



U.S. DEPARTMENT OF
ENERGY

The DOE Baseline Knowledge Survey: Measuring “H2IQ”

Christy Cooper
U.S. DOE Hydrogen Program

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Survey Purpose:

To learn what people know and don't know about the hydrogen economy and hydrogen technologies. The data will –

- Guide education program development and activities
- Provide a quantifiable baseline from which to measure changes in knowledge of hydrogen technologies among key target audiences over time

Survey Requirements:

- ✓ National in scope
- ✓ Repeatable over time
- ✓ Statistically valid

Literature Review

- Published October 2003

- Scope:

- Scientific (claiming statistical validity) and non-scientific surveys
- Surveys focused on hydrogen and fuel cells, as well as other energy-related surveys with a section on hydrogen and fuel cells

- Findings:

- Few surveys to determine existing knowledge of hydrogen technologies have been published
- No single survey previously published had covered all of DOE's targeted audiences on a national level
- No other survey published indicated plans to repeat an identical survey at a future point

Project Team

- DOE
- Oak Ridge National Laboratory (ORNL)
 - Tykey Truett, PI
 - Rick Schmoyer, PhD, Statistics
- Opinion Research Corporation (ORC)
 - 70+ years experience in market and opinion research
 - Support to hydrogen baseline survey –
 - Provided input to development of hydrogen survey instruments
 - Assisted with identifying target audience contact lists
 - Conducted surveys

Survey Design

- Four survey instruments – one for each target audience
 - Public
 - Students
 - State and Local Government Officials
 - Potential End Users
- Questions developed with input from National Hydrogen Association and U.S. Fuel Cell Council
- All questions used “closed-end” format
- Respondents assured there were no trick questions; “don’t know” or “no opinion” always an option
- Average time to complete interview was expected to be 10-12 minutes

Survey Methodology

Computer Assisted Telephone Interviews (CATI) – trained interviewers read scripted questions and simultaneously enter responses into a database

- Ensures consistency, less chance of human errors
- Respondents are randomly selected
- Responses cannot be “stacked”
- Survey of a national audience is repeatable
- Can accurately and efficiently handle large numbers of scheduled appointments
 - Automated system handles “ring-no answers” and “busy” records
 - Staff can respond to requests for removal from the call list

Survey Questions

Sample Technical Questions:

- Hydrogen can be produced using which of the following sources of energy?
(A) Natural gas, (B) Sunlight, (C) Organic matter, (D) All, (E) Don't know
- When using pure hydrogen, fuel cells generate electricity, water, and what else?
(A) Carbon dioxide, (B) Nitrous oxides, (C) Heat, (D) All, (E) Don't know
- True/False/Don't Know:
 - **Hydrogen gas is toxic**
 - **Hydrogen is lighter than air**
 - **Hydrogen has a distinct odor**
- In which state or condition can hydrogen be stored?
(A) Chemical compound, (B) Liquid, (C) Both, (D) Neither, (E) Don't know

Survey Questions, continued

Sample Opinion Questions:

- How would you feel if your local gas station also sold hydrogen?
(A) *Frightened*, (B) *Uneasy*, (C) *At ease*, (D) *Pleased*, (E) *Don't know/No opinion*
- Which of the following would you most closely associate with the word *hydrogen*?
(A) *The H Bomb*, (B) *Chemistry class*, (C) *Fuel*, (D) *The Hindenburg*, (E) *Don't know/No opinion*
- Agree/Disagree/Neutral/No Opinion:
 - **Using hydrogen as a vehicle fuel will reduce U.S. dependence on foreign oil**
 - **Using hydrogen as a vehicle fuel will improve air quality**
 - **Using hydrogen as a vehicle fuel is as safe as using gasoline or diesel**

Survey Questions, continued

Sample Audience-Specific Questions:

Public –

- Which of the following is more important to you when selecting a power supply?
(A) Safety, (B) Low cost, (C) Environmental protection, (D) Convenience, (E) Don't know

Students –

- Have you ever...(Yes/No/Don't Know)
 - **Received instruction on hydrogen and fuel cells**
 - **Used a model fuel cell car kit**

State and Local Governments –

- How often do you use the following as a source of energy information?
(Never/Sometimes/Frequently)
(A) Teacher/schools, (B) Friends/family, (C) Environmental groups, (D) Utilities, (E) Federal government, (F) State government, (G) Local government

Potential End Users –

- Have you received information about hydrogen and fuel cells at your workplace?
(Yes/No/Don't Know)

Pilot Testing

- General public and student surveys were pilot-tested – 50 public interviews and 37 student interviews conducted
- State and local government and end user surveys were not pilot tested – survey instruments were similar to public and student survey instruments

Office of Management and Budget Approval

Required by Paperwork Reduction Act of 1995

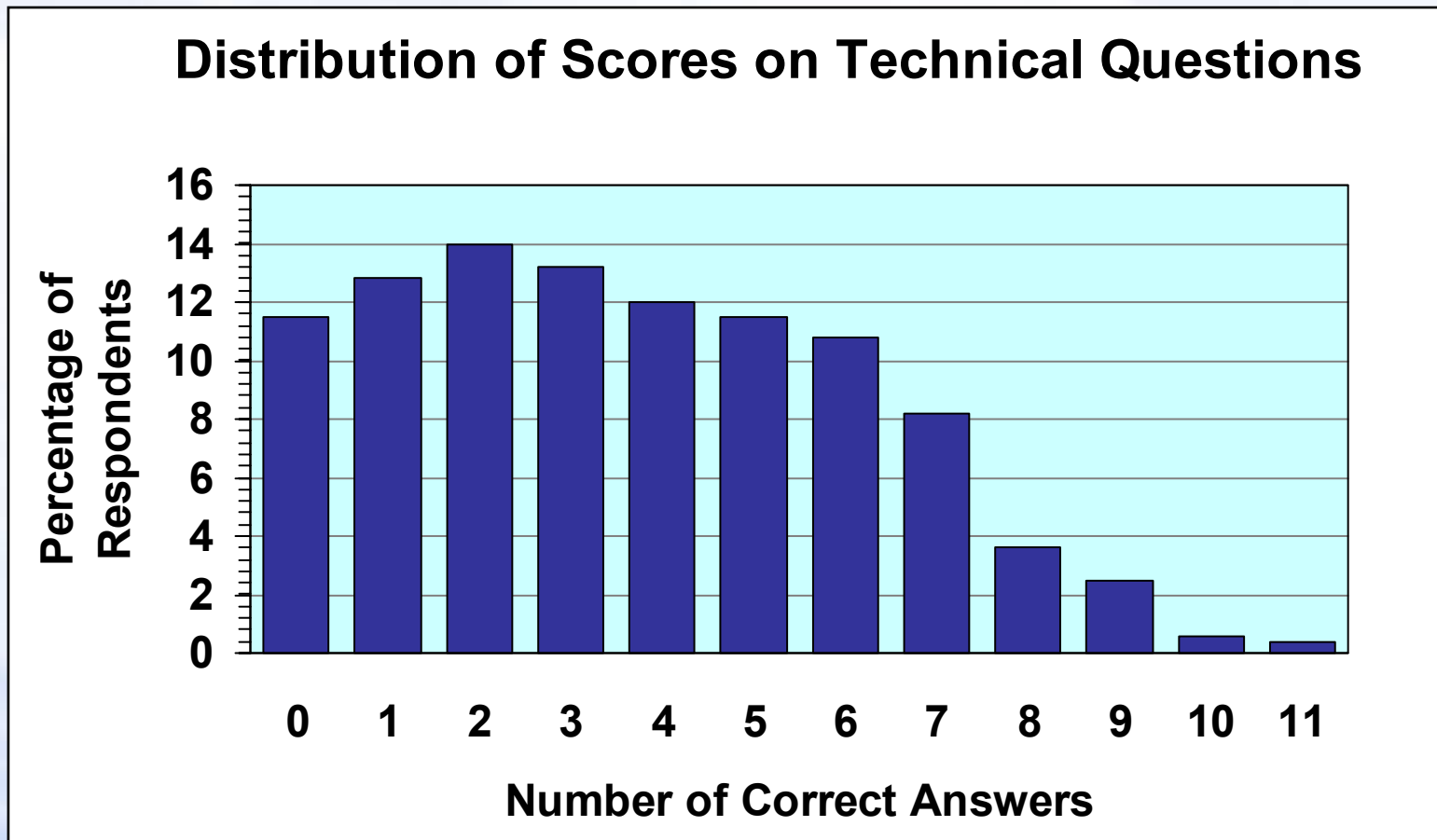
- Process included two Federal Register Notices (published August 2003 and January 2004) seeking public comment on DOE intent to collect – no comments received
- OMB required approval of each individual data collection – both the survey instrument and the methodology (sample selection, etc.)

General Public Survey

- Used GENESYS system (listed and unlisted telephone numbers) and random digit dialing
 - General public (ages 18+) – statistical sampling population essentially infinite
 - Random selection within the household based on most recent birthday
- 25% response rate, for a total of 889 completed interviews

General Public – Technical Knowledge

- Mean score for general public was 32.8%
- 43% of the responses were “Don’t Know”
- Only 6% scored a “passing grade” (8 or more correct answers)



General Public – Technical Knowledge

- Only 19% knew that when pure hydrogen is used, fuel cells produce electricity, water, and heat
- 38% could correctly identify the sources of energy from which hydrogen can be produced
- 37% said hydrogen is toxic
- More than 40% didn't know hydrogen is lighter than air

General Public – Opinions

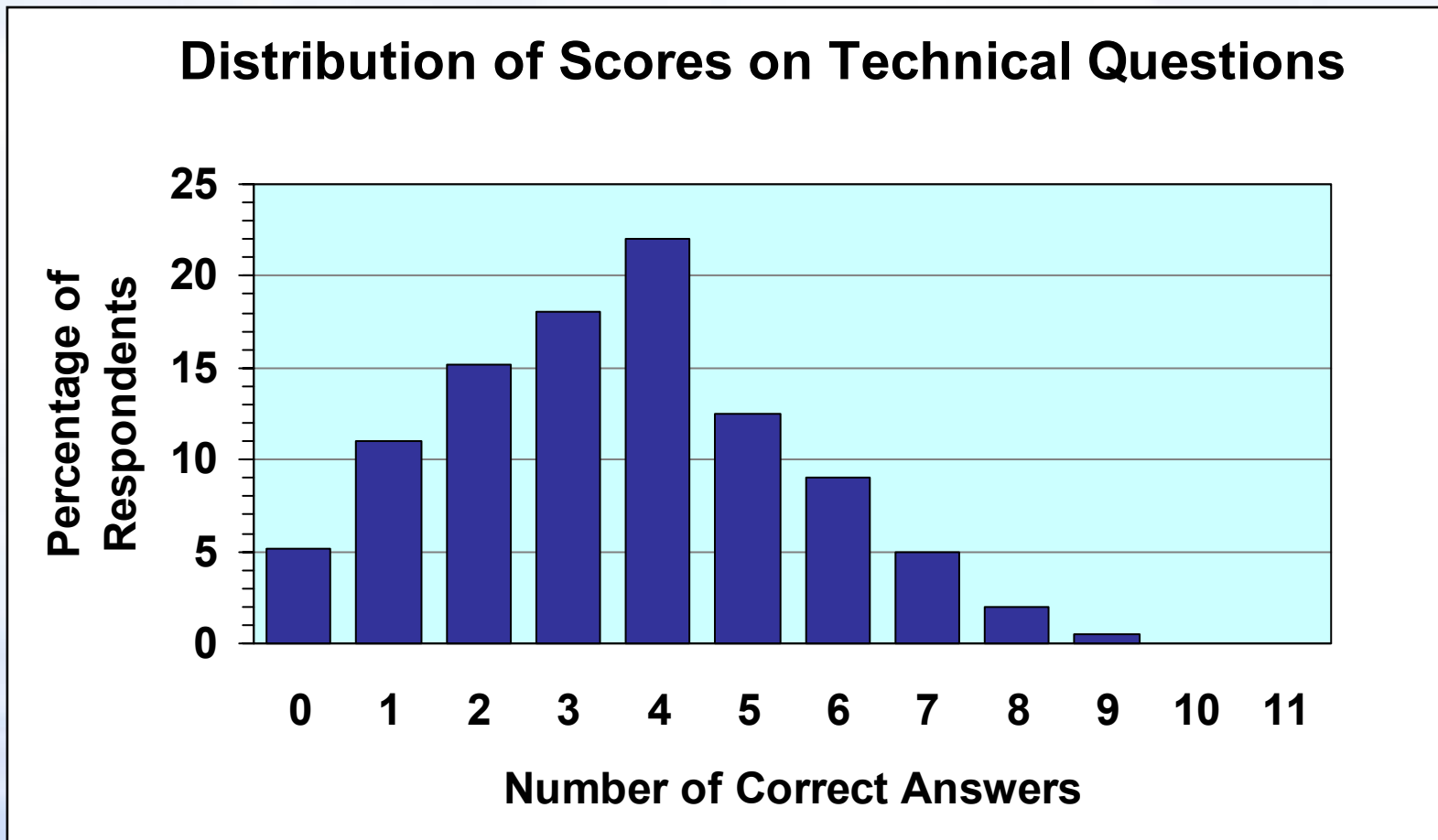
- 41% thought that hydrogen is too dangerous for everyday use
- When asked how they'd feel if their local gas station also sold hydrogen, more than 50% of the public said they'd feel frightened, uneasy, or “don't know”
- When selecting a fuel supply, the public considered safety as the most important factor; cost and the environment were next in importance; and convenience ranked as least important

Student Survey

- Used GENESYS system (listed and unlisted telephone numbers) and random digit dialing
 - Students (ages 12 – 17)
 - Random selection within the household based on most recent birthday
- 28% response rate, for a total of 1,000 completed interviews

Students – Technical Knowledge

- Mean score for students was 32.2%
- 32% of the responses were “Don’t Know”
- Only 3% scored a “passing grade” (8 or more correct answers)



Students – Technical Knowledge

- Only 17% knew that when pure hydrogen is used, fuel cells produce electricity, water, and heat
- 35% could correctly identify the sources of energy from which hydrogen can be produced
- Almost 40% said that hydrogen gas is toxic
- Knew much more about hydrogen than about fuel cells:
 - Answered 40% of the hydrogen-related technical questions correctly
 - Answered only 11% of the fuel cell-related technical questions correctly

Students – Opinions and Experience

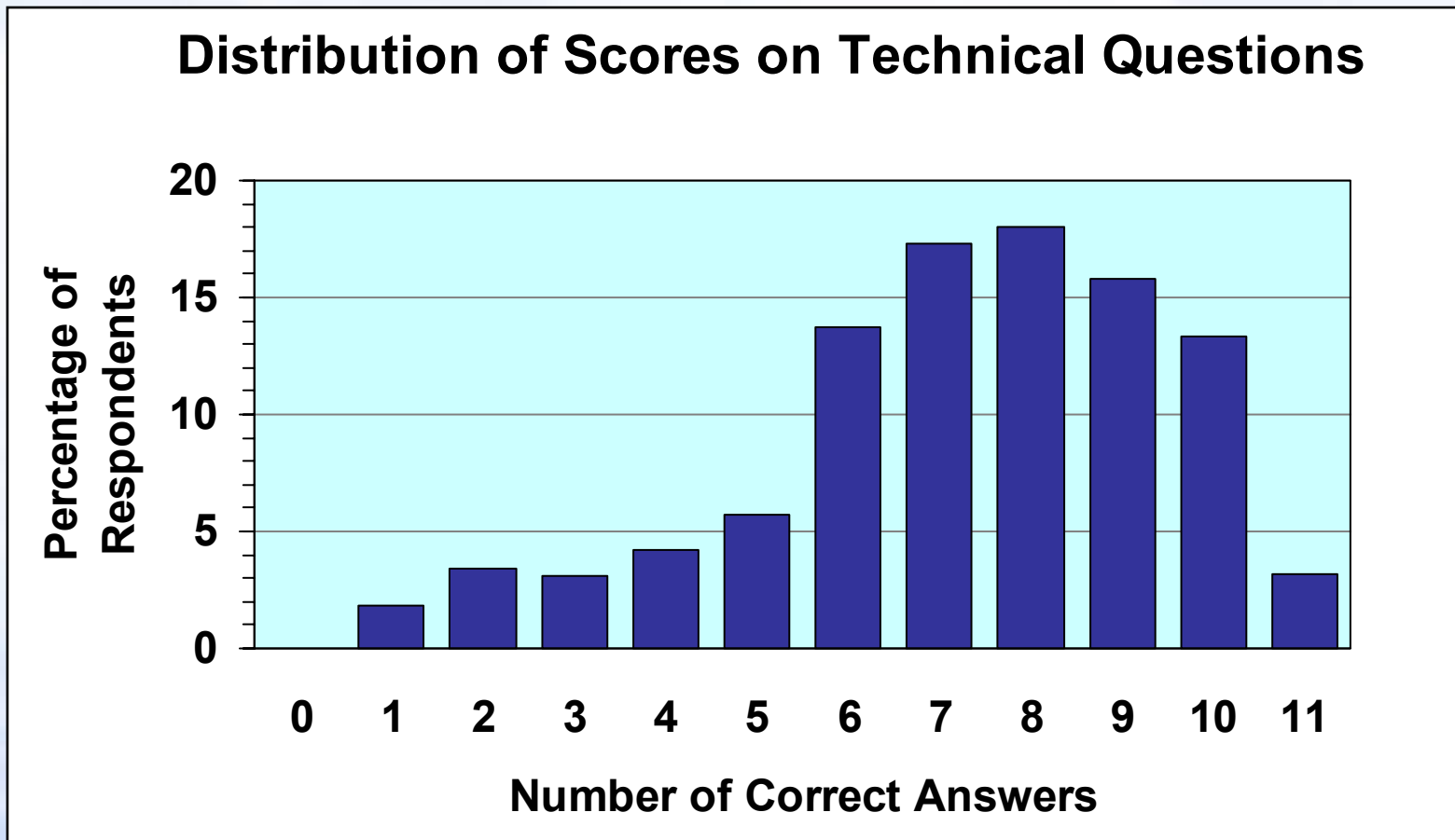
- About 45% thought that hydrogen is too dangerous for everyday use by the public
- When asked how they'd feel if their local gas station also sold hydrogen, more than 60% of the students said they'd feel frightened, uneasy, or “don't know”
- When students were asked about hydrogen, fuel cells, and energy studies in school –
 - 59% said they had received some level of instruction about energy use, fuels, and emissions in school
 - 52% said they had received some level of instruction about hydrogen and fuel cells in school
 - 9% said they had used a fuel cell model kit in school

State and Local Government Survey

- Used national databases to compile contacts
 - DOE sent letters to the entire state and local government sample in advance of survey to improve response rate
- Targeted Organizations
 - State-level: directors of State Energy Offices, DOTs, and DEPs
 - City- and county-level: mayors and supervisors in the 12 most populous cities and counties of the four U.S. census regions
 - For cities and counties combined in a single office (e.g., City and County of Denver), only one call was made and the next largest county was selected for interviewing
- 96% response rate, for a total of 236 completed interviews

State and Local Government Officials

- Mean score for state and local governments was 65.8%
- 18% of the responses were “Don’t Know”
- 50% scored a “passing grade” (8 or more correct answers)

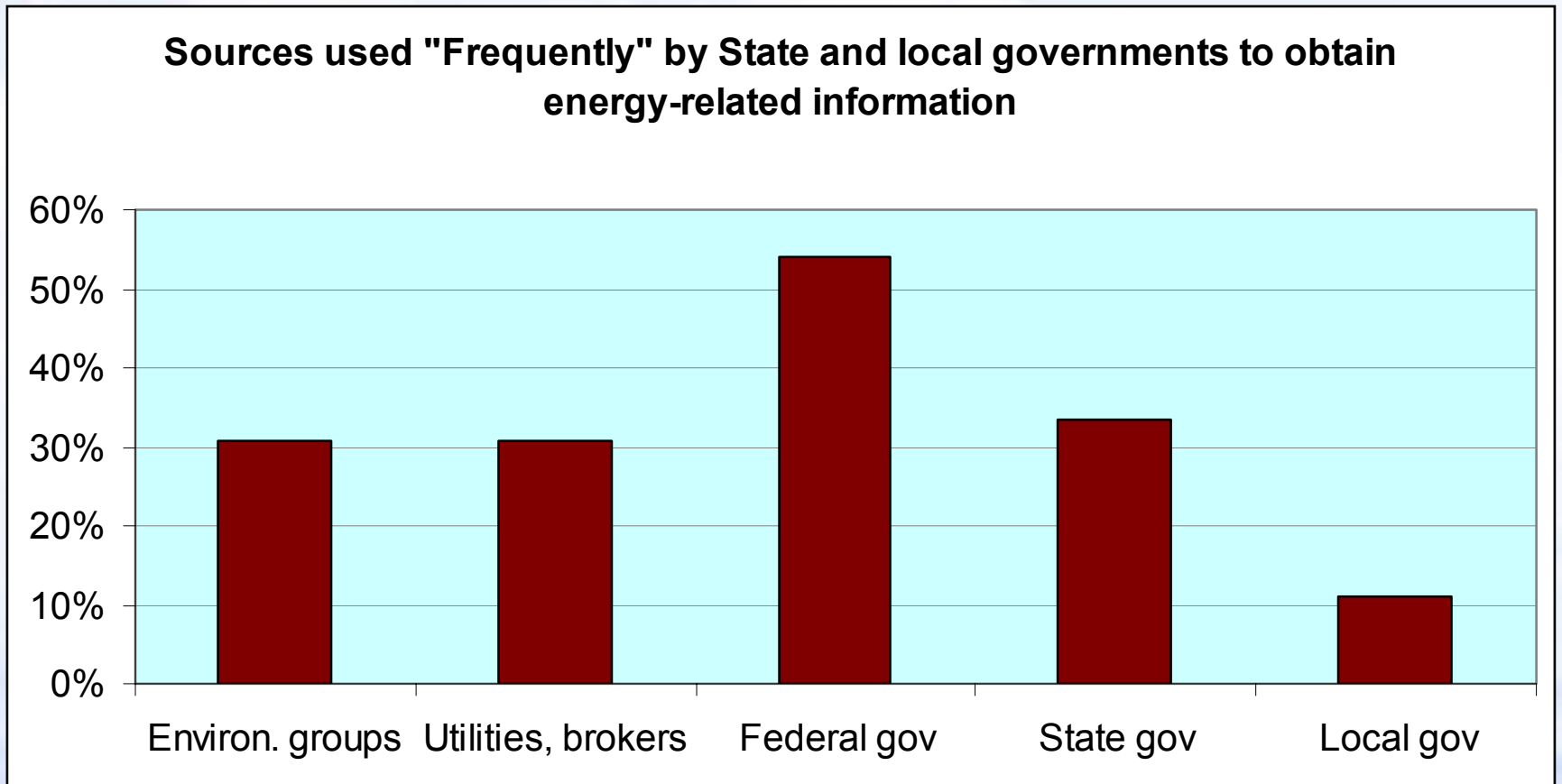


State and Local Government Officials – Technical Knowledge and Opinions

- 52% knew that when pure hydrogen is used, fuel cells produce electricity, water, and heat
- 67% could correctly identify the sources of energy from which hydrogen can be produced
- When asked how they'd feel if their local gas station also sold hydrogen, 88% said they'd feel pleased or at ease

State and Local Government Officials

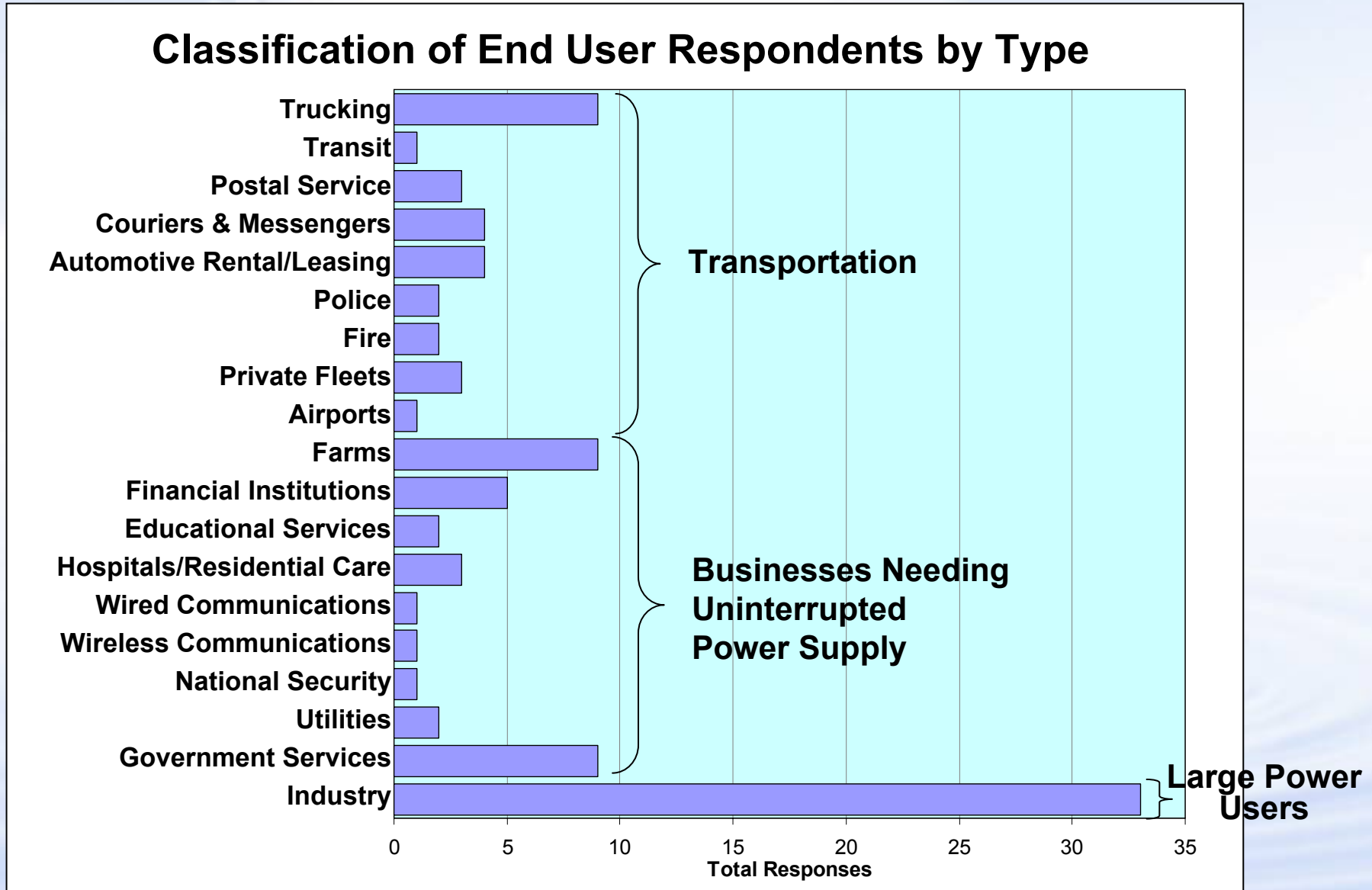
The Federal government is a frequently used source of information for state and local government officials



End Users Survey

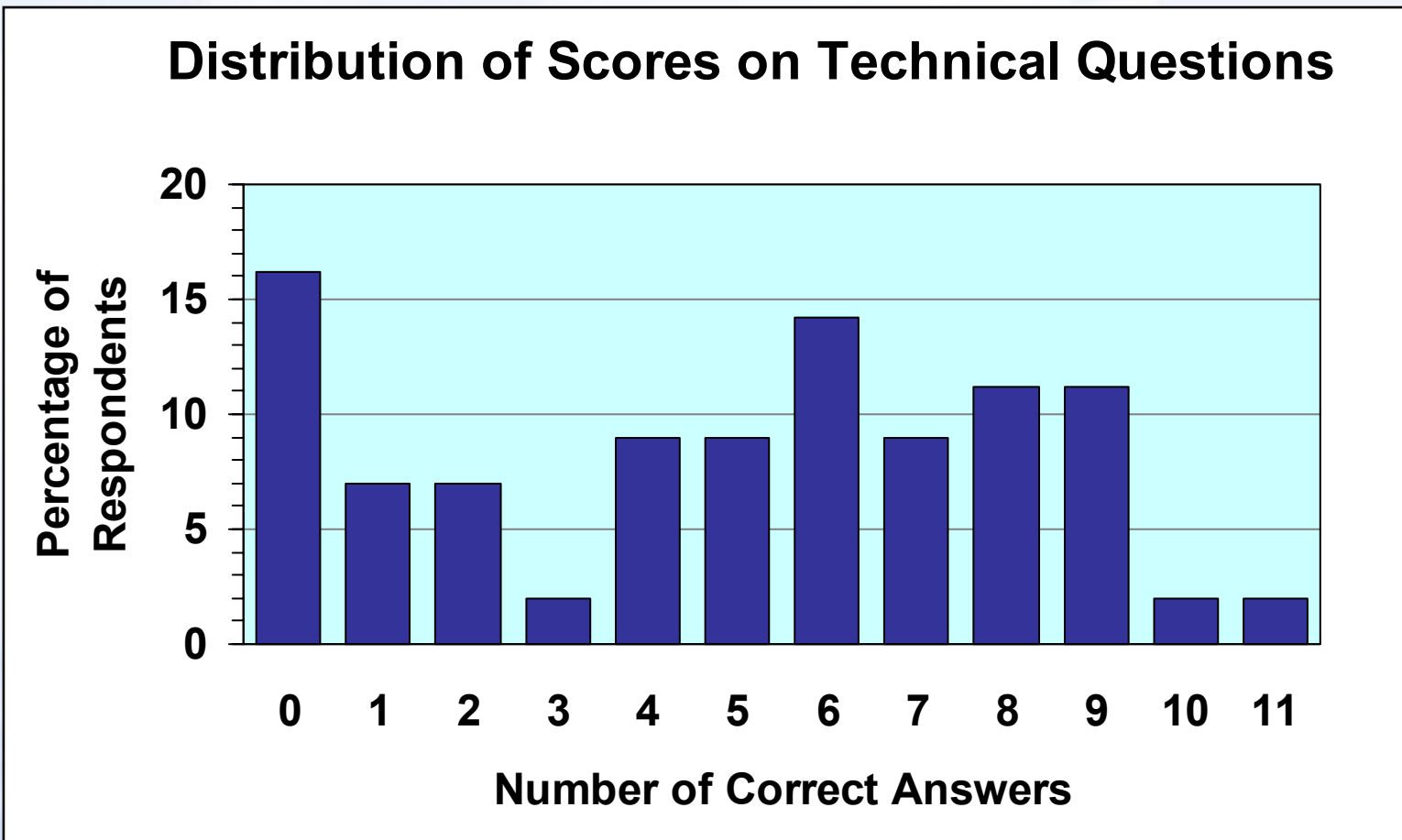
- Potential respondent businesses were identified by North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes
 - Grouped into three categories and ranked by number of employees or revenue
 - *Transportation services* – public and private fleets (# of employees)
 - *Businesses needing uninterrupted power supplies* – hospitals, financial institutions (# of employees)
 - *Industries with large power requirements* – mills, wastewater treatment and other plants (revenue)
 - Within each category, the largest 0.3% were identified and randomly sampled
 - Contact lists were purchased from Dun & Bradstreet Market Place database
- 29% response rate, with 99 completed interviews

End Users



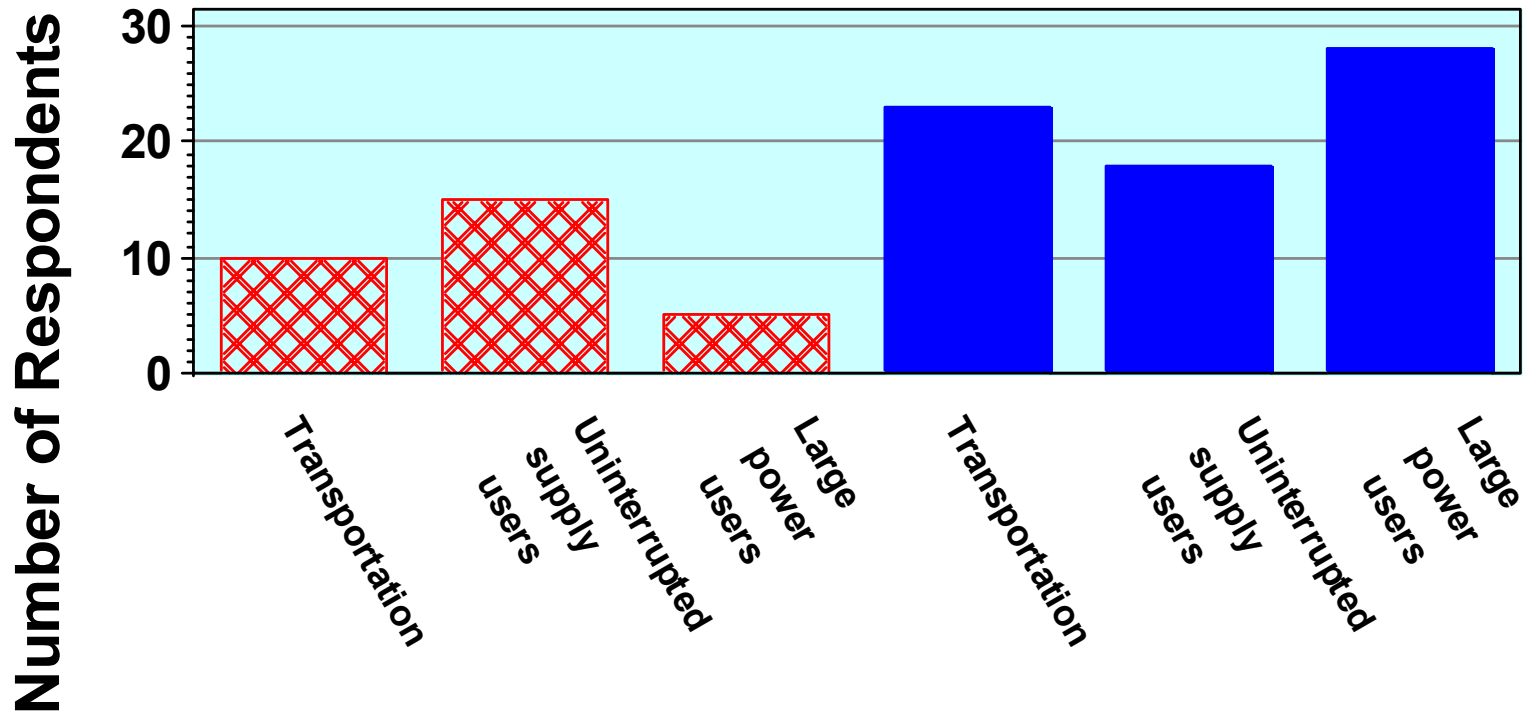
End Users – Technical Knowledge

- Mean score for End Users was 44.4%
- 42% of the responses were “Don’t Know”
- 26% scored a “passing grade” (8 or more correct answers)



End Users

End User Business Categories
High vs. Low Scores on Technical Knowledge Questions

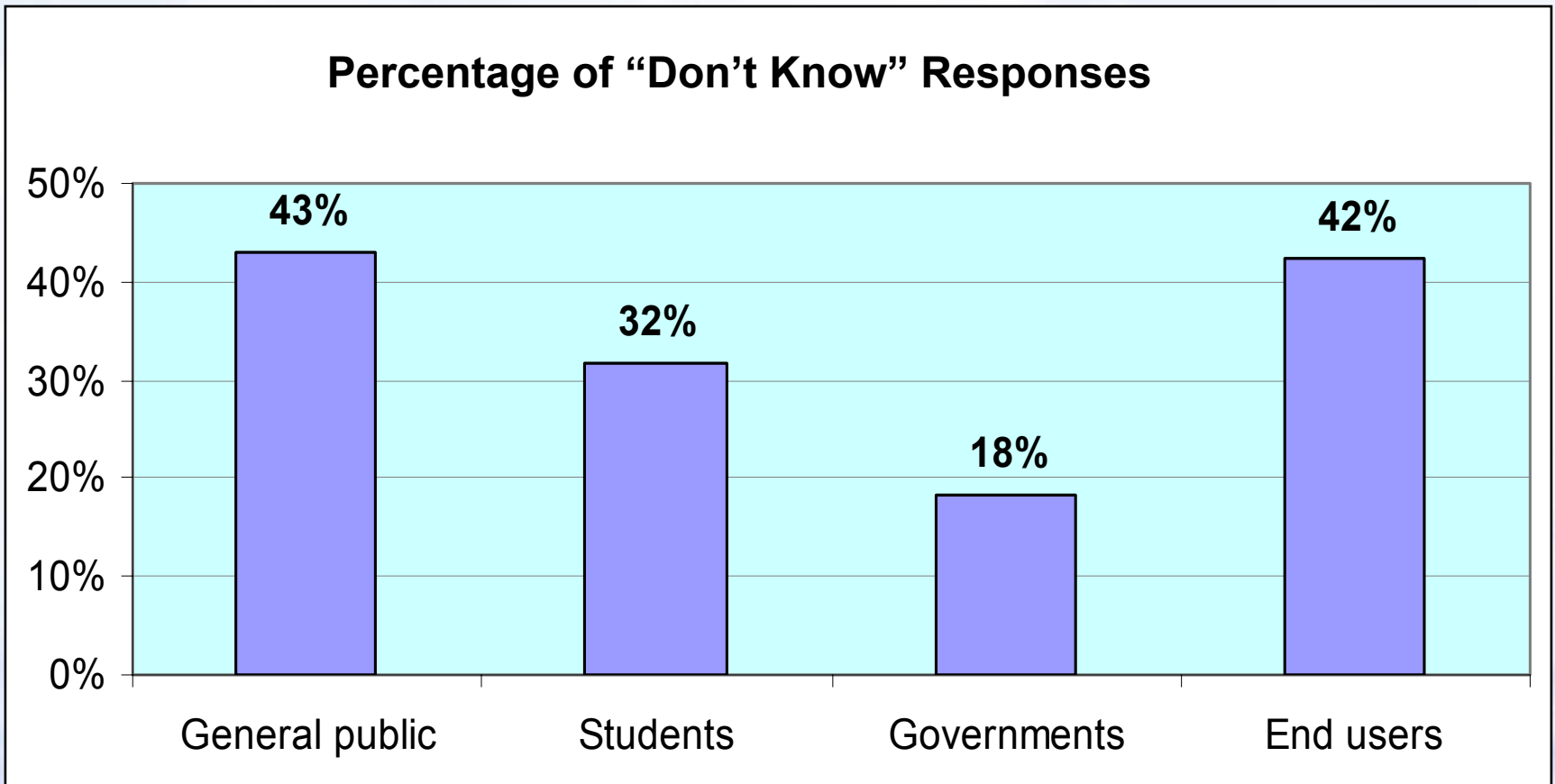


Number of Technical Questions Correct:

 Fewer than three
 At least three

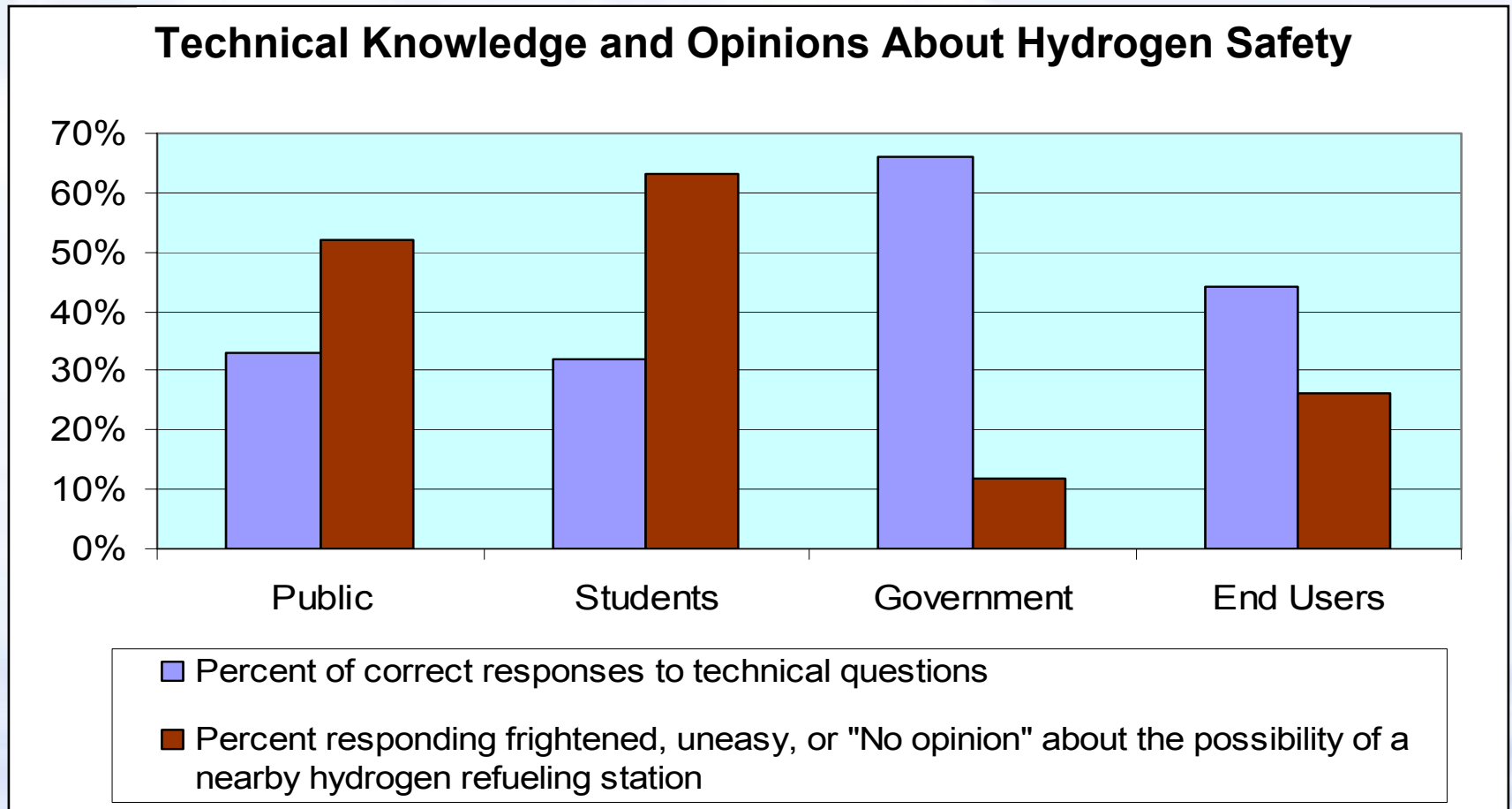
Summary and Conclusions – All Populations

There is a general lack of knowledge about hydrogen and hydrogen fuel cell technologies



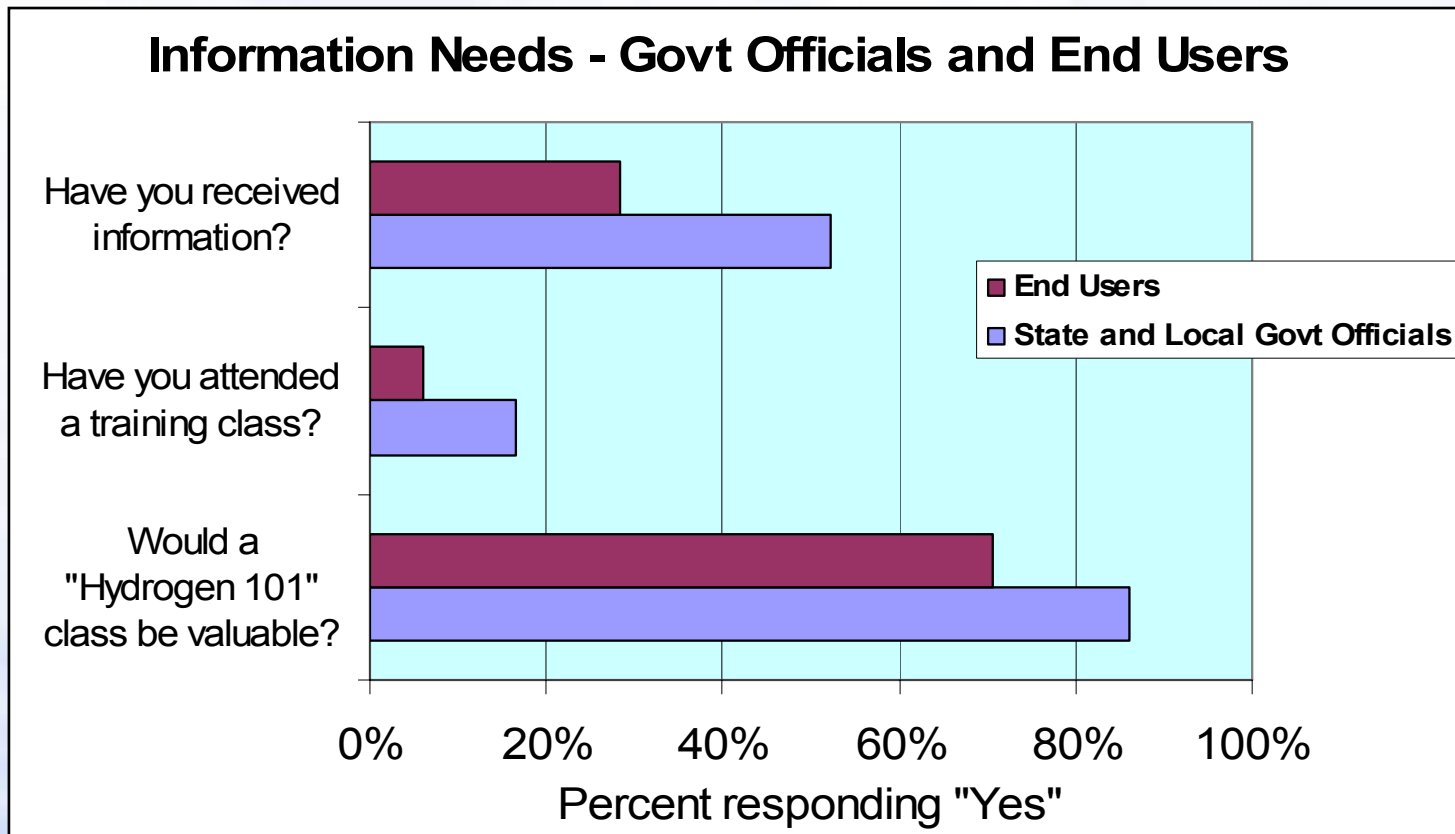
Summary and Conclusions – All Populations

There is a correlation between technical knowledge about hydrogen and fuel cells and opinions about safety



Summary and Conclusions – All Populations

There is a general desire for more information and for training opportunities. Even populations that achieved *relatively high* scores on the technical knowledge questions expressed a need for “hydrogen basics” training.



What's Next for the Survey?

- Publish final peer-reviewed report
 - ✓ Report and overview presentation of key results now available on www.hydrogen.energy.gov (see Library/Facts and Figures)
- Repeat surveys in 2008 and 2011 to measure changes in knowledge and opinions over time
 - Archive all 2004 survey data (methodology, data analysis plan, etc.)
 - Plan for future surveys to include safety and code officials as a separate target audience category

What's Next for the DOE Education Program?

Focus education strategy and activities on raising H2IQ

- All education activities must tie to the survey
- Messages and information conveyed in education resources are designed to increase H2IQ
 - Focus on addressing/answering technical knowledge questions
 - Note: survey finding that technical knowledge can affect opinions about safety

Raising H2IQ: Community and Media Information Program

Using various media to “seed the clouds” – introduce the concept of a hydrogen economy and hydrogen technologies

- Drive people to “information toolbox” on *hydrogen.energy.gov*
- Program components include radio spots, Podcasts, radio/satellite media tours
- Information toolbox and program components broadly inform and demystify the technology – address the survey questions

For More Information – DOE Education Resources

hydrogen.energy.gov

New intro fact sheets – and the Baseline Survey Report now available in the web site library!

The screenshot shows the homepage of the DOE Hydrogen Program website. At the top, it says "U.S. DEPARTMENT OF ENERGY" and "hydrogen.energy.gov". Below this is a navigation bar with links for Home, DOE Program, Offices/Programs, International, Library, and News/Events. A search bar is also present. On the left, there is a vertical menu with categories like Hydrogen Production, Hydrogen Delivery, Hydrogen Storage, Hydrogen Manufacturing, Conversion/Fuel Cells, Applications/Technology Validation, Safety, Codes & Standards, Education, Basic Research, Systems Analysis, and Systems Integration. The main content area features several news items, including "DOE Releases New Analysis Tools for Hydrogen Delivery Technologies" and "DOE Seeks Public Comment on Draft Paper on the Potential Roles of Ammonia in a Hydrogen Economy". A red arrow points from the "Library" link in the navigation bar to a stack of fact sheets in the foreground.



All hard copy documents, fact sheets, CDs, etc. can be ordered from the DOE Information Center and shipped free-of-charge
877-EERE-INF(O) or 877-337-3463
Mon – Fri, 9am – 6pm EST