

X.6 H₂ Educate! : Hydrogen Education for Middle Schools

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Objectives

- Collaborate to develop, design, and deliver a first-class, comprehensive middle school hydrogen education program that includes: Training, Classroom Materials, technical and best-practices exchange, and evaluation.
- Design a program to link hydrogen science and technology and the concept of a hydrogen economy to the classroom.

Technical Barriers

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

- *A. Lack of Awareness*
Interest in hydrogen and fuel cell technology is increasing, but there remains a general lack of awareness of hydrogen as an energy alternative.
- *C. Institutional Barriers and Access to Audiences.*
Once audience information needs have been defined and educational materials or training workshops have been developed, they must reach their intended audiences to be effective. Institutional barriers can complicate or inhibit access to target audiences.
- *D. Regional Differences.*
Educational needs will vary by audience, but they may also vary regionally. What applies to one state, county, city, or district may not apply to another.

Introduction

The National Energy Education Development (NEED) Project brings its 25 year history in energy education, curriculum development, teacher training, and networking efforts to H₂ Educate for middle school curriculum development, teacher training, and the expansion of hydrogen understanding and knowledge in classrooms throughout the country. NEED, with SENTECH, Inc. of Bethesda, Maryland as a key partner, launched a bold effort to exceed the U.S. Department of Energy's (DOE) expectations for a hydrogen education program.

H₂ Educate and the activities undertaken as part of this project are the result of a collaborative effort among teachers, students, advisors, technical specialists, federal employees and professional educators. This effort brings together resources from NEED, its national partners, and DOE to capitalize on success, resources, networking opportunities, curriculum development, and delivery capabilities. Key elements of this program are NEED's 42-state network, a strong relationship with the National Association of State Energy Officials, and an annual budget capable of doubling the resources provided by this cooperative agreement. Making up this network are a conservatively estimated 45,000 classrooms touched by NEED materials and training each year.

The materials developed for the project include hands-on kits and classroom guides for middle schools. These include printed hydrogen energy resource portfolios and associated hands-on activity kits, as well as supplemental online resources and research materials for parents, students, and teachers. NEED's existing energy education materials are correlated to the National Science Education Standards and to over twenty state standards, and all curriculum offerings created as part of this project are similarly correlated to all appropriate national and state standards. Teachers receive curriculum units and hands-on hydrogen, fuel cell, and electrolysis kits. Materials created by the project help students and teachers understand the vision of a hydrogen economy and the future of hydrogen fuels nationally and worldwide.

The basic curricular materials are supplemented with enrichment activities targeted to students

interested in pursuing a deeper understanding of hydrogen and fuel cell technologies.

Curriculum materials without ample training opportunities will go unused. This project provides for the direct training of teachers at hydrogen specific programs for the duration of the project. Those educators will often act as secondary presenters, providing training programs in their localities. Many training programs offer educators the opportunity for close interaction with hydrogen experts and, where possible, hydrogen facilities. NEED's six hundred-plus training programs each year include 2-hour sessions on hydrogen and the new curriculum materials. The special hydrogen training workshops provide an in-depth look at hydrogen for teachers interested in going the extra step and delving deeper into the subject matter. NEED's national five-day training conferences added a new focus area on hydrogen and provide teachers with field trips to hydrogen facilities when possible.

A critical challenge to this project is that the current demand for the middle school hydrogen education materials outpaces the supply of available resources. NEED is working on third-party sponsorship of materials and training programs to keep pace with demand. Using its corporate and energy agency networks, NEED will provide resources developed for this project to schools with DOE funding and other funding when possible.

NEED and SENTECH have a long history of providing high quality content and curriculum materials to a variety of agencies, organizations, and schools. NEED serves as the primary lead for this project and employs the full reach of its network to deploy a comprehensive, objective hydrogen education curriculum program representing a commitment to student learning, to energy education, and to the future of a hydrogen economy.

Approach

NEED has adopted the following approach, which has proven successful in its other energy education efforts, to accomplish the goals of the H₂ Educate program:

Ask and Evaluate: "What do you want to know about hydrogen, and what would your students want to know?"

Survey: Consider the national and state education standards and develop the program to meet classroom needs.

Create: Have educators create the program and secure technical support to assist and troubleshoot.

Deploy: Tap educators to pilot, field test, and deliver to their peers on a local, regional, state, and national scope.

Accomplishments

In 50 percent of the time estimated, the team created the middle school H₂ Educate learning module. It has completed external DOE technical review and DOE internal review. Final changes are being made.

Collaboration keeps the project economically efficient. All partners had the same end goal: Provide as many modules as possible to the middle school community. NEED and all partners are working to provide additional financial resources for the project.

Pilot programs were completed in New York State; Albuquerque, New Mexico; Grand Rapids, Michigan; Raleigh, North Carolina; and Chicago, Illinois. Results were incorporated into the final draft of materials.

Additional Outreach:

Addition of hydrogen information and activities to the EIA Kid's Page www.eia.doe.gov/kids (210,000 users per month)

- H₂ Educate Teacher and Student Guides
- 6 pilot workshops in New York State supported by NYSERDA
- Sessions at the National Science Teachers Association – Dallas, TX – April 2005
- 75 students participated in NEED's H₂ Educate DOE/EIA Take Your Kid to Work Day – April 2005
- Materials provided to other hydrogen outreach efforts – Bonneville Power Authority, NREL
- \$150,000 of hydrogen education grant money given to California teachers as part of NEED's

partnership with BP in the A+ for Energy Program.

- 400 students and teachers participated in the H₂ Educate program hosted as part of NEED's Youth Awards for Energy Achievement, June 24 – 27, 2005.
- 1,200 teachers trained on the materials in July 2005.

Future Directions

- The first H₂ Educate sessions will be hosted at NEED's 13 National Energy Conferences for Educators in July and August 2005.
- Those conferences include:
 - Alexandria, VA
 - New Orleans, LA
 - Las Vegas, NV
 - San Diego, CA
 - Long Beach, CA
 - Long Beach, CA
 - Palm Springs, CA
 - San Francisco, CA
 - San Francisco, CA
 - Universal City, CA
 - Sacramento, CA
 - Orlando, FL (in conjunction with the American Solar Energy Society Annual Meeting)
 - Syracuse, NY
- Work with other hydrogen partners to maximize reach of programs and materials; that is, working with infrastructure grantees to provide educational resources.
- Continue incorporation of materials and programming into NEED's existing training initiatives.
- Annually update materials with new data and provide major changes to educational community.
- Launch H₂ Educate website for materials, links, and additional information.
- Deliver maximum number of hands-on resources to classrooms leveraging resources to do so.