IX.3 Hydrogen Education for Code Officials

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Subcontractors:
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- Ecommerce Systems, Inc., Greenwood Village, CO

Project Start Date: October 1, 2007
Project End Date: September 30, 2009

Objectives

Develop an introductory information (e-learning) package for code officials that specifically addresses safety, codes, and standards for hydrogen technologies to facilitate demonstration and deployment project permitting.

Technical Barriers

This project addresses the following technical barriers from the Education section (3.9) of the Hydrogen, Fuel Cells and Infrastructure 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

(D) Lack of Educated Trainers and Training Opportunities

Contribution to Achievement of DOE Education Milestones

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

- **Milestone 2:** Develop introductory package for code officials. (2Q, 2008)
- **Milestone 5:** Update introductory information package for code officials. (4Q, 2010)

Accomplishments

- Module 1–Introduction to Hydrogen
  - Includes hydrogen properties, production, storage, and applications.
- Module 2–Fuel Cell Applications
  - Provides the learner with a detailed look at fuel cell applications and how they work.
- Module 3–Hydrogen Codes and Standards
  - Educates the learner about codes and standards used for hydrogen systems and is linked to a codes and standards database.
- Module 4–Permitting Hydrogen Fueling Stations
  - Walks the learner through the permitting process and provides examples of relevant codes and standards and station designs.
- Module 5–Permitting Stationary Hydrogen Facilities
  - Educates the learner on aspects of permitting a hydrogen stationary facility and provides examples of applicable codes and standards and facility designs.

Introduction

NREL is developing an e-learning package for code officials. The course modules are designed to introduce code officials to hydrogen, hydrogen applications, and the safety, codes, and standards currently used for hydrogen technologies. This information will help facilitate demonstration and deployment projects across the nation.

The challenge of this project is the decentralized enforcement of codes or adopted standards. About 44,000 different jurisdictions in the United States make use of existing codes and standards by either incorporating appropriate sections, or by referring to those sections. States and municipalities may also impose more stringent or additional requirements. Incorporated content of codes and standards is enforceable by law. These modules will provide a uniform starting point for code officials and facilitate the permitting process.

Approach

To develop the code official learning package, NREL evaluated e-learning tools, methods, and software available to determine the most suitable approach for presenting the information. A detailed outline for each course was developed. Codes and standards experts then reviewed the content to ensure accuracy.

The e-learning resources are designed to maximize usability and engage the learner. Studies have shown that interaction between the learner and the software increases the information that learners remember upon completion. An example of this is shown in Figure 1 by the test-question method. At the end of each lesson, the learners are asked a series of questions about the content that was presented and they receive instant feedback about their answers.

Results

Module 1 is an introduction to hydrogen, which includes hydrogen properties, production and storage methods, and applications. Figure 2 displays the course content page that the learner can access at any time by clicking on the course map tab at the top. This enables learners to take the lessons in the course in any order or study just one or two lessons depending on their level of knowledge.

Module 2 provides a detailed look at fuel cells and their applications. It describes the common types of fuel cells, how each type works, and the applications for which they are best suited. Module 3 educates the learner on the codes and standards used for hydrogen systems and also provides information on how to adopt these codes and standards in his or her jurisdiction.

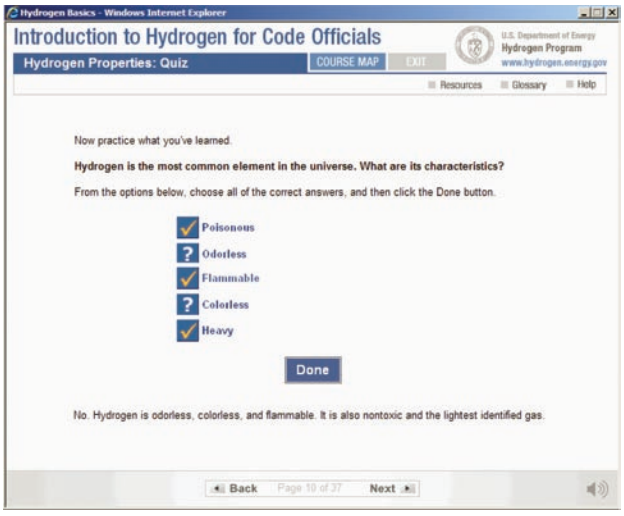

FIGURE 1. Screen Shot Showing Example of Test-Question Method

Module 4 provides the steps and applicable codes and standards for permitting hydrogen fueling stations and has a fueling station design at the end that can be used as an example and includes the setbacks, footprints, and codes and standards that apply to that design. Module 5 addresses stationary hydrogen facilities and provides examples of the codes and standards already in place.

Modules 3, 4, and 5 will link to a database that provides updated codes and standards as they become available. The content for the first four modules is complete. The content will be put into a design template similar to the one used in DOE's Introduction to Hydrogen Safety for First Responders. Module 5 will be completed in September 2008, in conjunction with a new Web-based permitting compendium specific to fuel cells for telecommunications applications.

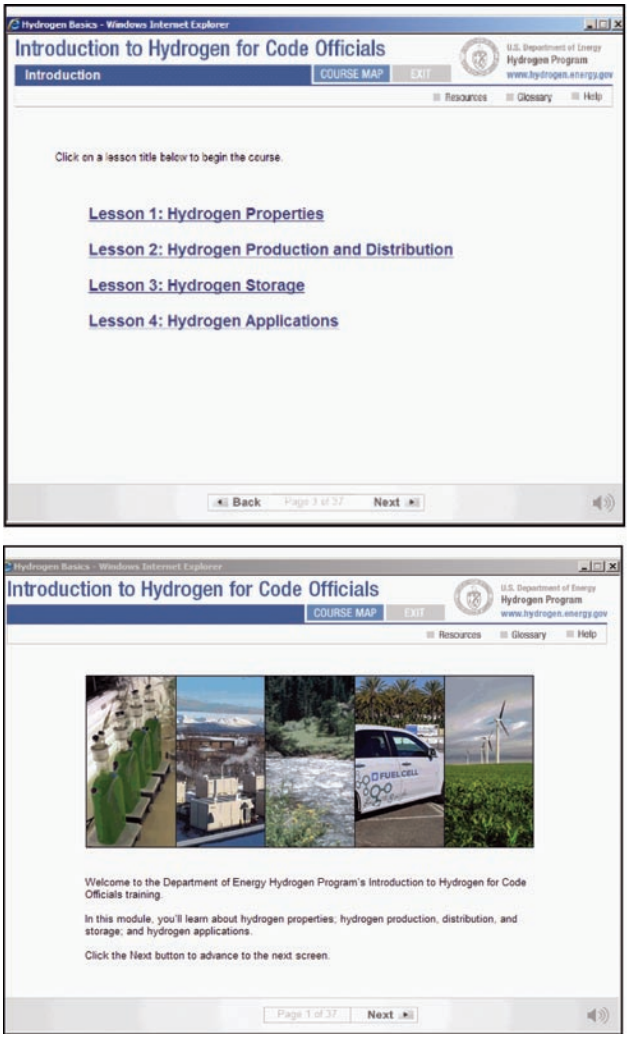

FIGURE 2. Screen Shots Displaying Course Content and Introduction Pages

Conclusions and Future Directions

Future work will include the following:

- Content and usability will be reviewed by the hydrogen and code official communities.
- Beta testing will be done and audio added near the end of the current fiscal year.
- Outreach activities and publications will be used to distribute the information resources to the code official community.
- The course will be integrated with other related information, such as the Introduction to Hydrogen Safety for First Responders, on the DOE Web site.

FY 2008 Publications/Presentations

1. *Hydrogen Fueling–Coming Soon to a Station Near You*: http://www.eere.energy.gov/hydrogenandfuelcells/pdfs/40907.pdf

2. Hydrogen Conversion Card.