



DOE Hydrogen Program

Hydrogen Technology and Energy Curriculum (HyTEC)

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Project ID # ED016



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HyTEC



Overview

■ Timeline

- Start: September 1, 2004
- End: February 28, 2012
- 95% complete (one module)

■ Budget

Total funding: \$3,015,955

DOE share: \$2,399,150

Contractor share \$616,805

Funding received in FY10:

\$ 150,000

Funding FY11: Pending

■ Barriers addressed

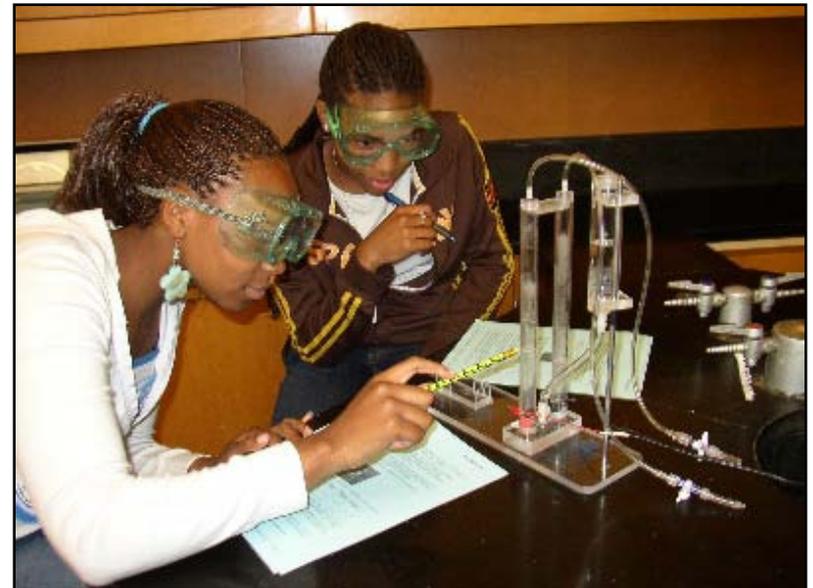
- A. Lack of readily available, objective, and technically accurate Information
- C. Disconnect between hydrogen information and dissemination networks
- D. Lack of educated trainers and training opportunities
- E. Regional differences

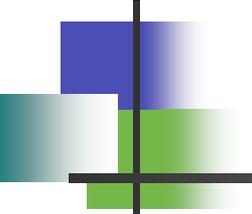
■ Partners

- SERC, Humboldt State
- AC Transit
- Filmsight Productions
- LAB-AIDS, Inc.
- Lead Institution: Lawrence Hall of Science, UC Berkeley

Relevance: Overall Objectives

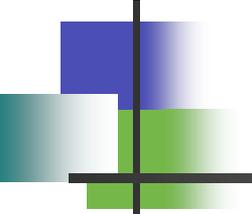
- Educate a diverse group of high school students and their teachers about:
 - The scientific and technological basis for hydrogen and fuel cells
 - R&D currently underway to implement safe and effective hydrogen and fuel cell transportation demonstration programs
 - Current challenges and potential promise of a hydrogen economy in the broader context of energy use and resources





Relevance: Specific Objectives

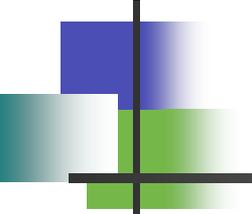
- Develop, field test in national centers, revise, publish, and disseminate a hydrogen and fuel cell curriculum module for varied high school science settings
- Develop and implement a professional development plan for teachers who will use and help disseminate the materials.
- Develop a model for collaboration among school districts, informal science centers, university scientists, local transportation agencies, and other leaders in the field
- Disseminate the materials to a broad national audience
- Evaluate the quality and effectiveness of the curriculum materials and professional development strategies



Relevance: Past Year's Objectives

Curriculum: Addressing Barrier A, Lack of readily available, objective, and accurate information.

- Work with Lab-Aids, Inc. to:
 - Publish and market an educational module for high school students, including extensive support for teachers
 - Complete and test the commercial kit components
- Further develop website
 - More content for students
 - Web support for teachers



Relevance: Past Year's Objectives

Professional development, implementation and dissemination to address Barrier C: Disconnect between hydrogen information and dissemination networks & Barrier D: Lack of educated trainers and training opportunities.

- Continue disseminating the curriculum and kit through state, regional and national science teacher conferences
- Continue professional development to develop teacher leaders for future implementation and dissemination in a trainer of trainers model

Approach: Curriculum

- Development by curriculum specialists at LHS through iterative cycles of classroom testing of a curriculum that is objective and accurate, works well in classrooms, and correlates to state and national high school standards.
- Extensive input from scientists and engineers at SERC.
- During the past year we worked closely with a well-known publisher and producer of hands-on science materials for secondary audiences to prepare commercial quality print and kit materials.

Approach:

Implementation and Dissemination

- Intensive teacher professional development workshops prepare teachers for effective instruction and to lead future dissemination and professional development efforts
 - 2- or 3-day training
 - Content background and experience conducting activities
 - Regular follow up and connection with project staff.
 - Materials needed to implement curriculum in classroom
- Expansion to additional sites through LHS and publisher networks
 - Focus on sites with hydrogen projects nearby

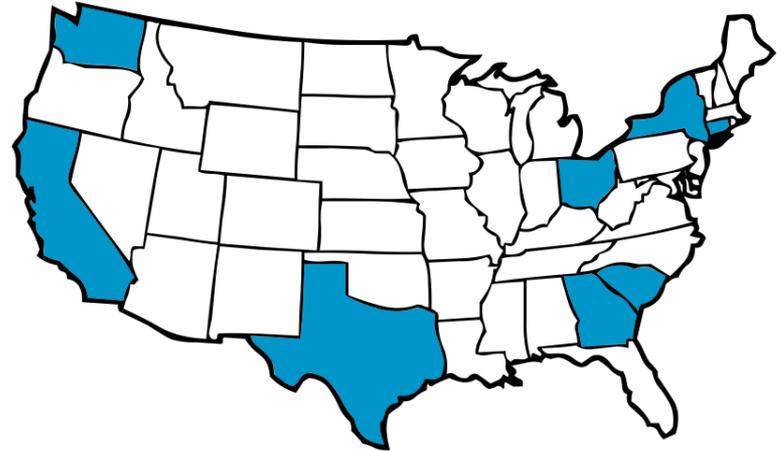
Milestones: Approach

| Milestones | Status and notes. |
|--|--|
| Complete national trials of curriculum module. | Complete. Twenty-seven teachers from seven states used the module and provided feedback by the end of the 2009-2010 school year. |
| Disseminate information and curriculum materials at 2010-2011 science education conferences. | Complete. From October 2010 through March 2011, the curriculum was presented at 11 science teacher conferences. |
| Publish module and produce kit. | Module published in March 2011. All kit components have been produced. |
| Conduct professional development workshop. | Workshops were held in Oakland July 28, 2010 and in Berkeley February 19–20, 2011. |
| Develop additional web content for students and teachers. | Website has been revised and student content is 90% complete. Teacher content is in progress. |

Previous Accomplishments:

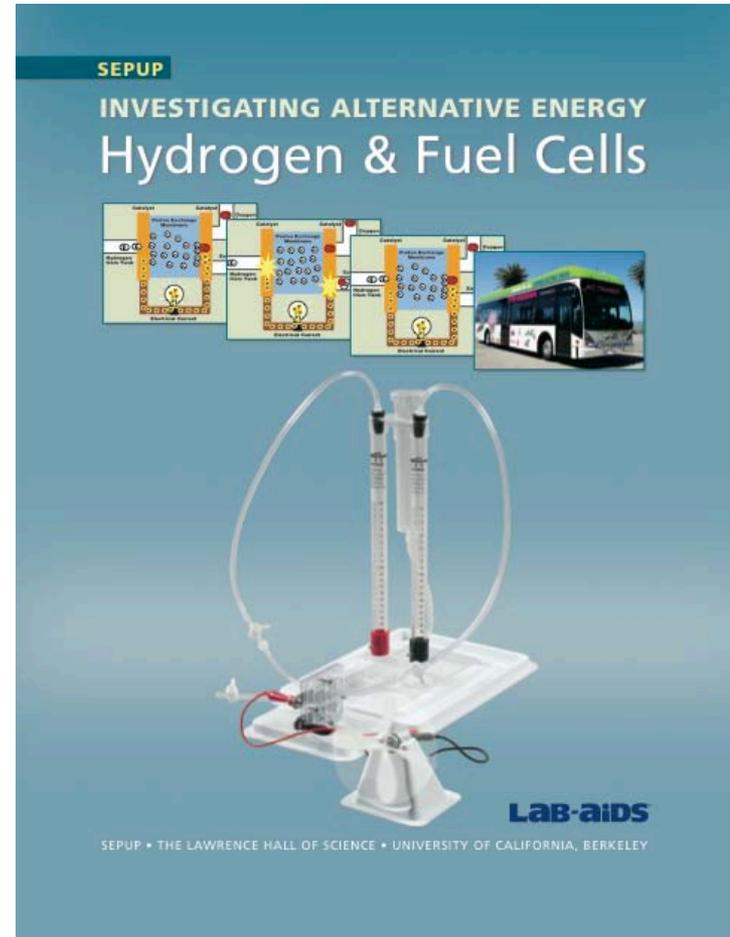
Field testing and early implementation

- Since field testing began, over 800 students have used the two-week curriculum in the classrooms of teachers who have received professional development and equipment.
- Many more are likely to have used activities or been introduced to hydrogen and fuel cells by over 300 teachers who attended workshops.
- Diverse participants from
 - Public high schools
 - Parochial high schools
 - Charter high schools
 - Technical & agricultural
 - Selective private schools



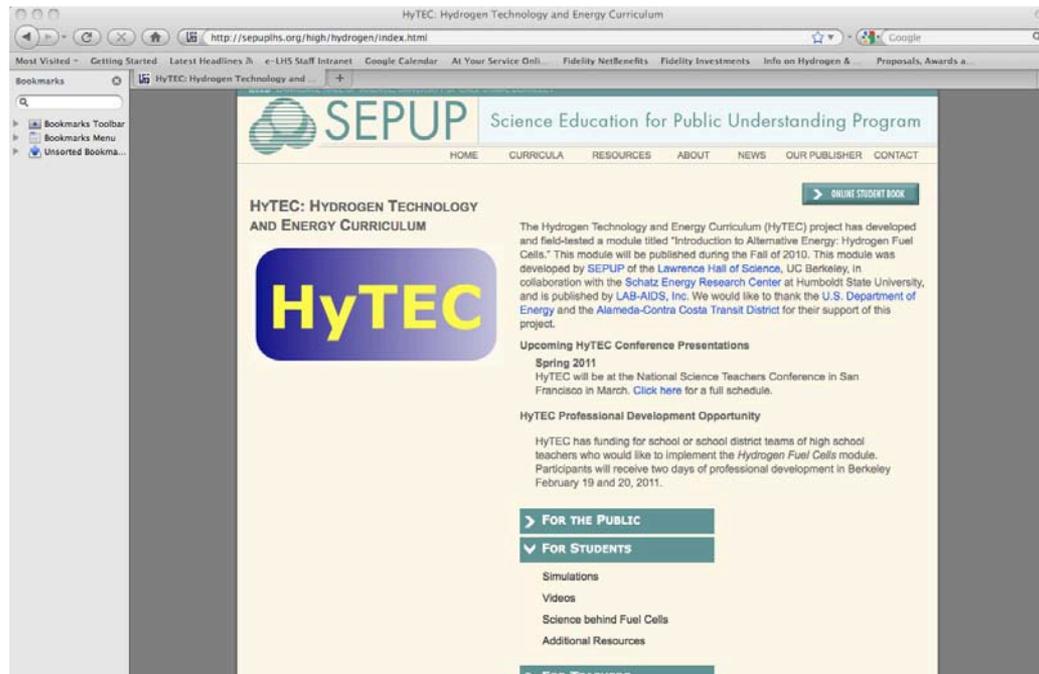
Accomplishments: Publication of Curriculum

- Investigating Alternative Energy: Hydrogen & Fuel Cells
- Two-week module for high school chemistry, environmental science or physical science
- Includes laboratory, simulation, data analysis, and discussion activities
- Incorporates online videos of applications and simulations of FC reactions



Accomplishments: Website for students

- Redesigned website at sepuplhs.org/hydrogen
- Completed final revision of fuel cell simulation
- Developed an electrolysis simulation



Accomplishments : Teacher Professional Development 2011

February 19 & 20, 2011

Thirteen participants from:

- **Connecticut**
- **Northern California**
- **Southern California**
- **South Carolina**
- **Texas**

Adds to a growing pool of future professional developers



Accomplishments: 2011 Workshop Evaluation

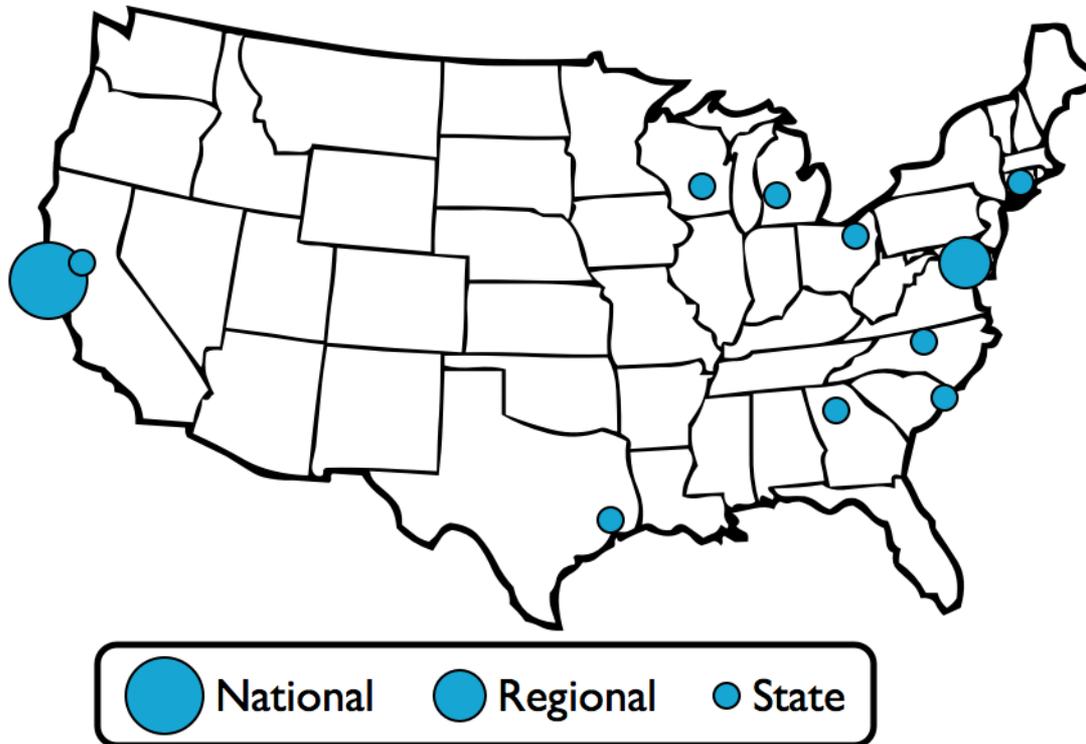
- On a 5-point scale with 5 as the highest rating, participants rated:
 - Curriculum—4.73
 - Activity presentations—5
 - Comparison to other professional development workshops—4.85



Accomplishments and Progress: Professional Development Evaluation

- Teachers' comments on the 2011 professional development workshop evaluations:
 - “Very informative. One of the better workshops I have attended.”
 - “Good hands-on practice and enough explanation. Support materials for teachers help me feel comfortable doing this with my class.”
 - “It is obvious that you have taken experiences and advice from teachers and workshops in the development process in order to make this a quality program and product.”
 - “It is such a treat to be treated like a professional.”

Accomplishments: Dissemination



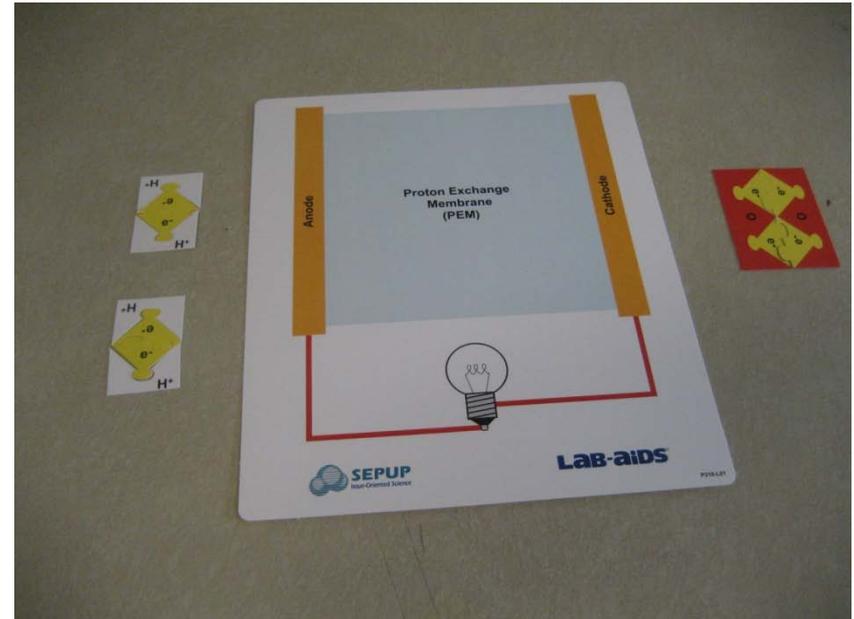
- Workshops introduced over 200 teachers to the curriculum at 11 science teacher conventions during the 2010-2011 school year.

Accomplishments: Dissemination



This workshop at the National Science Teachers Association (NSTA) National Convention in San Francisco, March 10, 2011, introduces teachers to a simulation and hands-on model of the fuel cell reaction. The simulation and curriculum activity are freely available on the project website.

Accomplishments: Dissemination



- All workshop participants receive two classroom activities that can be used without purchasing the full curriculum and a set of modeling pieces.

Accomplishments: Dissemination



- Hydrogen & Fuel Cell module and kit components at the Lab-Aids booth in the exhibit hall at NSTA in San Francisco. Future state, regional, and national conferences will include this display.

Key Collaborators



LHS is the primary institution. LHS's SEPUP project leads the curriculum and professional development, as well as working with the publisher to promote implementation and dissemination of the project.



SERC worked closely with LHS on all aspects of the project through a subcontract. They provided scientific input to the curriculum and kit, and contributed to professional development and outreach activities.

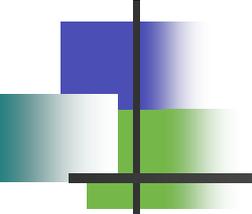


AC Transit has provided cost-share that supported SF Bay Area teachers, provided expertise, and funded production of the hydrogen video materials by FilmSight. They also provided tours of their hydrogen production and fueling station for teachers.



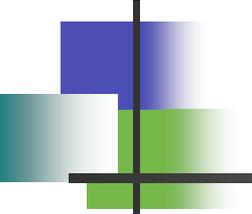
LAB-AIDS, Inc. provides cost-share to the project as the science education industry partner responsible for producing and distributing the print and kit materials.





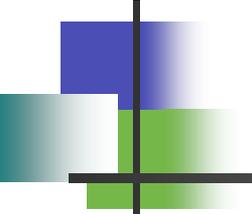
Additional Collaborators

- Schools and teachers in participating sites
- FilmSight productions produced the video that accompanies the curriculum
- Chabot Space & Science Center, Oakland, California
 - Invited half-day HyTEC presentations for 2010 and upcoming 2011 summer climate change professional development institute, funded by NASA
 - Chabot will have kit materials available for teachers to check out



Proposed Future Work

- Complete website materials and video for teacher professional development and support
- Collaborate with the publisher to disseminate the program through science teacher conferences
- Collaborate with the publisher to conduct professional development for new implementations and teacher leaders
- Develop partners for dissemination in areas with fuel cell projects



Summary

- Objective: To publish and disseminate the curriculum.
- Relevance: The curriculum provides objective and accurate information about hydrogen in an issue-oriented context that makes sense for students, provides support for teachers, and fits into typical high school curricula. Professional development prepares teachers to teach the curriculum and participate in dissemination and training of new teacher participants.
- Accomplishments: Publication, dissemination through numerous conferences, and professional development of new teachers and teacher leaders.
- Future work: Complete web support and continue dissemination and professional development.