PATH's Report on Hydrogen Codes and Standards

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Last year PATH began the process of developing a single source for codes and standards pertaining to hydrogen for PATH's member countries: Canada, Japan, and the United States. This report is now close to completion and provides insight into the development and scope of hydrogen codes and standards in each country as well as codes and standards that are internationally accepted.

Hydrogen is becoming a mainstream technology, and the development of codes and standards is critical for widespread acceptance. Currently one of the barriers is the lack of applicable codes and standards for hydrogen, as well as a limited knowledge of the technology. The Hydrogen Codes and Standards Technical Report is PATH's effort to provide a comprehensive source for its member countries' regulatory needs and to contribute to the general understanding of codes and standards that is critical to developing a global community of interest in hydrogen.

The report focus's on the development of a codes and standards matrix for each country and an international matrix listing all standards for those countries. Additionally, this report encompasses the approaches to establishing codes and standards for PATH member countries and provides an overview of each country's matrix and of the international matrix. The hopes are that the member countries' build on existing standards, and can use information from fellow PATH members to develop standards to address those areas that are lacking.

The codes and standards matrix developed by NREL was used as a template for this effort; however PATH collected information on US codes and standards in addition to those included in NREL's matrix. The PATH matrix is organized by the following categories: stationary applications; transportation applications; portable applications; hydrogen infrastructure; regulatory and quasi-regulatory organizations; and other useful applications.

Approaches to Hydrogen Codes and Standards

Canada and the United States have similar approaches to the regulation of hydrogen, and a few codes and standards are used by both countries.

Canadian law, which is governed at the province level, classifies hydrogen as a dangerous good. Efforts are underway to classify some forms of hydrogen as a fuel, thereby easing some restrictions. Four organizations in Canada are responsible for developing standards, each with a particular focus: Canadian General Standards Board, Canadian Standards Association, Underwriters' Laboratories of Canada, and Bureau de Normalisation du Quebec. Canada is involved with several international activities to promote the development of international standards for hydrogen systems, and hosts the Secretariat for ISO/TC 197 Hydrogen Technologies. Additionally, Canada and the United States have several cooperative efforts to develop codes and standards for hydrogen.

In the United States, there are many organizations involved in creating standards and best practices for industry for emerging hydrogen energy systems. For some applications, existing standards for natural gas systems are being revised to include hydrogen, in others, new standards are being developed. Codes and standards are developed nationally to assure safety and internationally to promote trade, and those

that are adopted by local and state government bodies have the force of law. Standards do not have the force of law unless incorporated into an adopted code. The United States strives to reach consensus positions on national standards and best practices and take that position forward internationally.

The goal of Japan's current codes and standards efforts are to deregulate the existing regulations in order to facilitate building hydrogen filling stations. The existing laws and regulations make the deployment of hydrogen filling stations difficult, and technical instructions for design, installation, operation, and safety for hydrogen filling stations are being developed. The Japanese government and related associations are working to complete deregulation by 2005. Japan does have a number of laws and regulations pertaining to hydrogen, including the High Pressure Gas Safety Law, Fire Service Law, Industrial Safety and Health Law, Building Standard Law, and Law on the Prevention of Disasters in Petroleum Industrial Complexes and Other Petroleum Facilities, as well as those specifically for hydrogen transportation, including the Road vehicles Act, Road Traffic Law and Harbor Regulation Law.

Review of the Matrices

The matrix that combines the Canada, Japan, and United States information provides a relatively comprehensive view of codes and standards. Three areas in which regulations are lacking are: hydrogen internal combustion engines, on-board fuel processors and the interface between the portable system and end-use. As noted before, the United States and Canada follow similar standards approaches and have a number of standards in common. Japan takes a more comprehensive approach to codes and standards making.

Internationally stationary fuel cells have several existing codes and standards. With the anticipated adoption of international standards for fuel cells approved over the next several years, fuel cells of all sizes should be covered for customer applications. As the integrated matrix indicates, there are a number of activities in the U.S. and Canada related to fuel processor and reformer standards. The activities are being mirrored with a joint IEC/ISO activity on hydrogen production from fossil fuels. All countries are working extensively on interface issues. There are significant international and individual country activities focusing on O&M and Testing and Evaluation procedures to anticipate adequate standards coverage over the next few years.

Codes and standards for vehicle fuel cells have been provided internationally; however the issues of fuel processors and internal combustions engines are not being addressed. Additionally, an applicable standard for hydrogen fuel does exist, although there are international standards being developed for on-board liquid and gaseous storage of hydrogen along with some proposed global technical regulations. Japan has the largest activity related to vehicle hydrogen safety and the United States has a number of standards activities related to O&M and Testing and Evaluation which SAE is developing.

The major international activities with respect to portable applications are IEC 62282-5 Portable Fuel Cell Power Generators and the new work group established by ISO/TC 197 on hydride storage for portable applications. In the U.S. UL and CSA also have or are working fuel cell and electrolyzer standards.

In hydrogen infrastructure virtually every category of activity is being addressed. Hydrogen production and storage are being addressed nationally and internationally. Transport of bulk hydrogen is being addressed by the individual countries but not internationally and there are no international standards being developed for hydrogen pipelines. Hydrogen refueling stations standards have not been addressed nationally or internationally. Additionally there are no international standards being developed in the areas of buildings and safety and emergency response, although extensive national activities are underway in each of these areas.

Conclusions

The report is one of the first steps for PATH to establish a global hydrogen community. By providing a comprehensive listing of existing and developing hydrogen codes and standards, PATH is providing its member countries with a critical tool in the development of their hydrogen efforts. The PATH Board has reviewed the report, and it will be issued in the Spring of 2003. Because new codes and standards are constantly being developed, this report will be a living document with yearly updates.