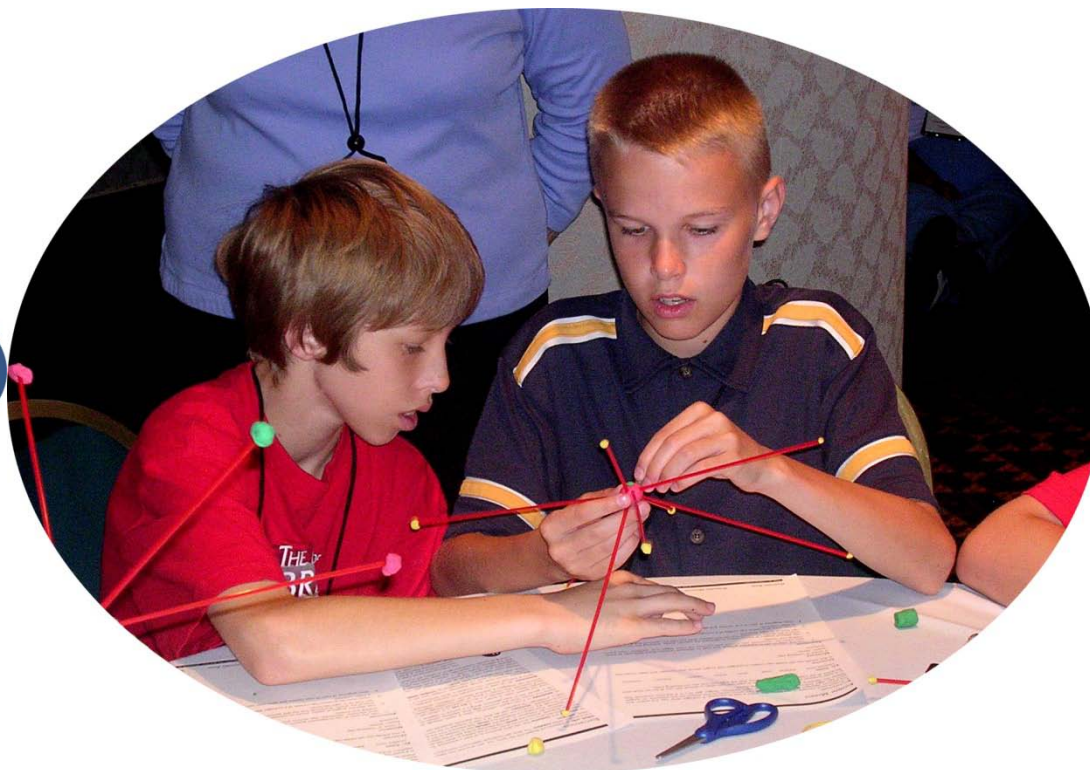


2010 DOE Hydrogen Program Review

H₂ Educate!

Hydrogen Education for Middle Schools



Project Number ED017

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National Energy Education Development

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

H₂ Educate Overview

Timeline and Budget

- Project Period: April 2004 – April 2011
- 100% complete with revised scope (8,000 teachers trained to date)
- Total project funding
 - \$750,000
- FY04 \$300,000
- FY05 and FY 06 \$0
- FY08 \$150,000
- FY09 \$150,000
- FY10 \$150,000
- Extension to provide additional workshop in 2010 - 2011



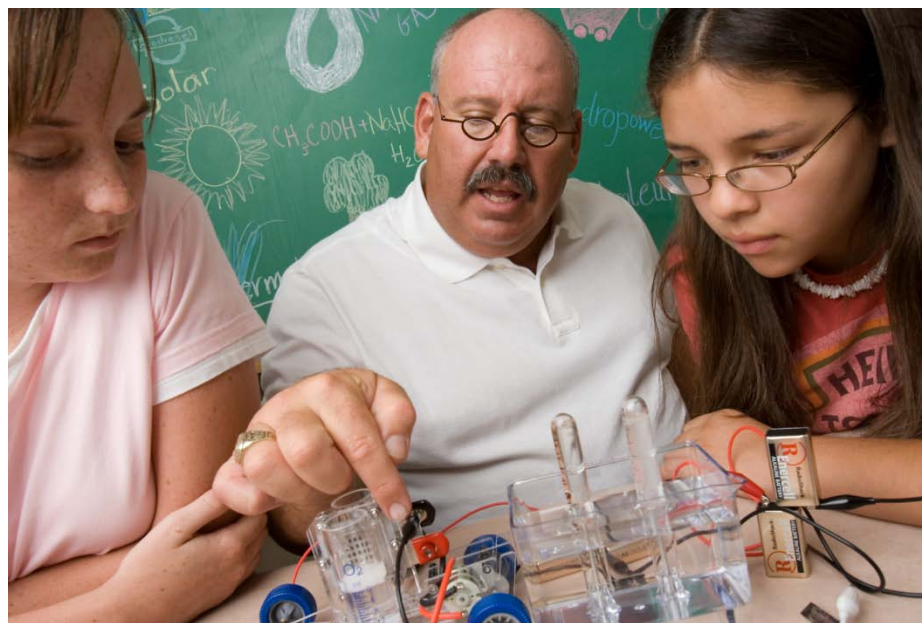


Special Thanks to our Partners

- 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
- NADA Scientific
- Virginia Department of Mines,
Minerals and Energy and the
Virginia Legislature
- Virginia Clean Cities
- State Energy Offices
- Pacific Gas and Electric Company
- BP
- DC Energy Office
- General Motors
- Sacramento Municipal Utility
District
- South Carolina Hydrogen & Fuel
Alliance
- USC Columbia Fuel Cell
Collaborative
- Idaho National Laboratory
- Idaho State Department of
Education

Challenges and Opportunities

- Demand too great for available resources
- Moving ahead beyond the end of the grant.
- Good news? Local investment moves the project forward at great speed.





Relevance

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.
- 4th , 5th , 6th year -- Expand program for new localities and workshops.
- 4th , 5th , 6th year -- Continue to evaluate effectiveness and usability of materials
- 4th , 5th , 6th year -- Expand financial resources for workshops



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 - Six 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, MA, NM, TX, IL, IN, FL, DC, CT, OR, VA, ID, TN, and SC. H₂ Educate is also part of summer professional development efforts – 2 weeks of teacher training with over 250 educators
- Measured success.
- National Science Teachers Association Outreach
- State Science Teachers Association Outreach

Implementation continued

In Year Six we:

- Continued annual revision of H2 Educate Teacher and Student Guides.
- Expanded H2 Educate Workshops
- Provide resources online



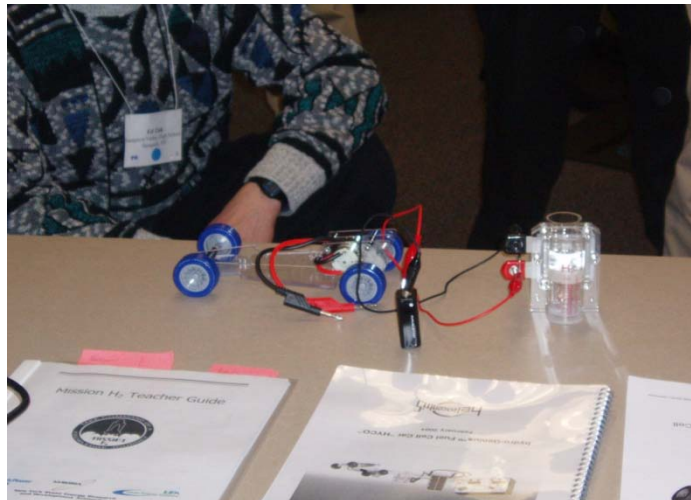


What do teachers and students need to know?

- 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 can power almost anything, from laptops to cars to homes.
- Just like gasoline and other fuels, hydrogen can be used safely.
- Fuel Cells can play a key role in disaster relief and recovery and provide distributed generation and emergency power.

Alignment - National and State Standards

- Continued alignment to national and state standards
- Aligned to Technology Standards and other STEM initiatives where those standards exist
- Expanded reach into the Technology Education market



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.

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

Rubrics for student assessment

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

Post workshop data indicates that educators are implementing the program in class, materials are appropriate for middle school and elementary/secondary as well, that materials are easy to implement and equipment is sturdy and high quality.

Big question: Are we reaching teachers effectively and improving energy education?



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 K-12 workshops through the Commonwealth's Department of Education and public education sessions and materials through the Virginia Department of Mines, Minerals and Energy.
- Utilities like PG&E and SMUD are funding the delivery of H₂ Educate Workshops with great success.
- Joint workshops – i.e. Wind and Hydrogen and Solar and Hydrogen are in the works.



Progress/Results

- Evaluation of the pre/post hydrogen survey nets the following average results:
 - **Pre: 5 out of 15 correct**
 - **Post: 13 out of 15 correct**
- NEED is working with other DOE hydrogen grant recipients to maximize impact of funding.
- Interest in hydrogen curriculum and materials remains high – workshops over capacity in all instances and with substantial waitlists.

H₂ Educate Future Work

- DOE funding extended through 2011. NEED will continue to maintain the curriculum, kits, and workshop delivery as part of the NEED portfolio.

Using partner support from state energy offices, private industry, and trade associations, extending the reach of the workshops is possible.

- It should be noted that NEED's program was created and launched in year one. Subsequent years are expansions of delivery of workshops and materials.





Support of DOE Hydrogen Program

- Curriculum continues to demonstrate the need for hydrogen production from a variety of fuels.
- Classroom activities showcase the hydrogen economy from both a transportation and electrical generation perspective and consider current hydrogen use and future hydrogen capability.
- Deployment of hydrogen education materials and workshops in strategic regions allows for greater discussion of hydrogen issues.
- Workshops provide opportunities for media events, public dialogue, and presentation of DOE research.
- Integration of hydrogen curriculum and research into other NEED/DOE efforts



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 8,000 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. as well as Ride and Drives with GM in DC, Richmond, and Norfolk.



Collaborations

Innovative Outreach

- H₂ Educate Teacher and Student Guides loaded to partner websites and others
- H₂ Educate Teacher and Student Guides loaded to the NEED website.
- Workshops at the National Science Teachers Association Conferences – Chicago, Nashville and Dallas (2005), Anaheim(2006), St. Louis (2007), Boston (2008) and New Orleans (2009).
- Workshops hosted as part of PG&E's Solar Schools initiatives – reaching over 300 teachers annually and connecting renewable generation to hydrogen and fuel cells
- Currently considering curriculum to assist schools with Fuel Cell installations
- National Energy Conference for Educators Nashville, 2009.
- Partnered with UTC on activities and training for Greensburg, KS and its fuel cell application.

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