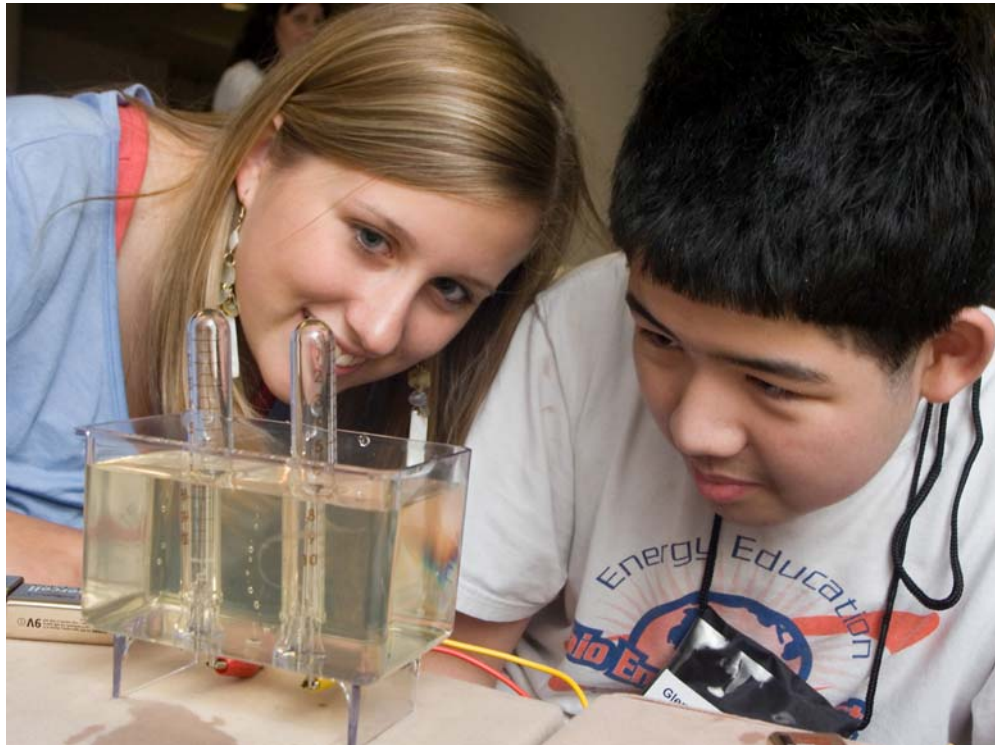


2007 DOE Hydrogen Program

H₂ Educate!

Hydrogen Education for Middle Schools



DOE Hydrogen Program

National Energy Education Development

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May 18, 2007

**Project ID #
ED2**

This presentation does not contain any proprietary or confidential information

H₂ Educate Overview

Middle School Training and Materials

Timeline and Budget

- Project Period: April 2004 – April 2009
- 100% complete with revised scope (4,000 teachers trained to date)
- Total project funding
 - \$900,000 (Program Zeroed)
 - \$600,000 (Matching Funds)
- FY04 \$300,000
- FY05 and FY 06 \$0
- FY07 \$150,000





Special Thanks to our Partners

- U.S. Department of Energy Hydrogen, Fuel Cells, Infrastructure and Technologies Program
- Sentech, Inc.
- U.S. Fuel Cell Council
- National Hydrogen Association
- Los Alamos National Laboratory
- NYSERDA
- Fuel Cell Store
- Virginia Department of Mines, Minerals and Energy and the Virginia Legislature
- State Energy Offices
- Pacific Gas and Electric Company
- BP



H₂ Educate Objectives

- 1st year - Collaborate to develop, design, and deliver a first-class, comprehensive middle school hydrogen education program including: Training, Classroom Materials, technical and best-practices exchange, and evaluation.
- 1st year - Design a program to link hydrogen science and technology and the concept of a hydrogen economy to the classroom.
- 2nd and 3rd year – Deploy materials via teacher training and other professional development outreach opportunities.
- 2nd and 3rd year – Provide technical support for schools that entered the program in year one and two. Collect data and evaluate for year two revisions.
- 2nd and 3rd year – Work to expand the reach of the program with new partners able to support training workshops at the local level.



Implementation

In Year One we:

- Asked and Evaluated: “What do you want to know about hydrogen, and what would your students want to know?”
- Surveyed: Consider the national and state education standards and develop the program to meet classroom needs.
- Created: Have educators create the program and secure technical support to assist and trouble-shoot.

In Years Two and Three we:

- Deployed: Move beyond the pilot project to one-day teacher training workshops hosted throughout the country as resources allowed. States reached: OH, MI, WV, CA, PA, IL, NY, and VA. H₂ Educate is also part of our summer professional development efforts – 12 weeks of teacher training.



Ask and Evaluate

- In a "hydrogen economy," hydrogen is used to power our cars, homes, and businesses.
- Hydrogen can be made from abundant and diverse resources found right here in the United States.
- Fuel cells use hydrogen to create electricity -- the only byproducts are water and heat (no pollutants or other emissions).
- Fuel cells can power almost anything, from laptops to cars to homes.
- Just like gasoline and other fuels, hydrogen can be used safely.

Survey - National and State Standards

- e. Electrical circuits provide a means of transferring electrical energy.
- f. In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.
- g. The sun is the major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths.

INTERMEDIATE STANDARD-E: SCIENCE AND TECHNOLOGY

2. Understandings about Science and Technology

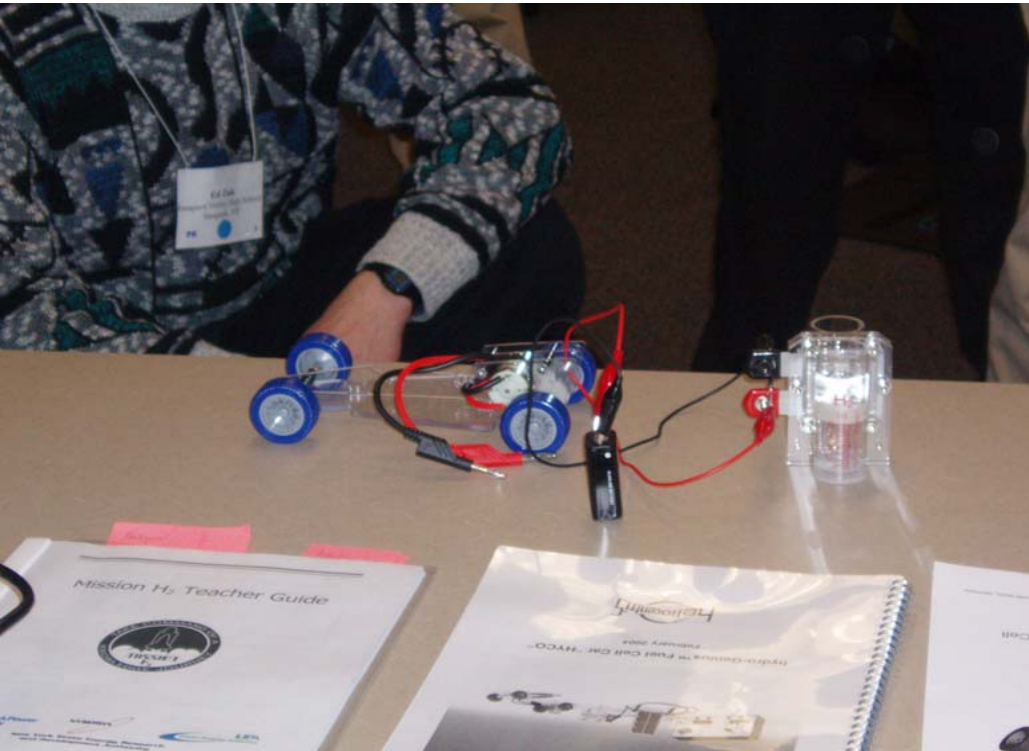
- a. Scientific inquiry and technological design have similarities and differences. Scientists propose explanations about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations.
- c. Technological solutions are temporary and have side effects. Technologies cost, carry risks, and have benefits.
- f. Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Risk is part of living in a highly technological world. Reducing risk often results in new technology.



Progress/Results

- In 50% of the time estimated, the team created the middle school H₂ Educate learning module, designed one-day workshops and began delivery of teacher training.
- All partners have the same end goal: Provide as many modules as possible to the middle school community. To date, demand exceeds supply due to available resources. NEED is working with other DOE hydrogen grant recipients to maximize impact of funding.
- In the NY program, higher level fact sheets were created for the general public.
- In Virginia, the Appropriations Committee funded several workshops through the Commonwealth's Department of Education.

H₂ Educate



At work....





Measure Success

CATEGORY	4	3	2	1
Scientific Concepts	Written explanation illustrates an accurate and thorough understanding of scientific concepts underlying the simulation.	Written explanation illustrates an accurate understanding of most scientific concepts underlying the simulation.	Written explanation illustrates a limited understanding of scientific concepts underlying the simulation.	Written explanation illustrates inaccurate understanding of scientific concepts underlying the simulation.
Drawings/Diagrams	Clear, accurate diagrams are included and make the simulation easier to understand. Diagrams are labeled neatly and accurately.	Diagrams are included and are labeled neatly and accurately.	Diagrams are included and are labeled.	Needed diagrams are missing OR are missing important labels.
Summary	Summary describes the skills learned, the information learned and some future applications to real life situations.	Summary describes the information learned and a possible application to a real life situation.	Summary describes the information learned.	No summary is written.
Procedures	Procedures are listed in clear steps. Each step is numbered and is a complete sentence.	Procedures are listed in a logical order, but steps are not numbered and/or are not in complete sentences.	Procedures are listed but are not in a logical order or are difficult to follow.	Procedures do not accurately list the steps of the experiment.

Gather data on school usage

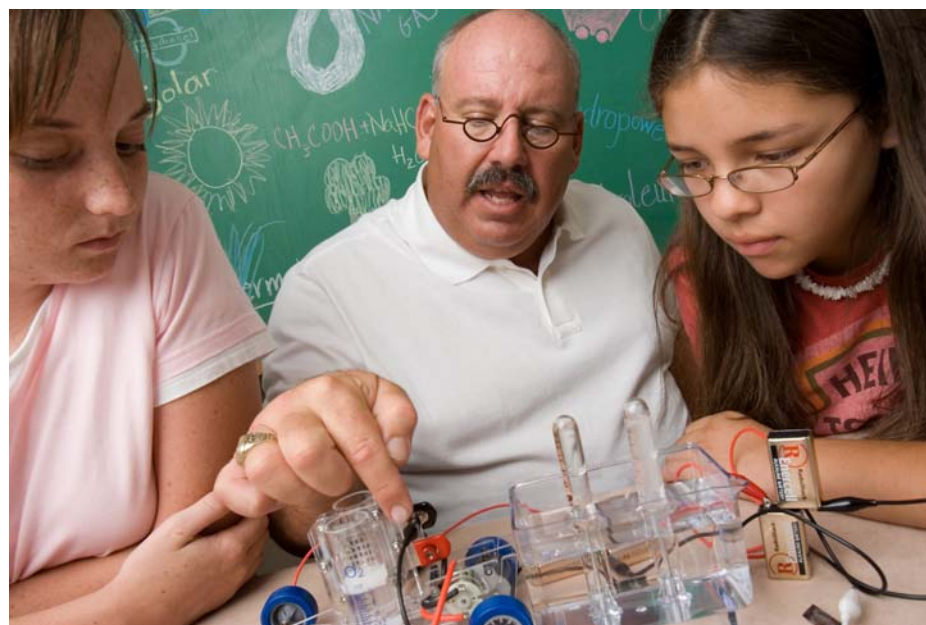
Collect quantitative and qualitative data to improve, re-assess, and expand programs

Provide educators the assessment tools needed to review student performance

Pre and Post Data from participating schools and workshops shows a 60% increase in student and teacher knowledge.

Challenges and Opportunities

- Demand too great for available resources
- Moving ahead in spite of limited financial resources.
- Good news? Local investment moves the project forward at great speed.





Forward Progress

Since project inception, we have:

- Worked with other hydrogen partners to maximize reach of programs and materials – i.e. working with infrastructure grantees to provide educational resources.
- Continued incorporation of materials and programming into NEED's existing training initiatives.
- Annually updated materials with new data and provide major changes to educational community.
- Delivered maximum number of hands-on resources to classrooms leveraging resources to do so.
- Reached over 4,000 teachers.
- Provided hydrogen education experiences to analysts and economists from the Energy Information Administration and field trips to Shell's fueling station in Washington, D.C.

Innovative Outreach

- Addition of hydrogen information and activities to the EIA Kid's Page www.eia.doe.gov/kids (350,000 users per month)
- H₂ Educate Teacher and Student Guides loaded to several web sites
- 8 workshops in New York State supported by NYSERDA, program renewed
- Workshops at the National Science Teachers Association Conferences – Chicago, Nashville and Dallas (2005), Anaheim(2006), St. Louis (2007). Over 600 teachers trained.
- \$200,000 of hydrogen education grant money given to teachers as part of NEED's partnership with BP in the A+ for Energy Program.
- 1,200 teachers trained in July 2005, 900 in July 2006 and 1,000 in July 2007.
- Workshops hosted in cooperation with Orange County Office of Education (CA), Lansing Community College (MI), NASA, NETL, and NAFTC (WV/PA), Westerville Electric Division (OH).

Have a Question or Want to Participate?

- Contact Rebecca Lamb at rlamb@need.org or Mary Spruill mspruill@need.org or 800-875-5029.
- Materials are available at www.need.org.

