 respondents)**

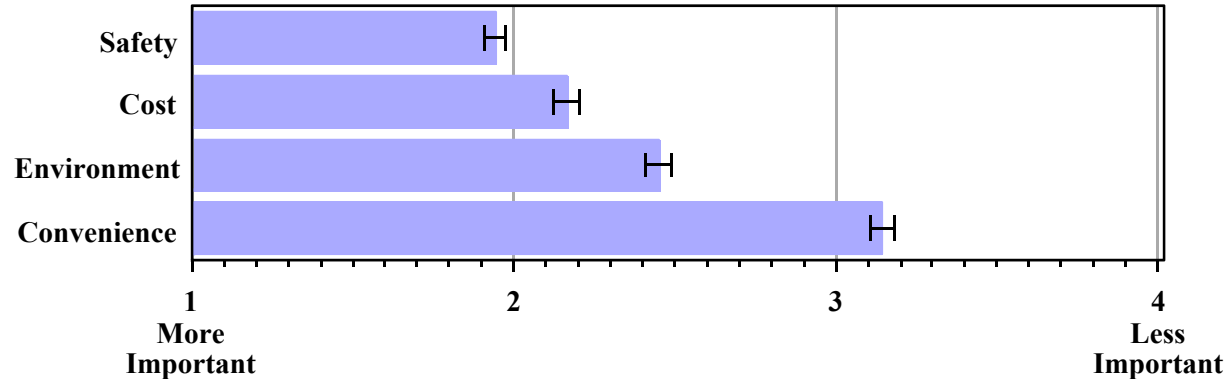


**2008 (1,000 respondents)**

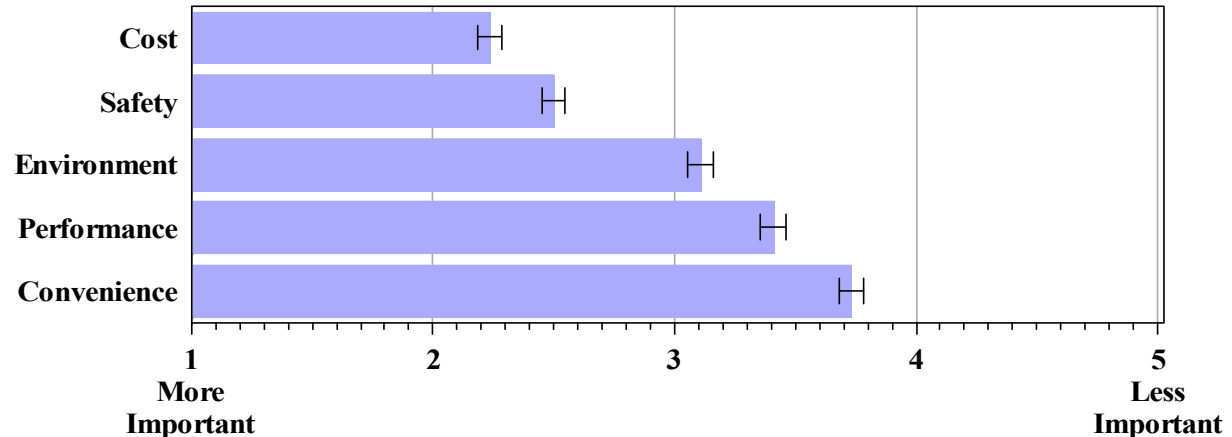


# Average Value Rankings, General Public

2004

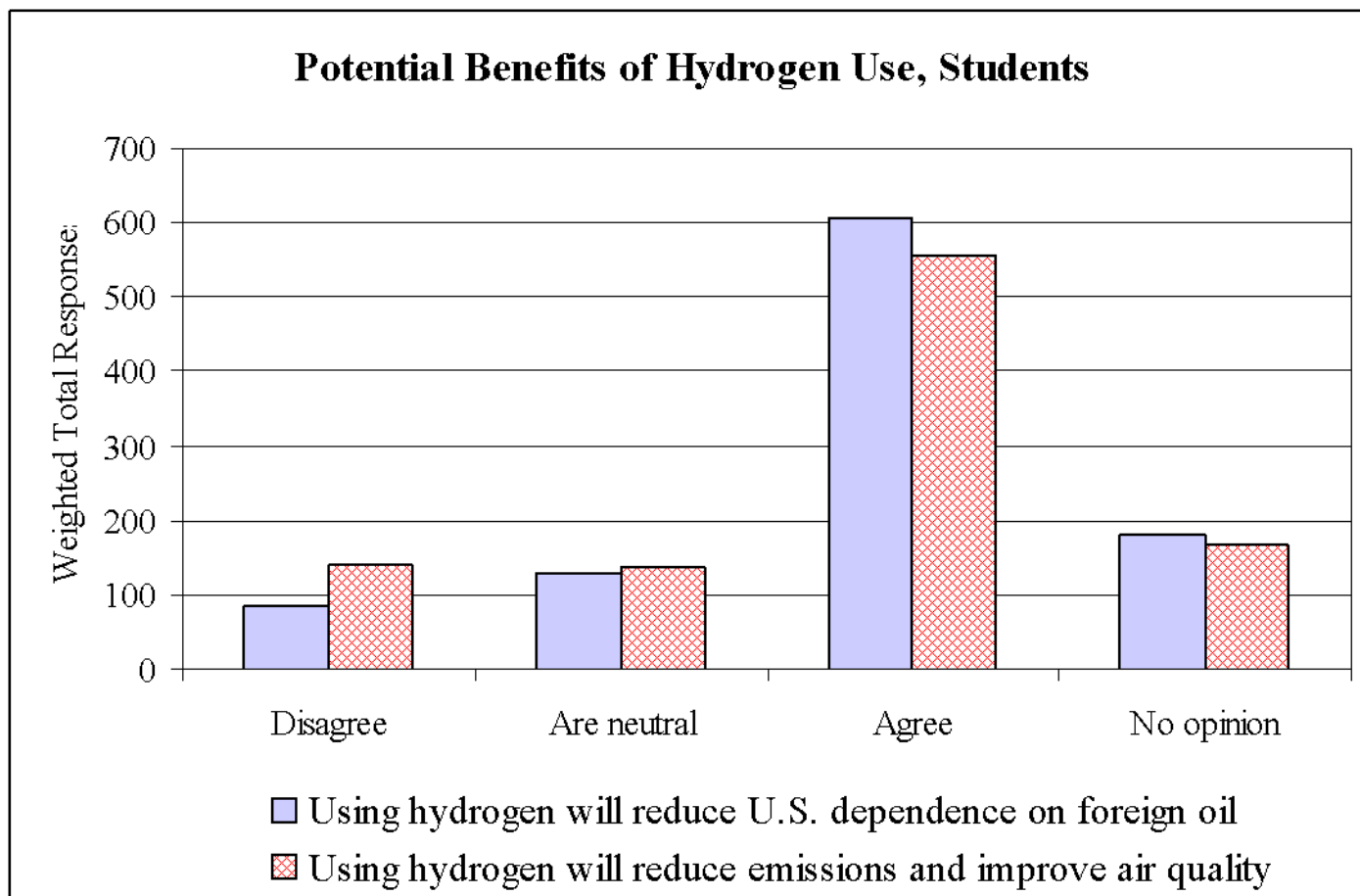


2008



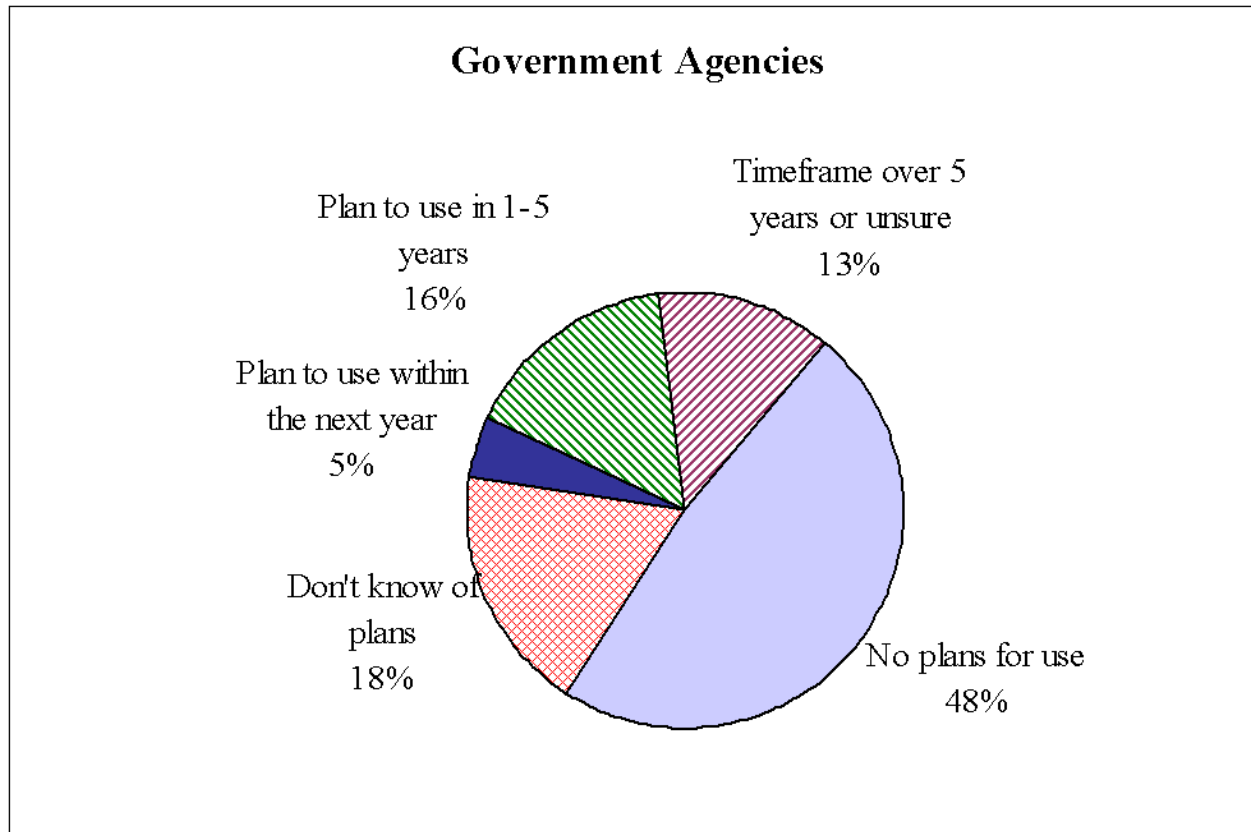
- The “|—|”s on the charts are 95% confidence intervals. The differences within years are statistically significant.
- The “performance” category was added for 2008
- Rankings reported by a few individuals were partial.
- Cost and safety are most important when selecting a fuel or power source, but note the switch in their order between 2004 and 2008.

# Responses to Statements about the Potential Benefits of Hydrogen Usage, 2008 Student Survey



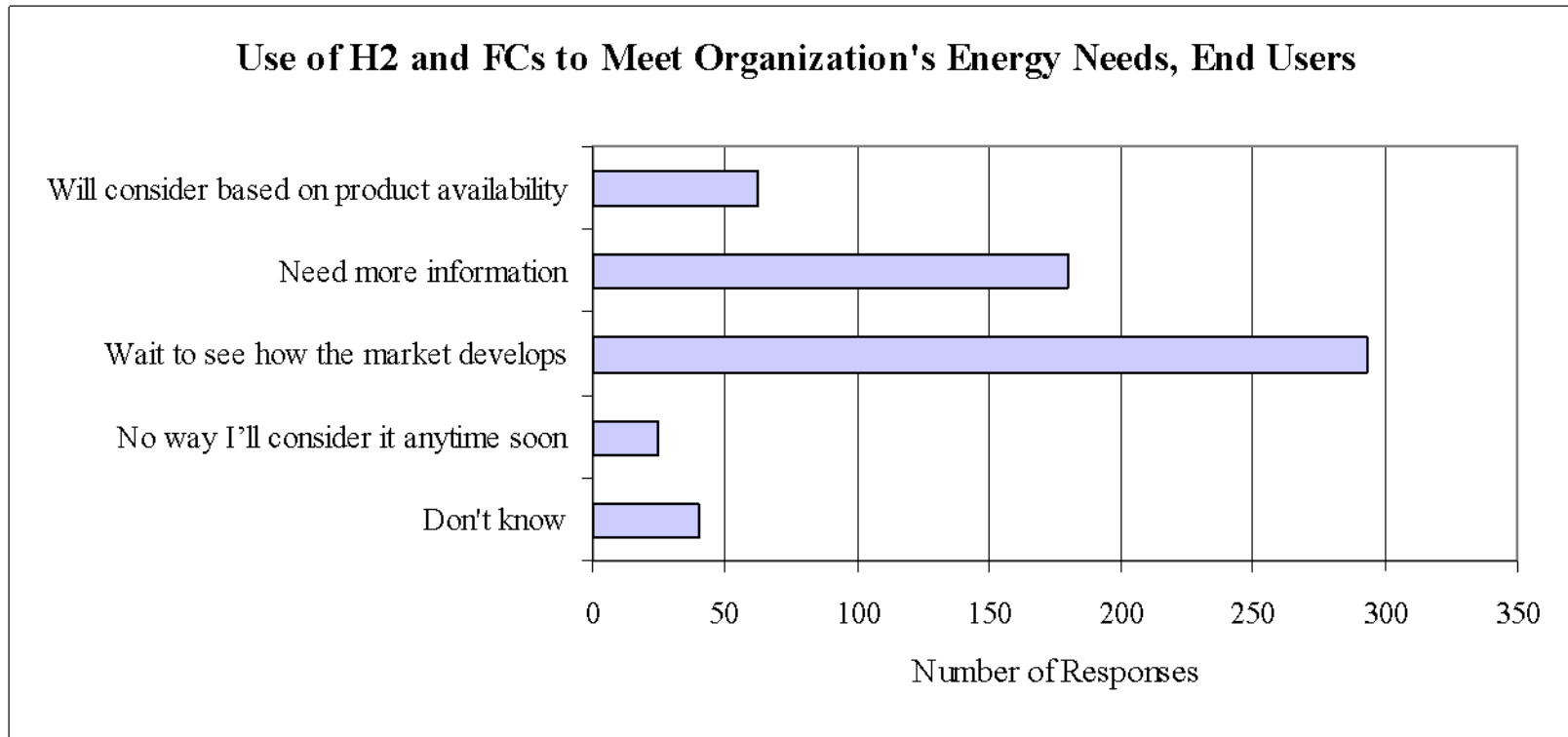
***Students generally “Agree” that the use of hydrogen will reduce emissions, improve air quality, and reduce U.S. dependence on foreign oil***

# Plans to Use Hydrogen and Fuel Cell Technologies, 2008 State and Local Government Survey



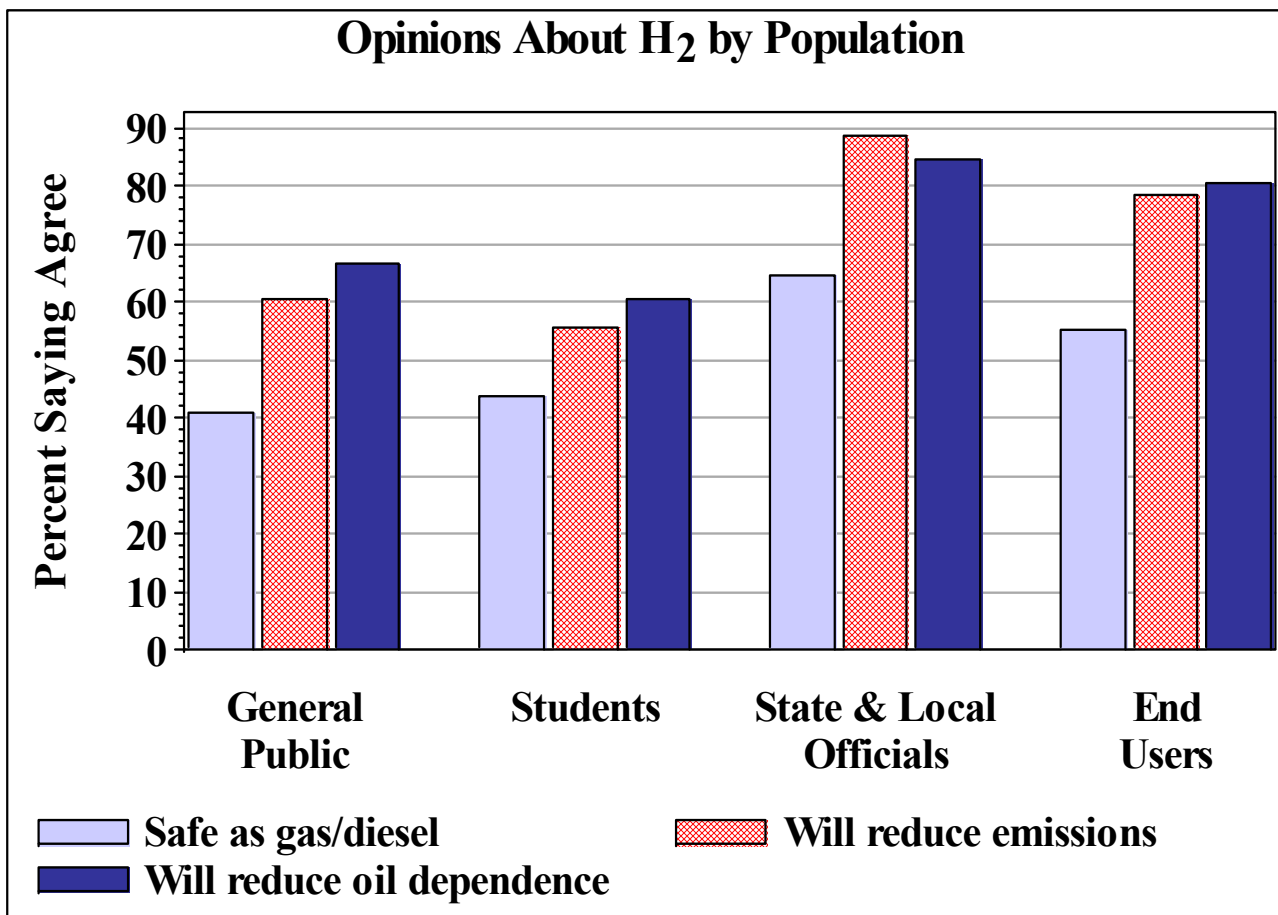
**Corresponding results for the 2004 survey were similar to the above chart.**

# End users' opinions about using hydrogen and fuel cell technologies to meet their organizations' energy needs



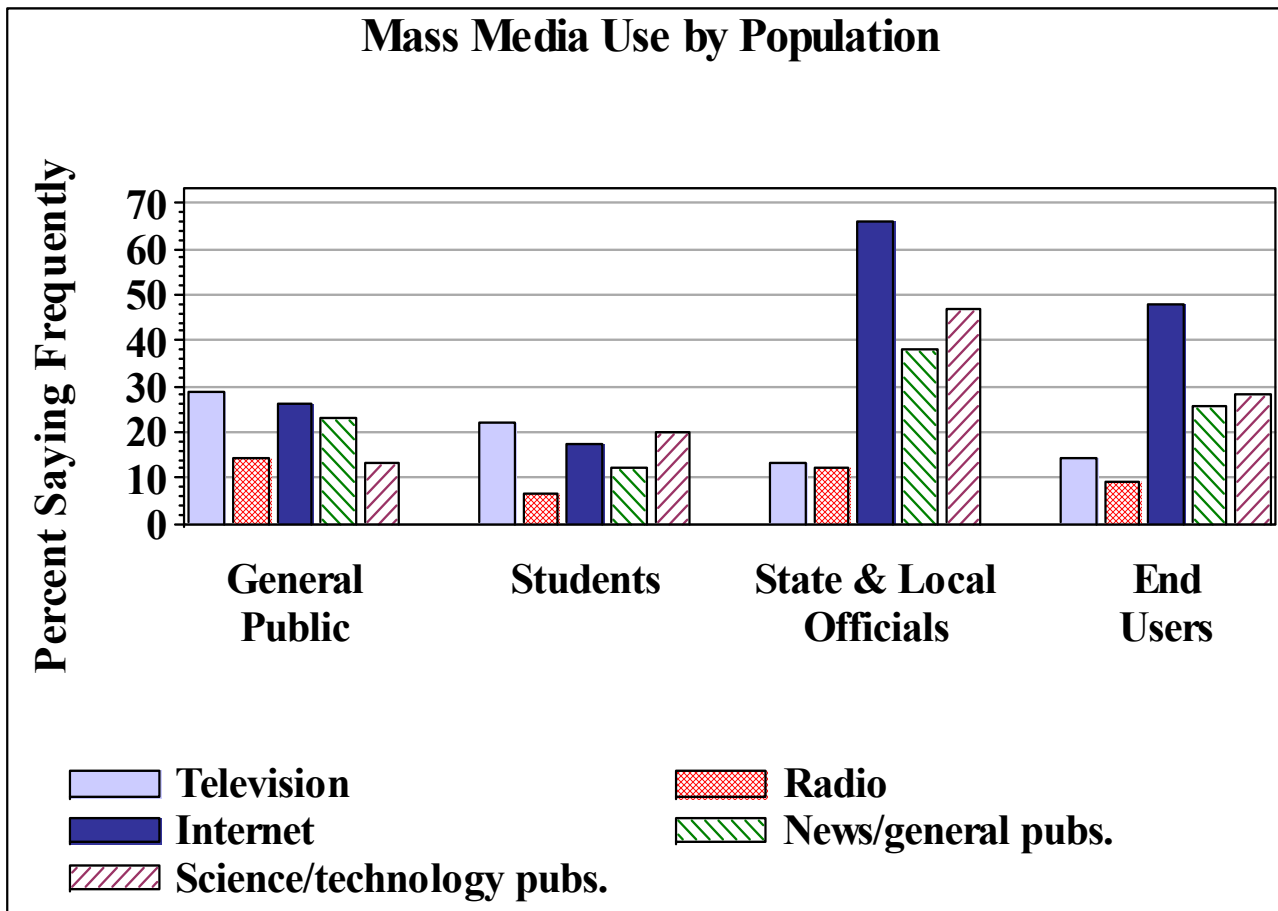
***Most end users plan to wait to see how the market develops before considering the use of hydrogen and fuel cells.***

# A Comparison of Opinions about Hydrogen Usage by Population Group



***All four populations believe that hydrogen technologies will reduce emissions and dependence on oil; in addition, over 60% of government officials and over half of end user respondents considered hydrogen as safe as gasoline or diesel fuels.***

# Use of Mass Media to Obtain Energy Information



***The Internet is the prime energy information source for government officials and end users; television is the most frequently used source for the general public and students.***

# Collaborations

- **Oak Ridge National Laboratory (primary research collaborator)**
- **National and international organizations to obtain clarifications and data; also, hydrogen and fuel cell associations (document reviews and other information)**
- **Opinion Research Corporation (polling and market research)**



# Future Work

## FY09

- **Conduct survey of safety and codes officials (dependent on OMB approval) and analyze results**
- **Prepare draft and final reports on 2008/2009 survey findings**
- **Prepare presentations and other publications to publicize the results of the surveys, as appropriate**

## FY12

- **Repeat surveys of all populations and compare results with the findings of the baseline survey of 2004 and the current (2008) survey**

# Summary

- **Four populations (general public, students, state and local officials, and potential end users) were surveyed in 2008 and the results were analyzed**
- **Findings were compared with baseline survey results from 2004**
- **Undercoverage (particularly because of cell-phone-only households) and nonresponse bias pose challenges, but to some extent cancel in cross-year comparisons**
- **Identical surveys are planned for 2011/2012 to assess further changes in knowledge and opinions**