

X.2 Education for Emerging Fuel Cell Technologies

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- Smart Chemistry, Sacramento, CA
- Sloane Solutions, Oxford, MI
- CSA Standards, Cleveland, OH
- MorEvents, Englewood, CO
- GWS Solutions, Tolland, CT

Project Start Date: 1995
Project End Date: Project continuation and direction determined annually by DOE

Objectives

- Conduct research and development (R&D) needed to establish sound technical requirements for hydrogen and fuel cell codes and standards.
- Support code development for the safe use of hydrogen and fuel cell technologies.
- Advance safety, code development, and market transformation issues through collaborations with appropriate stakeholders.
- Facilitate the safe deployment of hydrogen and fuel cell fuel technologies.

Technical Barriers

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

- (A) Lack of Readily Available, Objective, and Technically Accurate Information
- (C) Disconnect Between Hydrogen Information and Dissemination Networks

Contribution to Achievement of DOE Education Milestones

This project will contribute to achievement of the following DOE milestones from the Education section of the Fuel Cell Technologies Program Multi-Year Research, Development and Demonstration Plan:

- 18. Develop end-user workshop materials for use at events. (4Q, 2009)
- 19. Develop short courses for end-users at technical colleges. (4Q, 2011)

Accomplishments

NREL has accomplished the following in support of section 3.9 of the DOE Fuel Cell Technologies Program Multi-Year Research, Development and Demonstration Plan:

- Codes and standards workshops: Expanded codes and standards workshops from Fiscal Year (FY) 2009 to cover more subject matter, including a new module on electric vehicles and infrastructure requirements for electric vehicles. Presented four workshops in FY 2010 partnering with local fire departments and government organizations.
- Web-based information compendium: Expanded compendium to include other vehicle fuels and to include updated code official training course that includes material on indoor hydrogen fueling.



Introduction

It is essential to develop and promulgate codes and standards in order to provide for the safe use of hydrogen and fuel cell technologies. With the help of key stakeholders, the DOE Fuel Cell Technologies Program and NREL are coordinating a collaborative national effort to prepare, review, and promulgate codes and standards for all hydrogen and fuel cell technologies.

Approach

The Fuel Cell Technologies Program recognizes that domestic and international codes and standards must

be established to enable the timely commercialization and safe use of hydrogen and fuel cell technologies. The lack of codes and standards applicable to hydrogen and fuel cell technologies is an institutional barrier to deploying these technologies. It is in the national interest to eliminate this potential barrier. As such, the Program works with domestic and international standards development organizations (SDOs) to facilitate the development of performance-based and prescriptive codes and standards. These standards are then referenced by building and other codes to expedite regulatory approval of hydrogen and fuel cell technologies. This approach ensures that U.S. consumers can purchase products that are safe and reliable, regardless of their country of origin, and that U.S. companies can compete internationally.

Results

The Safety Codes and Standards work is divided into three major areas:

- National Template Implementation
- Codes and Standards Research
- Codes and Standards Training and Outreach

This report will address codes and standards outreach.

Codes and Standards Training and Outreach

NREL has several active training and outreach projects in FY 2010 including the following:

- Codes and standards workshops.
- Update of code official on-line training course.
- Analysis of two emerging fuel cell technology projects (funded through Education).

NREL conducted four Codes and Standards Workshops in FY 2010. These workshops were held in Tampa, FL, New Orleans, LA, San Francisco, CA and Los Angeles, CA. All four were held in collaboration with local fire service departments or organizations. These workshops were targeted at code officials and project developers who would be working on fuel cell or hydrogen technology projects.

The proceedings from these workshops are posted at the Hydrogen Program Safety, Codes and Standards Web page. Generally, the workshops have been effective at getting information to individuals who will be directly involved in hydrogen and fuel cell projects. These individuals include plans review officers for fire departments and project managers responsible for getting hydrogen and fuel cell projects built.

The code official training course that was placed on-line in FY 2009 was amended to include material on indoor fueling operations. Indoor fueling is a special

concern because of the developing use of hydrogen-fueled forklifts that are typically fueled indoors.

Another key project is two case studies that address emerging fuel cell technologies. The first project is an evaluation of codes and standards and safety issues associated with a fuel cell system used to supply backup power at military base and the second is an evaluation of indoor fueling and forklift operations at a military storage facility. The analysis and findings from these projects will be published as an NREL technical report that would assist code officials and project developers in codes and standards and safety evaluations in similar projects.

Figure 1 shows how the work done in the outreach activities feeds into the research projects and codes and standards development work.

Conclusions and Future Directions

NREL will continue to support the development of codes and standards by:

- Working with DOE to implement a national template for vehicle codes and
- Continuing R&D support of the key technologies required to close the gaps identified in the codes and standards development process.
- Continuing R&D collaborations with national and international stakeholders on vehicle codes and standards activities.
- Performing outreach work to distribute information on hydrogen and fuel cell technologies to code officials, project
- Coordinating domestic codes and standards and International standards to ensure consistent requirements.

FY 2010 Publications/Presentations

1. Vehicle Codes and Standards: Overview and Gap Analysis, Blake, C., Buttner, W., Rivkin, C. 2010 NREL technical report TP-560-47336.
2. A National Set of Hydrogen Codes and Standards for the US, Rivkin, C., Blake, C., Burgess, R., Buttner, W., Post, M. 2010 published in the International Journal of Hydrogen Energy.
3. An Overview of Hydrogen Safety Sensors, Butter, W., Blake, C., Burgess, R., Post, Rivkin, C., 2010 published in the International Journal of Hydrogen Energy.
4. Hydrogen Storage, Transportation, Handling, and Distribution: Section 13- Hydrogen Safety Codes and Standards, Blake, C. and Rivkin, C. CRC Press 2010.
5. US Department of Energy Support for Codes and Standards Development, Rivkin, C. University of Ulster Belfast, UK Short Course on Hydrogen Safety June 14, 2010.

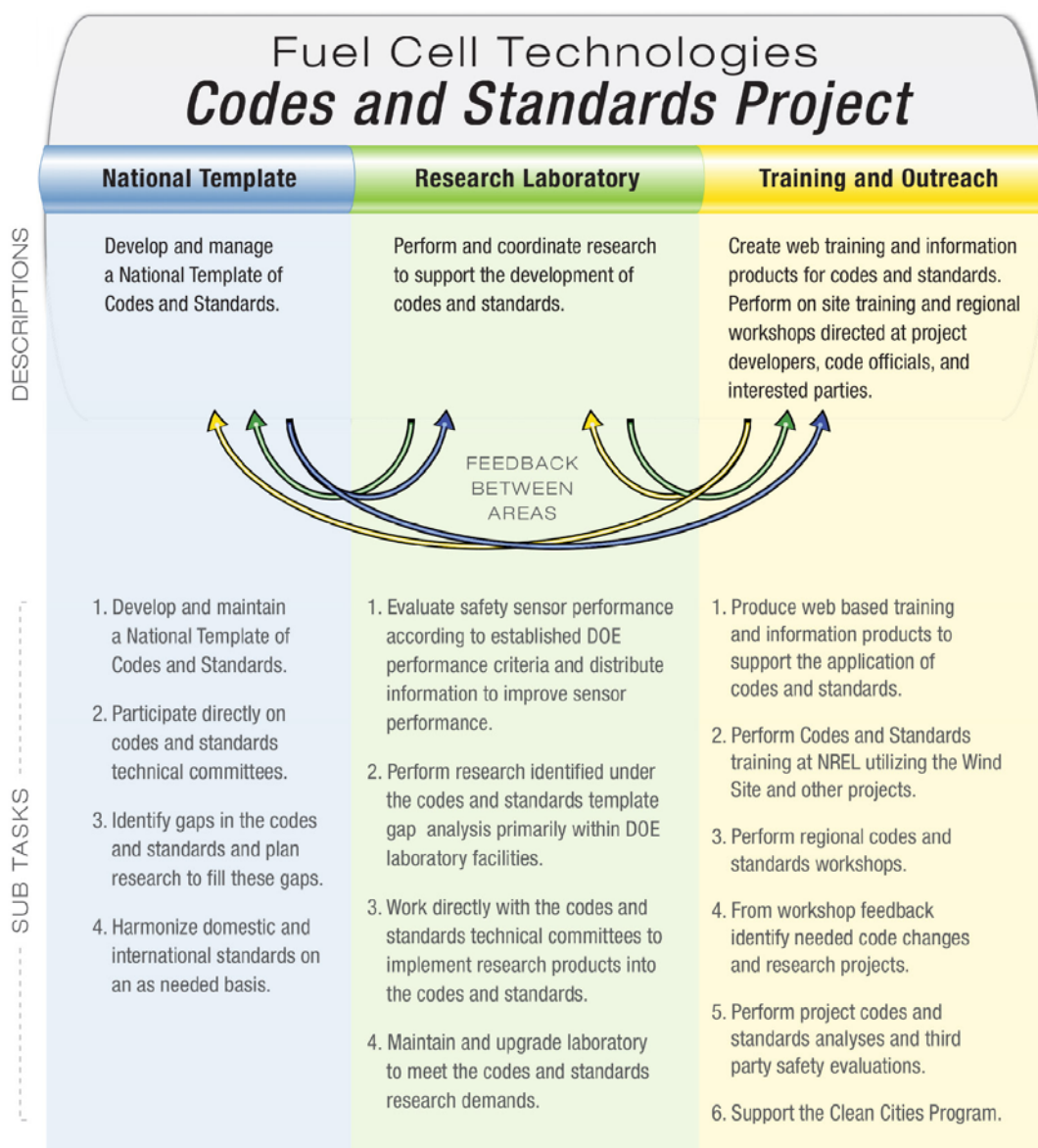


FIGURE 1. Structure of Safety, Codes and Standards Work at NREL

6. NREL Hydrogen Component Projects Rivkin, C. University of Ulster Belfast, UK Short Course on Hydrogen Safety June 15, 2010.

7. Round Robin Testing of Commercial Hydrogen Sensor Performance- Observation and Results, Buttner, W., Burgess, R., Rivkin, C., Post, M., Boon-Brett, L, Black, G., Harskamp, F, Moretto, P. published in the proceedings of the National Hydrogen Association 2010 Annual Conference.

8. High pressure Hydrogen Storage; Validation Testing of SAE performance Based System Level Requirements, Burgess, R. published in the proceedings of the National Hydrogen Association 2010 Annual Conference.