

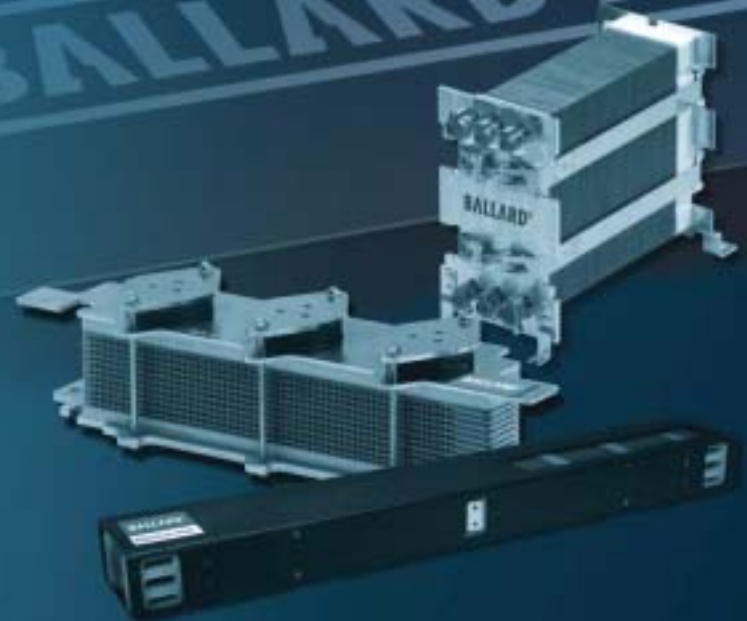
THE ECONOMICS OF STANDARDIZATION – THE FUEL CELL INDUSTRY



▶ **NSS Conference: June 2-4, 2008**

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Š Drivers for Fuel Cell Commercialization

- ▶ Fuel cells enable a clean and more sustainable energy system
- ▶ Continued innovation in this sector advances objectives for:
 - Clean air
 - Greenhouse gas reduction
 - Energy reliability and security
 - Economic development and innovation-based job creation



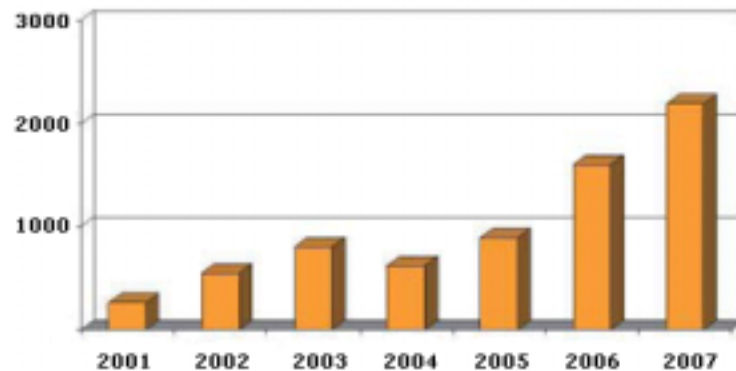
Š The Canadian Fuel Cell Sector

- ▶ Canada has demonstrated success in fuel cell R&D and early stage commercialization
- ▶ Canadian companies are now providing parts, systems and services to a global market



§ The Canadian Fuel Cell Sector

- ▶ Total Canadian industry revenue was \$133M in 2006
- ▶ Industry R&D expenditures in Canada at \$193M in 2006 (more than \$1B over the past 5 years)
- ▶ Certain market areas appear to be entering the growth stage



Industry-wide annual shipments of small stationary fuel cells

Source: Fuel Cell Today Small Stationary Survey 2008

§ Three important ways that standardization is affecting the bottom line:

- ▶ System integration costs
- ▶ Technology cluster productivity
- ▶ Improved delivery of standards

§ System Integration Costs

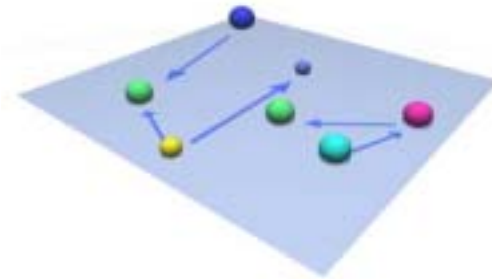
- ▶ The fuel cell standards improve productivity
 - Easier to coordinate requirements with system integrators, most of whom are located in various countries around the world
 - Corporate risk management is simplified
 - Requirements of the local regulator are identified
- ▶ Example – a new standard for fuel cell modules:
 - Without: ~10 - 20 standards in a purchase agreement
 - With: ~3 - 5 standards
 - Goal: One Standard / One Mark (e.g. IECEx)

Š System Integration Costs - Opportunity

- ▶ These cost reductions are real; however, within industry, they have typically not been measured. Without measurement, it is difficult to estimate a return on investment.
- ▶ Developing methods to capture this information and using it with new economic models would allow resources for standards to be allocated more effectively.
- ▶ Doing so, would increase the productivity gains associated with each new standard that is developed.

§ Technology Clusters

- ▶ Technology clusters form when organizations in proximity to each other exchange complementary technology, knowledge and skills
- ▶ When the same industry standards are used by the member companies, that cluster becomes more productive and the standards they choose may become industry platforms



§ Technology Clusters - Opportunity

- ▶ Knowing what standards for modularity and interfacing that are most likely to lead to successful platforms may be key to the competitiveness of companies within a technology cluster
- ▶ The economic models and skill sets needed to develop these standards in the Canadian technology industry should be advanced through collaborative efforts of industry and academia
- ▶ Finding ways to transfer these skill sets across technology sectors is also desirable (e.g., I.C.T. -> Clean Energy)

§ Delivery of Standards

- ▶ Costs for standards development have typically been recovered through future sales of those documents
- ▶ Some standards bodies now rely on sponsoring organizations for funding, then make the standards freely available
 - W3C members pay in advance, with those standards then distributed at no cost over the web
 - In Canada, the Canadian General Standards Board (CGSB) has made certain standards freely available over the web

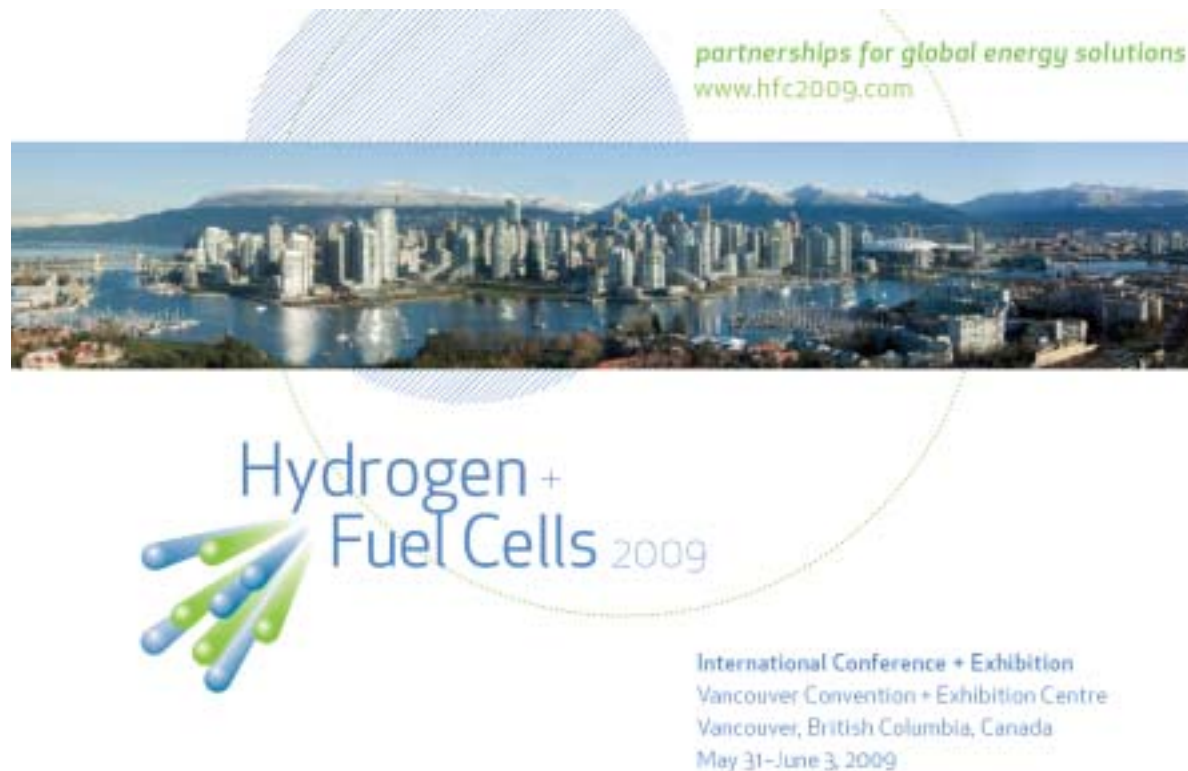
§ Delivery of Standards - Opportunity

- ▶ An economic model is needed to help each industry evaluate, then select their best method for standards distribution. The model should include hidden costs and the value associated with:
 - The reduced commercialization time that results when engineers have immediate and free access to the standards for a new technology
 - Increasing the rate at which content in Canadian standards are referenced internationally
 - The positive externalities created through free availability of standards for safety

Economics of Standardization



Š Suggested venue for future work



ACCELERATING FUEL CELL MARKET ADOPTION



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Thank You

We would like to acknowledge...



...for their advice in the preparation of this presentation