



DOE Hydrogen Program

Hydrogen Technology and Energy Curriculum (HyTEC)

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Project ID # edp_01_nagle



Overview

■ Timeline

- Start: September 1, 2004
- End: February 28, 2012
- 75% complete (one module)

■ Budget

Total funding: \$3,015,955
DOE share: \$2,399,150
Contractor share \$616,805

Funding received
FY08: \$150,000
FY09: \$150,000

■ Barriers addressed

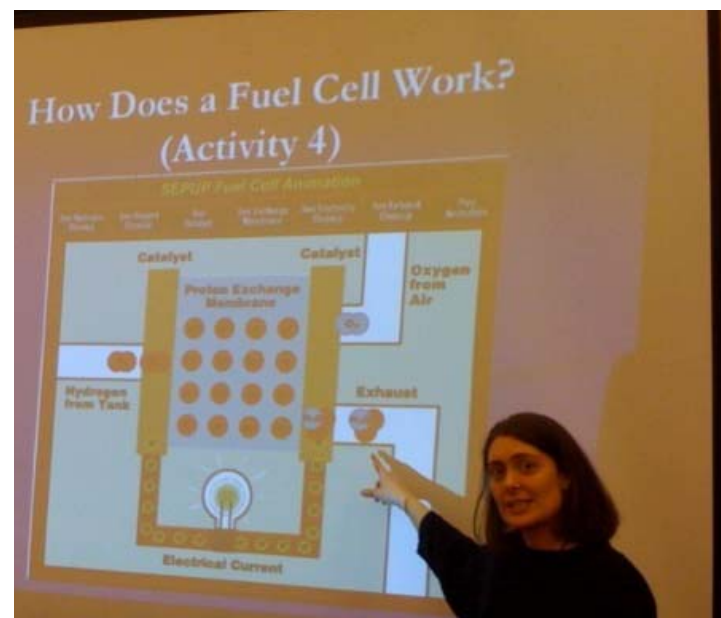
- Lack of readily available, objective, and technically accurate Information
- Disconnect between hydrogen information and dissemination networks
- Lack of educated trainers and training opportunities

■ Partners

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

Goals

- 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





Overall Objectives

- Develop, field test in national centers, revise, publish, and disseminate three curriculum modules and integrate hydrogen and fuel cells into existing LHS high school materials.
 - Develop and implement a professional development plan for teachers who will use 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.
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Objectives: Past Year

- Conduct and evaluate professional development workshop to prepare teachers to implement HyTEC two-week curriculum module and kit for high school students
- Field test HyTEC curriculum materials in California and national sites representing diverse student groups
- Develop teacher leaders for regional and state science presentations in other areas of U.S.
- Present Hydrogen and Fuel Cell awareness sessions at state and national teacher conferences
- Develop fuel cell kit into production level product that can be widely disseminated
- Finalize and prepare curriculum activities for publication



Milestones: FY 08

Month/Year	Milestones or Go/No Go
October 2007	Milestone: Completed a version of the curriculum with support for teachers to implement independently
June 2008	Milestone: Teachers completed pilot test of curriculum materials
June 2008	Milestone: Conducted 3-day teacher professional development workshop to prepare 16 teachers from the San Francisco Bay Area, Washington, and Ohio to teach the module.



Milestones: FY 09

Month/Year	Milestones or Go/No Go
October, 2008/ January, 2009	Milestone: National field test edition of print materials prepared (10/08) and revised (01/09).
December, 2008	Go/No Go: Publisher/kit producer evaluated print and kit materials for commercial development and agreed to produce the module.
June, 2009	Milestone: National field test complete. Approximately 16 high school teachers will have taught the curriculum to their high school chemistry, physical science, environmental science, or integrated science students.
July, 2009	Milestone: Local and national teacher leaders to attend 3-day professional development.
September, 2009	Milestone: Published module and complete kit available.



Approach

- Iterative cycles of curriculum development and revision based on feedback from scientists, curriculum developers, and diverse groups of teachers and students to ensure objective and accurate curriculum materials that can be implemented in a variety of high school classrooms nationwide
- Teacher professional development to prepare teachers for effective instruction and to lead future dissemination and professional development efforts
- Expansion to additional sites through LHS and publisher networks and development of teacher leadership
- Development of commercial kit and publication of module by experienced producer and distributor of LHS curriculum materials for secondary education market

Accomplishments: Teacher Professional Development



During the three-day program, teachers spend two days at LHS and:

- **Conduct all activities**
- **Interact with scientists/engineers/curriculum developers**
- **Provide feedback**
- **Plan to teach the materials the next school year**

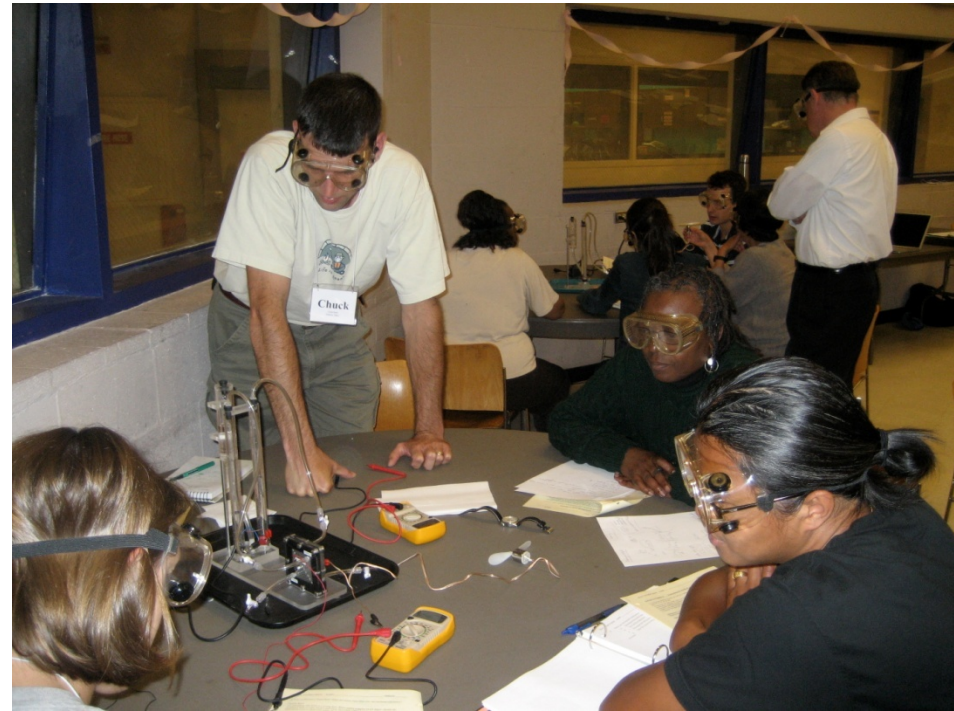
Accomplishments: Teacher Professional Development

During the third day, at AC Transit, teachers ride the hydrogen fuel cell vehicles, tour the hydrogen production facility and fueling station, and interact with AC Transit staff. This enhances their content background for teaching and disseminating the materials.



Accomplishments: 2008 Summer Workshop Evaluation

- **Participants rated:**
 - Curriculum
 - Activity presentations
 - Scientist presentations
 - AC Transit Field Trip
 - Comparison to other professional development workshops
- **Average scores ranged from 4.4 to 4.9 (very good to excellent) on a 5-point scale**





Accomplishments: Summer Workshop Evaluation

- Teachers' comments on the workshop:
 - "Presentations from experts were awesome."
 - "It was great to see cutting edge science right here in my home town."
 - "Loved it. Best chemistry workshop I've been to."
 - "Excellent chance for professional development."



Accomplishments: Curriculum field-testing

- As of April 1, over 600 students have used the two-week curriculum during the 2008–2009 school year, with many more scheduled to use it in April–June.
- Participating schools, students, and teachers are diverse
 - Districts include:
 - Urban districts in the San Francisco Bay Area (such as Oakland and Berkeley)
 - Dublin, Ohio (a suburb of Columbus)
 - Bellevue, Washington (a suburb of Seattle)
 - Schools include:
 - Public high schools
 - Parochial high schools
 - An alternative high school
 - Student population:
 - Includes students from groups under-represented in science, technology, engineering and mathematics (STEM) fields, English-language learners, and special needs and GATE students.



Accomplishments: Curriculum

- Curriculum activities are ready for final preparation for publication by Lab-Aids, Inc.
- Teacher responses from Summer 2008 workshop:
 - “Great curriculum.”
 - “Great information, equipment, and practical application.”
 - “Good thought and pedagogy, and user friendly.”

Accomplishments: Dissemination

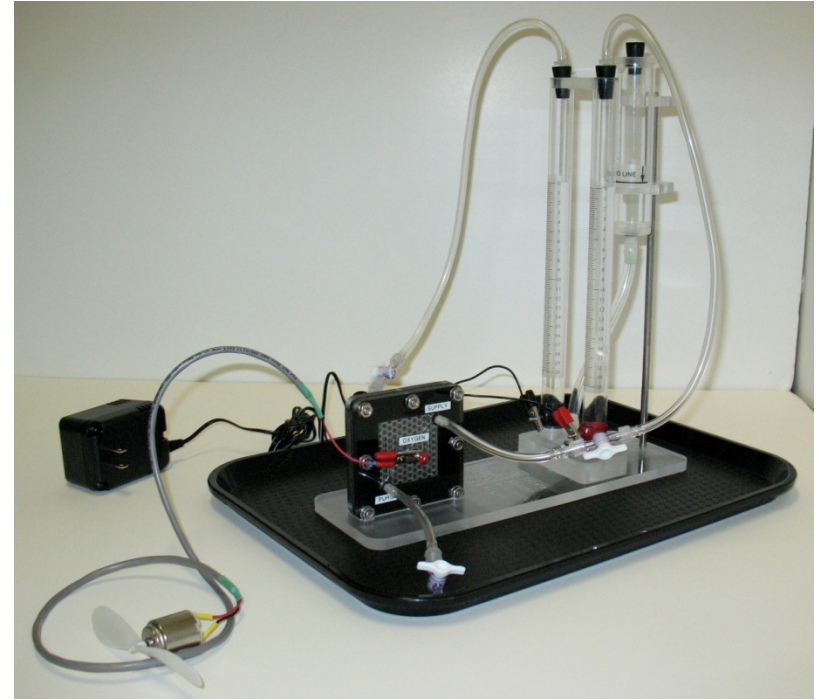
- Presentations at California Science Teachers' Association (CSTA) and National Science Teachers' Association (NSTA) meetings
- Over 100 high school teachers were introduced to hydrogen and fuel cells and given classroom activities to take back to their schools
- Ms. Lesia Whitehurst, a chemistry teacher in Emeryville, California, co-presented at CSTA



Emery High chemistry teacher, Lesia Whitehurst, with Jaimie Levin of AC Transit.

Accomplishments: Curriculum and kit production

- Lab-Aids, Inc. is on track to prepare a commercial version of the curriculum and laboratory kit for the 2009–2010 school year.



The field test laboratory kit prepared by SERC



Future work

- Conduct a three-day teacher training workshop, to be held at Lawrence Berkeley National Lab (LBNL) and AC Transit, July 8–10. This will expand the program in the San Francisco Bay Area and to new national sites.
- Complete commercial kit and publish curriculum
- Disseminate the curriculum and kit through state, regional, and national teacher meetings
- Continue to develop teacher leaders for future implementation and dissemination



Summary

- Objective: To conduct national field testing and prepare for commercialization of the project.
 - Relevance: The curriculum provides objective and accurate information about hydrogen in an issue-oriented context that makes sense for students and fits into typical high school curricula. The professional development prepares teacher leaders who will teach the curriculum and develop additional teachers.
 - Accomplishments: Final national testing and revision of curriculum activities and kit; delivery, evaluation, and refinement of teacher professional development and awareness workshops for a larger audience; progress toward commercialization of kit and curriculum materials
 - Future work: Final publication and kit production, and dissemination to a national audience
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HyTEC Collaborators

