# Standards Help Fuel Cell Technology Reach Commercial Uses

## Background

Both Americans and Canadians express growing concern about our dependence on carbon-based fuels and the impact of Green House Gas emissions on the environment. As a result, fuel cell technology as an alternative energy source has become a major interest of both the US and Canadian governments. Fuel cells are fuel conversion devices that can produce electricity from a fuel source, such as methanol or hydrogen gas, and an oxidant. The process of producing energy is electrochemical and does not involve combustion. So fuel cells are efficient, quiet, and clean.

More than 2500 fuel cells are already installed to provide either primary or backup power in stationary applications such as hospitals, office buildings, and utility power plants in the US and Canada. As portable power sources, fuel cells can power laptops and cellular phones. Miniature fuel cells running on methanol can power hearing aids and hotel locks. Although widespread fuel cell vehicles are still a few years away, automakers are rushing to expand fuel cell use in cars and buses.

The public's interest in sustainable energy and government support of research and development efforts have motivated the growth of portable fuel cell technology. The Canadian federal government provided $33 million to the Canadian Transportation Fuel Cell Alliance (CTFCA) initiative to demonstrate and evaluate fueling options for fuel cell vehicles in Canada. CTFCA is also developing standards along with training and testing procedures for fuel cells and hydrogen systems.

## Problem

To get more fuel cell vehicles on the road, the energy industry encounters not only economic and technology issues, but also infrastructure and safety challenges. Reducing costs by reducing materials and redesigning manufacturing processes will be important for achieving more affordable systems. Furthermore the industry must provide adequate infrastructure to produce, store, and distribute hydrogen fuel or ethanol.

Fuel cell vehicles can use pure hydrogen gas stored in high-pressure tanks or hydrogen-rich fuels such as methanol, natural gas, or even gasoline. But first a portable reformer must convert these organic fuel sources into hydrogen gas. Such systems can be explosive, thus posing serious safety challenges.

As the energy industry faces these challenges, standards play a key role in guiding the industry's application of new technologies, especially in the areas of safety and the testing required to ensure safe use.

## Approach

Fuel cell technology is relatively new. Research, development, and enforcement of codes and standards for permitting, siting, and testing are continuously evolving. Many organizations – including CSA (Canadian Standards Association) America, the National

Fire Protection Agency (NFPA), the National Hydrogen Association (NHA), the International Organization for Standardization (ISO), and International Electrotechnical Commission (IEC) – are developing standards to assist in creating fuel cell applications that are both safe and environmentally friendly. For example, the NHA regularly holds workshops to discuss developing codes and standards and to identify areas in hydrogen energy technologies which would benefit from industry standards. Members – including fuel cell developers, automotive manufacturers, research and development organizations, and government representatives – influence the industry's direction, and the NHA seeks to identify safety issues that are omitted. Standards organizations such as NFPA, ISO, and IEC then receive information about needed standards that the workshop identifies.

CSA-FC 3 is an important portable fuel cell standard that states requirements for safety, construction, and performance. This standard applies to AC and DC fuel power cell systems that are less than 600 volts and are used in commercial, industrial, and residential locations. Such portable fuel cells can power lights, computers, or household appliances. These fuel cell systems use natural gas, alcohols, liquefied petroleum gasses such as propane, other hydrocarbons, and hydrogen, or metals.

The CSA-FC3 standard reflects experience in various phases of portable fuel cell system development including manufacturing, testing, installation, inspection, and research. It considers all of a fuel cell system's interlinking processes: fuel and air processing, thermal management, electrical output, control, and the fuel cell module itself. As portable fuel cell technology advances, standards organizations will revise standards like CSA-FC 3 to reflect current experience or to conform to international standards.

The CSA-FC 3 statement of criteria makes an important contribution. The standard requires pressure testing at 1.5 times the maximum working pressure, thus providing a safety margin and reducing the risk of ruptures and fractures. CSA-FC3 also defines a method for testing the flammable gas concentration and requires that, in the fuel cell system, the concentration must be less than 25 percent of the lower flammability limit.

These technical requirements ensure fuel cell system safety. Governments and the public can be confidant that a new fuel cell system is safe when it meets such standards. And compliance with these standards can speed regulatory processes and encourage commercial use of fuel cell technology.

As fuel cell technology and applications evolve, standards like CSA-FC 3 also evolve through revision and development of other associated standards. For example, the Canadian Hydrogen Installation Code (CHIC) helps to secure approval for CTFCA's hydrogen demonstration projects and thereby promotes commercialization. The current standards for equipment components that apply to fuel cell systems – including codes for fire protection, pressure vessels, and electrical systems – will likely be revised to reflect the new application.

As part of the evolution, most standards development organizations coordinate their standards, where possible, with international, bi-national, or regional standards. For example, Canada adopted IEC 62282-2 Part 2: Fuel Cell Modules to replace CSA-FC 3 itself in order to correspond with the internationally accepted standard. Such agreement helps free trade by ensuring a single standard for the product, assisting both the manufacturer and the consumer. Canada employed their CSA-FC 3 standard until an appropriate international standard was developed.

Multiple standards organizations are working to establish safety and performance requirements not only for fuel cells but also for the supporting infrastructure. The resulting consistency and safety hastens commercialization of fuel cell technology. Common standards also encourage financial investment into research and development. And fuel cell users can be confident that this new form of energy is both safe and better for the environment.

**Outcome**

The CSA-FC 3 and IEC 62282-2 Part 2 standards harmonize the development of products using fuel cells and hydrogen. By pointing the direction for research and development efforts, this coordinating expedites the process of bringing safe, effective fuel cell products to the consumer.

Standards help to advance new fuel cell technology by reducing risk:

- Governments and the public are assured of safety.
- Investors and users can be confident of fuel cell performance.
- Environmental organizations can be certain of sustainability and reduced environmental impact.

Standards also provide proven criteria that legislation and governing bodies can reference to ensure safety and environmental responsibility.