
X.18 H₂ Educate – Middle School Hydrogen Education Program

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- Sentech, Inc., Bethesda, MD
- Los Alamos National Laboratory, Los Alamos, NM

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hydrogen advocacy groups have produced educational information that in some areas would be considered more public relations information than education. This project addresses the need for educational materials that are available, objective, and accurate. Harnessing NEED's primary objective of objective information across its curriculum portfolio, the H₂ Educate materials are reviewed by subject matter experts, are made readily available via Web and partner Web sites as well as workshops, and are compared and contrasted with other hydrogen materials on a regular basis. This project's materials will continue to adapt as the need for additional and more robust materials becomes apparent.

B. Mixed Messages

This project was created and continues with the intent to provide cornerstone materials that address misconceptions, provide clarity of information, and link to accurate and available information when necessary and possible. The hydrogen community continues to have disparate views on certain subjects and the key messaging to use. NEED, with review from DOE, national labs, and subject matter experts, works to provide this project with common, clear language and messaging that students, teachers, and their families find useful and appropriate for age and knowledge level. NEED works to remove the misinformation from the diverse messages and provide a concise message for the intended audience.

C. Disconnect between Hydrogen Information and Dissemination Networks

NEED has capitalized on this disconnect and continues to work with information networks to become a stronger dissemination network – using local energy information networks to deliver training and information about hydrogen to the project's intended audience. Working with the information networks, NEED – acting as a dissemination network – provides a conduit for valuable and accurate hydrogen information for the 4-12 community. In addition, NEED has created its own information and dissemination network of 4-12 educators and the education community to deliver quality hydrogen education materials and training.

D. Lack of Educated Trainers and Training Opportunities

This project addresses the lack of educated trainers by providing professional development opportunities for teachers and energy professionals. These training opportunities provide participants with general

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.
- Educate the K-12 audience about hydrogen and fuel cell technologies to facilitate market acceptance.

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 Readily Available, Objective, and Technically Accurate Information

As awareness of hydrogen increases with increased media activity and inclusion in many state and local energy plans, there continues to be a lack of information that is readily available, accurate, and objective. Many

background, foundation knowledge, and expansion information for more technically advanced audiences. NEED trains a network of trainers to deliver the information in local communities as well.

E. Regional Differences

This project is adapted – in training methods and messaging – for local and regional differences – including proximity to hydrogen use and production. NEED’s programming is locally based, with local needs – both economic and educational – considered as programs are created. Regional differences in attitudes are addressed and discussed in training programs. In addition, regional access to hydrogen infrastructure is part of the program. Should hydrogen fueling stations, vehicles or fuel cells be nearby, the infrastructure is included in the programming.

F. Difficulty in Measuring Success

The project is measuring knowledge gain among its target audience and finding good results. Educational programs often have longer term impacts that are not easily measurable in the course of a month or year. True attitude change takes a longer period of time than information gain. In all cases, educators report a minimum of a 40% knowledge increase in hydrogen knowledge upon completion of the H₂ Educate workshop.

Contribution to Achievement of DOE Education Milestones

This project contributes to achievement of the following DOE Education milestones from the Education section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan – Task Six: Facilitate Development and Expansion Hydrogen Technology Education for Middle and High Schools:

- **Milestone 22:** Develop middle school teacher and student guides. (2Q, 2006)
- **Milestone 23:** Hold teacher workshops. (2Q, 2007 – 4Q, 2010)
- **Milestone 24:** Update middle school teacher and student guides. (4Q, 2008)
- **Milestone 25:** Update middle school teacher and student guides. (4Q, 2010)
- **Milestone 26:** Develop modules for high schools. (4Q, 2007)
- **Milestone 27:** Launch high school teacher professional development. (4Q, 2008 through 3Q, 2011)

Accomplishments

- In 50% of the time estimated, the team created the middle school H₂ Educate learning module. In spite of resource constraints, the project is 100% complete with its revised scope and now is in replication and outreach to more communities. The project is scalable and can be deployed incrementally with additional resources.
- The effort has garnered additional support from a variety of partners – state energy offices, Clean Cities organizations, utilities, energy companies and others.
- Over 7,000 teachers trained.
- Training programs completed in thirty-five states with additional training in 2009 due to renewed DOE funding.
- Pre-survey scores were five out of 15 correct on the survey of hydrogen knowledge and 13 out of 15 correct on post surveys.



Approach

The NEED Project brings its 29-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 expectations for a hydrogen education program in 2004 and have exceeded development calendar and outreach targets.

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 and its national partners and the U.S. Department of Energy, to capitalize on success, resources, networking opportunities, and curriculum development and delivery capabilities. Key elements of this project are NEED’s national 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 65,000 classrooms touched by NEED materials and training each year.

Results

Results of the project continue to show success with pre-training survey results showing a five out

of 15 correct successful response and a post-training survey result showing a 13 out of 15 correct successful response.

Workshop outreach expanded from six training programs and several hundred teachers trained in the first year of the project with over 7,000 teachers trained by 2009. NEED works to deliver the H₂ Educate curriculum throughout the network of NEED schools and the schools they reach with educational outreach.

Curriculum materials are live on the NEED and U.S. Department of Energy Web sites and Web stats indicated substantial download activity.

Addition of hydrogen information and activities to the Energy Information Administration Kid's Page www.eia.doe.gov/kids (350,000 users per month).

Students and teachers show knowledge gain and deeper understanding of hydrogen knowledge.

On post-workshop surveys, teachers indicate feeling prepared to teach the materials in their classrooms.

Conclusions and Future Directions

H₂ educate programs this year continued to expand the reach of the project to middle schools throughout the country. Additional outreach via state energy offices has allowed additional programs to be delivered outside of the programs within the U.S. Department of Energy funding for this project. NEED has included the project in its partnership with the BP A+ for Energy Program and the Pacific Gas and Electric Solar Schools Program thus allowing several thousand teachers to benefit from the project training and curriculum materials.

The Virginia Department of Mines, Minerals and Energy and the Virginia General Assembly appropriated funding to provide teacher workshops and curriculum kits and materials to schools in Virginia in execution of the Virginia Hydrogen Roundtable recommendations.

Future Directions

- H₂ Educate sessions will be hosted at NEED's four National Energy Conferences for Educators in July and August 2009.
- H₂ Educate materials presented at 650 local teacher workshops.
- Work with other hydrogen partners to maximize reach of programs and materials – i.e. 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.
- Addition of H₂ Educate Web site for materials, links and additional information.
- Deliver maximum number of hands-on resources to classrooms leveraging resources to do so. Expand partnerships with infrastructure grant recipients to provide outreach and education programming to additional communities.