

### **(16) Development of a Regional Hydrogen Technology Education Consortium (HyTEC)**

This three-year effort led by a consortium of four universities from four states will provide education and training for students, professionals, and the public. The consortium will establish centers at each university, develop courses, workshops, establish a quarterly electronic newsletter, and develop and disseminate K - 12 outreach materials.

Project lead: North Carolina A&T State University Center for Energy Research & Training

Project participants: University of South Carolina; University of Florida; University of Georgia

#### Presentations/Publications

None.

#### Patents

None.

#### Progress in Past Quarter and Current Status

This quarterly report covers the period ending September 30, 2005. After first six-months, DOE discontinued funding to this project. NASEO provided a no-cost extension to this project for six months. During this reporting period, we completed following:

We offered workshops and educational experience to school students on hydrogen and fuel cells under the Energy Engineer Starter Program (EESP). At NCATSU campus in June 13-July 1, we had summer program for school students (June 13-24, 2005 for 7<sup>th</sup> and 8<sup>th</sup> Grade Students and June 20-July 1, 2005 for 9<sup>th</sup>, 10<sup>th</sup>, and 11<sup>th</sup> Grade Students). In this program, forty-two students and three math/science teachers from local schools participated.

We posted our first (and probably the last) web-based HyTEC Newsletter in July 2005. University of Florida took lead to develop this newsletter. The newsletter can be accessed via the following links:

<http://seecl.mae.ufl.edu/hytec/hytec.html>

[http://seecl.mae.ufl.edu/hytec/HyTEC\\_Newsletter\\_Summer\\_05.pdf](http://seecl.mae.ufl.edu/hytec/HyTEC_Newsletter_Summer_05.pdf)

Unless we can secure new funding, HyTEC activity will remain dormant. The HYTEC consortium members are actively seek new funding sources to continue the work.

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## Task Schedule

Task Number Per Statement of Work	Title or Brief Task Description	Task Completion Date				Progress Notes
		Original Planned	Revised Planned	Actual	Percent Complete	
1	Establish STAC Executive Committee	25,000	25,000	25,000	100	Year one
2	Hire and Support STAC Program Director	300,000	156,000	156,000	100	Year one
3	Develop and Conduct STAC Planning Process	35,000	35,000	35,000	100	Year one
4	Prepare Competitive Solicitation	50,000	50,000	50,000	100	Year one
5	Develop Merit Review Process	25,000	25,000	25,000	100	Year one
6	Conduct Solicitation 1 and 2 and Select and Fund Projects	11,525,392	11,669,392	11,669,392	99/50	First solicitation complete, projects selected, most contracts negotiated. Second solicitation complete, first contract negotiated.
7	Negotiate contracts and manage projects from solicitation 1 and 2.	713,377	713,377	pending	ongoing	Project management continued for the projects associated with solicitation 1 and will continue for up to three years. Second solicitation in process.
8	Information Transfer	60,000	60,000	Pending	0	Work on electronic information dissemination approach began this quarter with additions to the STAC web site.
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\*Substantial federal funding was added to the first solicitation following the creation of the original budget, and funding for the second solicitation was also provided following the creation of the original budget. Totals are for federal funds only and do not include cost share from participants under the selected projects.

Current Budget Period: 11/14/02 to 11/13/07

**Spending Schedule**

Current Quarter: 07/01/05 to 09/30/05

Budget Category	Approved Budget Per Agreement	Project Expenditures	
		<i>This Quarter</i>	Cumulative to Date
Personnel	256,700.00	12,765.45	125,973.81
Fringe Benefits	105,003.00	4,793.59	49,783.85
Travel	25,424.00	0	12,129.53
Equipment	0	0	0
Supplies	0	0	0
Contractual	23,289,361.00	997,443.51	4,455,144.95
Construction	0	0	0
Other	12,678.00	1,595.38	13,788.14
<b>Total Direct Charges</b>	<b>23,689,166.00</b>	<b>1,016,597.93</b>	<b>4,656,820.28</b>
Indirect Charges	413,572.00	18,064.67	212,829.59
<b>Total</b>	<b>24,102,738.00</b>	<b>1,034,622.60</b>	<b>4,869,649.87</b>
DOE Share	14,490,996.00	1,034,622.60	4,869,649.87
Cost Share	9,611,742.00	324,821.15	4,626,433.30

## Cost Share Contributions Schedule

Funding Source	Approved Cost Share		This Quarter		Cumulative to Date	
	Total*		Cash	In-Kind	Cash	In-Kind
(1) Building Commissioning-Innovation to Practice	1,228,075		37,168.46	4,741.00	37,168.46	4,741.46
(2) Strategies to Increase HVAC Efficiency in the Northeast	326,149		91,487.65	666.02	242,509.45	10,472.00
(3) Development, Implementation and Deployment of Automated Fault Detection and Diagnostics for Vapor Compression Equipment	721,600		17,325	7,700	85,400	206,100
(4) Closing the Gap: Getting Full Performance from Residential Central Air Conditioners	851,537		5,652	5,076	28,443	72,288
(5) Real-Time Predictive Optimal Control of Active and Passive Thermal Storage Systems	184,937		4,900.02	4,260.00	46,762.45	37,260.00
(6) Field Trial of a High Capacity Gas-Fired Paper Dryer	790,000		1,236	67,181	255,594	149,588
(7) Western U. S. Food Processing Efficiency Initiative	897,125		0	0	435,195	115,812
(8) Achieving More with Less: Efficiency and Economics of Motor Decision Tools	568,000		0	0	136,113	262,356
(9) Use of Pressurized Ozone and Compressed Air Flotation with Membrane Filtration for Industrial Process Water Treatment at a Forest Products Facility	467,382		0	0	0	0
(10) Development of a Total Assessment Audit Protocol for the Chemical Industry in the Midwest	360,750		0	16,539	227,321	104,403
(11) Advanced Travel Center Electrification for Reducing Idling from Heavy-Duty Vehicles	1,987,697		0	0	2,163,937	0
(12) Distributed Energy Infrastructure Analysis and Pilot Project for New Jersey and Pennsylvania Targeted in the Small and Medium Sized Commercial and Industrial Sectors	1,000,000		0	0	0	0
(13) Distributed Energy Resources – Expanding DER Applications in Target Markets	412,482		0	0	0	0
(14) Hydrogen Technology Learning Centers for California, Florida, and New York	33,372			0	5,000	0

(15) Virginia-Maryland Hydrogen Technology Education Center (H2TEC)	43,651		0	12,415	0	12,415
(16) Development of a Regional Hydrogen Technology Education Consortium (HyTEC)	Not available at time of report		0	0	0	0
<b>Total</b>	<b>9,872,757</b>		<b>218,662.13</b>	<b>106,159.02</b>	<b>3,663,443.30</b>	<b>962,990</b>
<b>Cumulative Cost Share Contributions</b>						

\* In some cases, project totals were not divided by cash and in-kind contributions in the award contracts. NASEO will work with project participants to gather this information and will provide amended totals in the next quarterly report.

APPENDIX:  
ANNUAL HYDROGEN REPORT

## STAC Hydrogen Learning Centers

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*Contract Number: DE-FC36-03G013026.*

*Subcontractors: Three subcontracts and their partners participate through STAC – a cooperative program of DOE, NASEO, and the Association of State Energy Research and Technology Transfer Institutions (ASERTTI) – and contracts administered by the National Association of State Energy Officials.*

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*Start Date: January 2005*

*Projected End Date: 2008*

### **Objectives**

Within the State Technologies Advancement Collaborative (STAC) hydrogen project area, there are three multi-state projects focusing on hydrogen technology learning centers. The objectives of each multi-state project are:

## **Hydrogen Technology Learning Centers for California, Florida, and New York (H2USA)**

- Create four Hydrogen Technology Learning Centers called H2USA Centers.
- Educate students, government officials, industry members, the general public and others on the hydrogen economy, technology, and applications.

### *Virginia-Maryland Hydrogen Technology Education Center (H2TEC)*

- Provide learning opportunities in the area of hydrogen technology for undergraduate and graduate students.
- Create short courses targeted to energy professionals.
- Develop a seminar series to encourage information exchange.
- Offer a variety of activities for public outreach, and curriculum development opportunities for K-12 teachers.

## **Development of a Regional Hydrogen Technology Education Consortium (HyTEC)**

- Establish a regional Hydrogen Technology Education Consortium (HyTEC) for the south.

- Share technologies, facilities, personnel, and other resources among the four participating institutions for the purpose of providing interactive technology transfer through education and training in hydrogen technologies for students, professionals and the public.

### **Technical Barriers**

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

- A. Lack of Awareness
- B. Lack of Demonstrations or Examples of Real World Use
- C. Institutional Barriers and Access to Audiences
- D. Regional Differences

### **Technical Targets**

#### **1. Build Materials Library and Dissemination Infrastructure**

H2USA is planning the creation of a web site operated with input by all four of the centers. The site will provide a virtual center online and will include educational materials, general interest publications, technical documents, and other information updated on an ongoing basis. The web site will serve as a clearinghouse for educators.

#### **2. Build Presence of Hydrogen and Fuel Cells in K-12 Education**

All three projects incorporate the K-12 education needs through short courses, curriculum for teachers, and field-experience programs.

#### **3. Facilitate Development of Hydrogen Technology Programs at Universities**

All three projects are focusing on university courses involving technologies, production and storage, energy conversion, and fuel cells. Courses range from general undergraduate level to graduate level for science, engineering, and technology students.

#### **4. Assess Perceptions and Understanding of Hydrogen Economy and Fuel Cell**

### **Technologies**

Part of the H2USA project is to conduct a detailed survey of the community college and university hydrogen courses and degree program now being offered within the U.S. The survey will be used as the basis to build the educational programs developed in this task. In addition, as in the previous task, existing material will be used whenever possible.

#### **5. Develop Public Education Campaign**

Through a quarterly newsletter, fact sheets, public forums, and education programs, all three projects will educate the public on hydrogen production, storage, transportation, and energy conversion.

## **6. Facilitate Partnerships and Information Exchange among Local, State, and**

### ***Regional Education Efforts, and National Partners***

Each project is a multi-state effort among two or more state entities. The exchange of information will take place between states, regionally and nationally in this way. Meetings provided to government and industry associations will allow for information exchange to these target audiences as well.

## **7. Develop and Implement Educational Activities for State and Local Governments**

State and local government officials are involved in each project through different means. Seminar series and one-day courses for officials offer an educational means, as well as a way for officials to communicate on these issues. Seminars will focus on the research, as well as policy options. This will increase knowledge in the concept and the affects on government and policy.

## **8. Develop and Implement Educational Activities for Large-Scale End Users**

Continuing education courses for industry, utilities, and specialized audiences will occur at the H2USA Centers. HyTec will create a multi-media presentation will be prepared on safe production, storage, and transportation of hydrogen as well as safety codes and standards. Presentation topics will include alternative energy sources with emphasis on fuel cells, which could be used for a variety of audiences – continuing education of engineers and other professionals, civic clubs, adult education classes, and non-technical college classes. Availability of these lectures will be publicized on the web sites of the Hydrogen Technology Education Consortium with links to all four participating Universities and State Energy Offices. Education means may include presentations at civic clubs, and holding adult education classes and non-technical college classes.

## **9. Develop and Implement Educational Activities for Safety and Code Officials**

Each of the projects has a component focused on safety and codes through educational courses at the centers or multi-media presentations.

### **Approach**

- Analyze the educational needs of the audience.
- Develop the courses for each target audience.
- Create materials based on the audience needs.
- Distribute materials and information through centers, websites, workshops, and forums, and utilize national groups for dissemination and notification.
- Analyze the materials and courses and make appropriate adjustments for future programs.
- Build demonstrations.

### **Accomplishments**

## Hydrogen Technology Learning Centers for California, Florida, and New York (H2USA)

- The team has begun to develop a draft curriculum for the *Hydrogen Pathways Graduate Course*. This task involved a detailed survey of relevant literature and available resources to establish important topic areas and themes.
- Continued planning efforts on the remaining two major projects, the creation of *Hydrogen and FuelCell Educational Modules* for students at the 6-12 grade levels and the *Fuel Cell Fundamentals and FuelCell Systems Laboratory Course* for university students.

### *Virginia-Maryland Hydrogen Technology Education Center (H2TEC)*

- Offered undergraduate senior design project course to design a hybrid electric vehicle.
- Developed a three credit hour undergraduate course in hydrogen technology.
- “Virginia Tech Future Truck,” a display illustrating a hydrogen fuel storage system and a hydrogen IC engine was presented at the Roanoke Civic Center as part of the Association of Energy Conservation Professionals (AECOP) Energy Fair.
- The proposal for a Virginia Hydrogen Network (of which the H2TEC is an element) was developed and presented at the following events:
  - September 8, 2004: US DoE Hydrogen Learning Workshop, Annapolis, MD;
  - September 20, 2004: MidAtlantic Hydrogen Coalition Inaugural Meeting, Baltimore MD.
- Industry reviews of the Virginia Hydrogen Network were held with General Motors and Air Products in October 2004.
- Elected officials to the Virginia General Assembly were also apprised of the status and objectives of the Virginia Hydrogen Network in November and December 2004, including Delegates Welch and McDonnell and Senators Rerras and Bolling.

## Development of a Regional Hydrogen Technology Education Consortium (HyTEC)

- A preliminary course outline was developed for a course on Fuel Cells and portions of the proposed course material were used in an existing undergraduate Energy Conversion course for student feedback.

### **Future Directions**

## Hydrogen Technology Learning Centers for California, Florida, and New York (H2USA)

- Develop content for the various lectures and topic areas of the hydrogen economy graduate course. These will include: lectures; background reading materials;

practice problem and homework sets; and a detailed description (and example) of the final hydrogen system design project.

### *Virginia-Maryland Hydrogen Technology Education Center (H2TEC)*

- Complete teaching of graduate and undergraduate courses in hydrogen and fuel cell systems.
- Renovate Virginia Tech research and teaching labs for hydrogen and fuel cells
- Begin construction of hydrogen refueling demonstration project at Virginia Tech
- Develop working SOFC system level model for presentation in short courses
- Have two seminars in the DC area for professionals including government employees.
- Develop educational materials for a one-day short course on hydrogen technology.

### Development of a Regional Hydrogen Technology Education Consortium (HyTEC)

- Prepare detailed fuel cell course.
- Prepare a newsletter for the general public with input from all the partners.
- Perform additional tours and demonstrations.
- Finalize course materials for Summer Institute designed for students and science teachers.

### **Introduction**

Hydrogen Technology Learning Centers educate students; potential endusers, such as fleets or building developers; local officials; and the public about the vision of a hydrogen economy, hydrogen technologies and applications, the safe use of hydrogen as an energy carrier, and the challenges to achieving a hydrogen economy. Grade school level curriculum, courses for college and university students, end-user continuing education, website clearinghouses, public forums, publications, interactive displays, workshops for state and local government officials, and newsletters are the means to disseminate the information. The centers will work collaboratively on a state, regional, and national level to access multi-level audiences through awareness by education and hands-on experiences.

Projects were only recently funded. Work began late in the fourth quarter of 2004. Due to decreases in Congressional appropriations, FY'05 funding was not provided. STAC is working with the project managers and DOE to determine how best to proceed given the lack of complete funding.

### **Approach**

The approach of this project is to create multiple hydrogen technology learning centers throughout the country to enhance the education and information dissemination on hydrogen technologies, trends, and issues. Through various educational means—courses, training, workshops, demonstrations, websites—the centers will reach several target audiences.

## **Results**

During year 1, the technology centers worked to complete course outlines, draft curricula, design modules, create demonstrations, and present lectures. Some of the work began later than hoped due to funding delays, thus only two quarters of work have actually been completed. Beyond that, each of the centers progressed with initial tasks.

The collaborative efforts of the multi-state projects lend themselves to a major DOE target of facilitating national, state, and local partnerships and exchanging information. The Virginia Hydrogen Network (of which the H2TEC is an element) speaks to this key element as well.

The major target audience reached this year was the college and university level. This audience was reached through a one-credit course on scientific challenges behind H2 technologies for graduate students at both UMCP and Virginia Tech, and a large seminar to incoming freshman on fuel cell technology and issues for transition to a hydrogen-based energy infrastructure at the UMCP College of Engineering. These accomplishments meet the target need to facilitate hydrogen programs in universities. Feedback from participants will allow for enhanced programs in the future.

The H2TEC project reached other target audiences in the first year, including the public, government officials, and industry through presentations on the centers and demonstrations. The information dissemination to those audiences answers to several of the targets in the education area. The "Virginia Tech Future Truck," a display illustrating a hydrogen fuel storage system and a hydrogen IC engine, was presented at the Roanoke Civic Center as part of the Association of Energy Conservation Professionals (AECOP) Energy Fair in Roanoke, VA. Attendance was approximately 1,000 people. Elected officials to the Virginia General Assembly were apprised of the status and objectives of the Virginia Hydrogen Network in November and December 2004, including Delegates Welch and McDonnell and Senators Rerras and Bolling. In these beginning stages, closing the education gap was quite imperative.

## **Conclusions**

- Awareness among target audiences is increasing as a result of the dissemination of hydrogen information and increased education.

## **References**

N/A

## **FY 2005 Publications/Presentations**

1. H2USA - *Hydrogen Pathways Graduate Course*
2. H2TEC - *Virginia Tech Future Truck*

## **Special Recognitions & Awards/Patents Issued**

N/A

## **Acronyms**

National Association of State Energy Officials (NASEO)  
Association of State Energy Research and Technology Transfer Institutions (ASERTTI)  
California Energy Commission (CEC)  
NY State Energy Research & Development Authority (NYSERDA)  
Virginia Polytechnic Institute & State University (VT)  
University of Maryland (UMCP)  
North Carolina A&T State University (NCATSU-CERT)  
Hydrogen Technology Learning Centers for California, Florida, and New York (H2USA)  
Virginia-Maryland Hydrogen Technology Education Center (H2TEC)

*Development of a Regional Hydrogen Technology Education Consortium  
(HyTEC)*

State Technologies Advancement Collaborative (STAC)

**Figure Captions**

N/A

**FY 2005 Publications/Presentations**

H2USA - *Hydrogen Pathways Graduate Course*

H2TEC - *Virginia Tech Future Truck*