

Hydrogen Technology and Energy Curriculum (HyTEC)

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Project ID # ED016



Overview

■ Timeline

- Start: September 1, 2004
- End: February 28, 2012
- 85% complete (one module)

■ Budget

Total funding: \$3,015,955

DOE share: \$2,399,150

Contractor share \$616,805

Funding received

FY09: \$150,000

FY10: \$150,000 (planned)

■ Barriers addressed

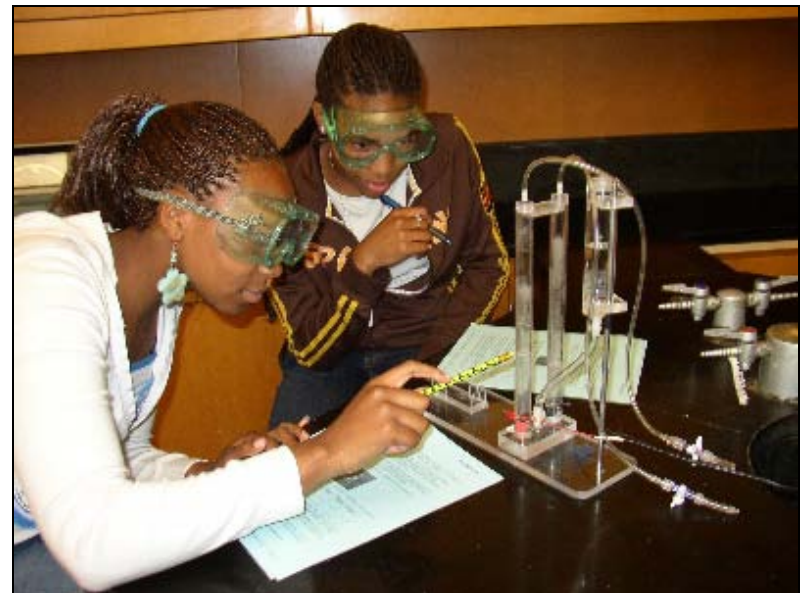
- A. Lack of readily available, objective, and technically accurate Information
- C. Disconnect between hydrogen information and dissemination networks
- D. Lack of educated trainers and training opportunities
- E. Regional differences

■ Partners

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

Relevance: Project 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





Relevance: Project 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

- Test in additional sites to ensure materials address Barrier E, Regional Differences, such as variations in state and local standards and student populations
- Revise and scientifically review curriculum module and refine kit to produce materials that address Barrier A: Lack of readily available, objective, and accurate information.



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.

- Expand professional development of teachers and implementation of curriculum to additional sites
- Continue to develop teacher leadership for the program
- Disseminate information about hydrogen and fuel cells and publicize the HyTEC curriculum



Approach: Curriculum

- 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. The past year focused on:
 - Final testing and implementation of the two-week flexible curriculum in diverse national classrooms
 - Development of commercial kit and publication of module by experienced producer and distributor of LHS curriculum materials for secondary education market

Approach:

Implementation and Dissemination

- Intensive teacher professional development workshop to prepare teachers for effective instruction and to lead future dissemination and professional development efforts
 - 3-day training: 2 days working with curriculum and science content plus 1 day at AC Transit's hydrogen bus, hydrogen production facility, and fueling station
 - Regular follow up and connection with project staff.
 - All materials needed to implement curriculum in classroom.
- Expansion to additional sites through LHS and publisher networks
 - Focus on sites with hydrogen projects nearby

Milestones: FY 09 (Approach)

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 attended 3-day professional development.

Milestones: FY10 (Approach)

Milestones or Go/No Go	Status
National implementation of curriculum module.	This is underway in six national sites.
Finalize commercial student electrolyzer and additional kit components.	Prototypes prepared by Lab-Aids have been tested by SEPUP and SERC. Final suggested changes are in progress.
Disseminate information and curriculum materials at 2009-2010 science education conferences.	Complete.
Complete manuscript to publisher for editing and page composition.	Manuscript is in final review for submission in May, 2010.
Milestone: Published module and complete kit available.	Scheduled for Fall, 2010

Accomplishments: Teacher Professional Development

**Three days
July 8-10, 2009
Nineteen participants:**

**Connecticut
Georgia
New York City
SF Bay Area
Southern California
South Carolina**



Accomplishments: Teacher Professional Development



First two days held at **Lawrence Berkeley National Laboratory**

- Teachers conduct all activities
- Interact with curriculum developers from LHS and scientists and engineers from SERC and LBNL
- Provide feedback
- Plan to teach the materials during 2009-2010 school year

Accomplishments: Teacher Professional Development

Third day, at Alameda Contra Costa (AC) Transit Facility



Accomplishments: 2009 Summer Workshop Evaluation

- **Participants rated:**
 - **Curriculum**
 - **Activity presentations**
 - **Scientist presentations**
 - **AC Transit Field Trip**
 - **Comparison to other professional development workshops**
- **Average scores ranged from 4.3 to 4.8 (very good to excellent) on a 5-point scale**





Accomplishments: Summer Workshop Evaluation

- Teachers' comments on the workshop:
 - "Surpasses anything else I have done by far."
 - "This was one of the best workshops I have attended."
 - "This was *real* training with *real* people here to learn. Very encouraging."

Accomplishments: National Implementation

- As of April 15, over 600 students have used the two-week curriculum during the 2009–2010 school year, with hundreds more scheduled to use it by the end of June. Some of these students are in classrooms of teachers who began the project in previous years.
- Participating schools, students, and teachers are diverse
- Schools include:
 - Public high schools
 - Parochial high schools
 - Charter and technical high schools, including an agricultural program
 - Selective private schools

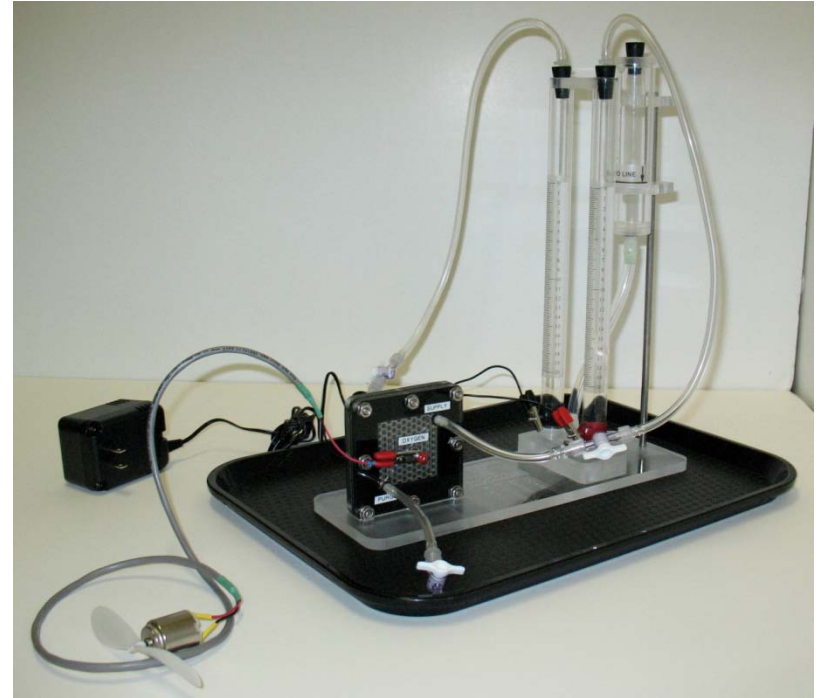


Accomplishments: Dissemination

- HyTEC presented to approximately 220 teachers at seven science teacher conventions during 2009-2010 school year
 - California
 - Connecticut
 - New York State
 - Ohio
 - Texas
 - National Science Teacher's Association Regional Meeting, Phoenix, Arizona
 - National Science Teacher's Association National Convention, Philadelphia, Pennsylvania
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Accomplishments: Curriculum and kit production

- Lab-Aids, Inc. has prepared prototype electrolyzers for the commercial kit. These have been tested by project partners and are currently being modified.



The field test laboratory kit prepared by SERC

Collaborators



LHS is the primary institution in charge of leading curriculum development and professional development, as well as dissemination of the project.



SERC works closely with LHS on all aspects of the project through a subcontract. They provide scientific input to the curriculum, kit, and professional development materials, and participate in professional development workshops.



AC Transit provides cost-share to the project, supporting SF Bay Area teachers, providing a real-world context and the hydrogen video materials, and supporting field trips for all teacher participants to AC Transit.



LAB-AIDS, Inc. provides cost-share to the project in their role as the science education industry partner responsible for production and distribution of the print and kit materials.



Additional Collaborators

- Schools and teachers in participating sites
- Lawrence Berkeley National Laboratory
 - Provided facilities for 2009 professional development workshop
 - Provided tours and scientist connections
- Chabot Space & Science Center, Oakland, California
 - Invited HyTEC presentations for 2009 and 2010 summer teacher institutes



Future work

- Complete commercial kit and publish curriculum
- Further develop web content for students
- Develop web materials and video for teacher professional development and support
- Continue disseminating the curriculum and kit through state, regional, and national teacher meetings and teacher professional development workshops
- Continue to develop teacher leaders for future implementation and dissemination



Summary

- Objective: To disseminate nationally 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 both teach the curriculum and participate in dissemination and training of new teacher participants.
- Accomplishments: Expanded implementation of materials in Northern California and five new sites
- Future work: Final publication and kit production, and continuing teacher development and dissemination to a national audience