

# Canadian Fuel Cell Commercialization Roadmap

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Canada

PRICEWATERHOUSECOOPERS 

 Fuel Cells Canada™

# Executive Summary

The Canadian Fuel Cell Commercialization Roadmap is an industry-led planning process supported by the Government of Canada and facilitated by Industry Canada. Its objective is to accelerate full-scale commercialization of fuel cell technologies by Canadian fuel cell companies.

This Roadmap has been developed through the participation, input and assistance of many leaders in industry, government and academia. It represents a critical step in identifying the commercialization challenges and in selecting the strategies and actions that will allow Canadian stakeholders to successfully meet these challenges.

The Roadmap reinforces the need for collaboration among government, industry and academia if Canada is to retain its leading position and realize the many economic, social and environmental benefits that fuel cell technology can provide for our country.

## The Opportunity

The potential market for fuel cells and related products is enormous. Global demand is projected to reach \$46 billion by 2011 and the potential for 2021 could exceed \$2.6 trillion.<sup>1</sup>

Canada has been a world leader in the research and development of fuel cell and hydrogen technology — spanning most fuel cell types, components and systems supply, systems integration, fueling systems and fuel storage, along with engineering and financial services.

There are currently 17 companies across Canada whose primary focus or goal is fuel cell production and/or system integration. In addition many other companies are active in the sector supplying to the fuel cell producers, focusing on fueling infrastructure, or providing services to the fuel cell industry.

The Vancouver area, with its cluster of fuel cell companies, suppliers, infrastructure developers and service providers, has arguably the largest concentration of fuel cell expertise in the world. Fuel cell industry clusters are also growing in the Calgary, Toronto, Kingston and Montreal areas.

<sup>1</sup> Fuel Cells Canada and PricewaterhouseCoopers, *Fuel Cells – The Opportunity for Canada, June 2002*.

However, Canada's position at the forefront of this new industry is not guaranteed. The superior efficiency of fuel cell technology and its environmental and social benefits have attracted the attention and investment of governments and industry in most industrialized countries.

Other countries have accelerated their investments through targeted policies and program support, and through strategic corporate and research alliances. This global investment includes:

**United States:** The federal government proposes spending \$2.7 billion over the next five years on hydrogen and fuel cell research and development, and advanced automotive technologies.<sup>2</sup>

**European Community:** The EC plans to spend \$3.3 billion from 2003 to 2006 on renewable energy — mostly hydrogen and fuel cells.

**Japan:** The government plans to spend over \$380 million a year on fuel cell research, development and commercialization.

Canada must redouble its activity and investment to retain its position as a world leader.

The time to act is now. Leveraging our existing market leadership position will require the immediate commitment and investment by industry and government.

Fuel cell technology represents a tremendous opportunity for Canada. It will enhance the overall competitiveness of our economy by providing significant growth in knowledge-based jobs, new opportunities for other key industry sectors, and a platform for growth in high value exports.

Through the export of fuel cell technology, products and applications, Canada can also play a critical role in reducing greenhouse gas (GHG) emissions worldwide, thereby contributing to the virtual elimination of urban pollutants, reduced health care costs and improved quality of life in the world's major cities.

## The Challenges and Actions

The Canadian fuel cell industry faces a number of significant challenges on the road to commercialization. Overcoming these challenges — common to the industry as a whole, regardless of product, market focus or stage of development — will require the collaborative efforts of all stakeholders. Many of the challenges are interrelated and, therefore, need to be addressed concurrently.

Within this Roadmap, specific strategies and actions have been identified to address each challenge. These actions should, in most cases, be viewed as only a starting point, to be followed by an implementation plan that addresses each action in greater detail.

<sup>2</sup> All information in this report is expressed in January 2003 Canadian dollars unless otherwise noted. US dollar figures were converted to Canadian dollars using a factor of 1.57.

## Stimulating Early Market Demand

The high price of new fuel cell products — reflecting higher production costs associated with small production volumes — poses a prohibitive barrier to potential purchasers. Production costs, and hence prices, will come down as demand stimulates increased production volumes. The sooner this demand is generated, the faster industry will be able to reduce costs and access new markets.

### Challenges

**Creating More Market Awareness**  
**Gaining More Knowledge of Markets**

### Actions

- Develop demonstration projects that showcase fuel cell technology, validate product reliability and output, ‘ruggedize’ the product and provide data necessary for commercialization
- Develop public information programs to educate policy makers, service providers, consumers and students
- Establish early purchase programs to encourage product procurement and benchmarking, allow public demonstration of the technology and provide critical early revenues for the industry

## Improving Product Quality While Reducing Cost

To compete with incumbent technologies that are both widely accepted and constantly improved, the fuel cell industry must enhance product quality and reduce production costs. Product quality includes performance, reliability and durability. Reducing costs will require a combination of materials, product and process development, and design engineering. To stimulate development of an effective supply chain, fuel cell developers and systems integrators need to standardize their component specifications. Suppliers must be encouraged to service early markets with the produce and process development, design engineering and an integrated supply chain.

### Challenges

**Continuing to Improve Product Quality**  
**Continuing to Reduce Costs**  
**Developing a Coordinated Supply Chain for Fuel Cell Power Systems**

### Actions

- Identify product performance and cost barriers, and develop strategies to overcome them
- Increase collaborative research and development on materials, component costs and product standardization and integrate production plans/processes for major cost components to ensure cost curve reduction
- Undertake demonstration projects to support cost and performance value propositions in operating environments and create an ongoing database of proven fuel cell performance
- Establish a supply chain forum to develop a process for sharing technical information among fuel cell developers, suppliers and the research community. This will stimulate innovation and further investment in component design, obtain industry agreement on appropriate benchmarks and performance standards, identify gaps in supply chain and develop strategies for enhanced domestic capabilities; and develop component cost reduction programs.

**The time to act is now. Leveraging our existing market leadership position will require the immediate commitment and investment by industry and government.**

## Financing

Innovative approaches to securing capital are needed to meet the significant capital resources that Canadian fuel cell companies will require as they move products along the path toward commercialization. The cost of increasing the scope and scale of production and marketing activities severely challenges the available capital resources of most industry participants.

### Challenge

#### Gaining Access to Capital

### Actions

- Develop financial incentives for fuel cell products and services in order to reduce the risk profile of needed investments in manufacturing capability
- Identify and pursue development partners, including exploring the feasibility of strengthening geographic clusters to attract further development; provide tax incentives for research and development; and dedicate matching funds for investments

## Creating Supporting Infrastructures

For some fuel cell applications — particularly in the mobile sector — supportive infrastructures will have to be developed. These infrastructures include: the availability of sufficient skilled personnel; the presence of codes and standards that allow and encourage the safe introduction of fuel cell applications and allow interconnectivity; and the development of a fueling infrastructure, where required.

### Challenges

#### Obtaining Skilled Resources

#### Developing Fueling Infrastructure

#### Developing Codes and Standards

### Actions

- Develop a human resources strategy to ensure a sufficient supply of skilled resources for the fuel cell sector; develop policies and criteria for training requirements; and undertake a national occupational analysis to identify where skills gaps may emerge as the industry grows
- Require a training component be incorporated into fuel cell demonstration projects and into early purchases involving government
- Develop curriculum material targeted at post-secondary students, teachers, academic and technical institutions
- Demonstrate fueling infrastructure systems solutions
- Ensure Canada takes a lead role in setting codes and standards for fuel, fuel cell and fueling systems

## Taking the Next Step: A Collaborative Effort

Participants in this Roadmap agree that government and industry need to work together to support demonstration projects, provide early purchaser opportunities and show leadership in overcoming the challenges facing fuel cell commercialization in Canada.

Specifically, a collaborative effort is required to:

- Develop a national fuel cell strategy within the next year which reflects the collaborative commitment of all key stakeholders
- Identify key stakeholder champions who will continually promote the Canadian fuel cell industry
- Educate government and other early users as to the long-term benefits of fuel cells and why they should demonstrate/purchase fuel cell products
- Support research and development, product development and early market products

The actions identified in this Roadmap potentially make up the key components of a national fuel cell strategy. Industry is committed to collaborating with government and the research community to develop a national fuel cell strategy, and to share the costs of implementing the actions identified.

It is imperative that this strategy is developed now, and that the actions are implemented on an urgent basis. These steps will help the development of a viable Canadian fuel cell industry, and help address Canada's climate change, health, sustainability and innovation objectives.