Government of Canada | Gouvernement du Canada

Canada's Hydrogen and Fuel Cell Sector
Expectations for the IPHE

Member Statements

International Partnership for the Hydrogen Economy (IPHE)

2nd Steering Committee Meeting

26-27 May, Beijing, China

Canada

Outline

- **Update on Canadian programs and activities**
- **Canada and the IPHE**
- **Canadian Goals and targets**
- **Annex – Information on key Canadian hydrogen and fuel cell programs**

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Canada's Fuel Cell and Hydrogen Industry

- **Canada is recognized as a centre of expertise in fuel cell research and development and early stage commercialization**
- **Canada is a total solutions provider**
- **The number of Canadian companies associated with the industry has doubled over the past 5 years**

- ✓ Employs over 1,800 people
- ✓ Total research and development expenditure on hydrogen and fuel cell activities estimated to be $280 million in 2003
- ✓ Total Canadian industry revenue estimated at $188 million in 2003
- ✓ Canadian participation in demonstration projects around the world estimated at 252

Canadian Hydrogen and Fuel Cell Industry Profile 2004

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Drivers of the Canadian Fuel Cell and Hydrogen Industry

- **Climate change challenges**
- **Industry opportunities**
- **Wealth generation**
- **Air quality and health**
- **Diversity of energy supply**

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Moving the Hydrogen Economy Forward

Federal

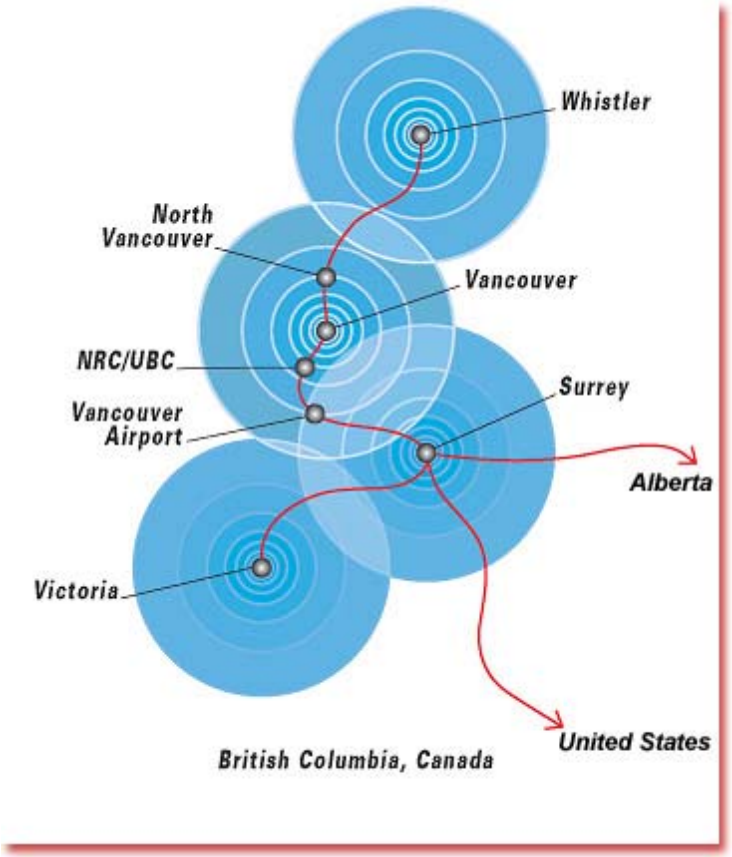
- Government of Canada has invested over $200M in this sector since the early 1980s
- Forecasted annual investment approximately $70M over next five years
- Development of a national, coordinated strategy and implementation of key actions
- Creation of the Federal Hydrogen and Fuel Cell Committee (H2FCC)

Provincial

- BC continues to support large, integrated demonstration projects and is developing a hydrogen strategy
- Alberta developing hydrogen production strategy
- Manitoba's hydrogen strategy released and being implemented
- Ontario developing a strategy and supporting significant demonstration and deployment activities
- Prince Edward Island focused on integrating renewable energy sources with hydrogen and fuel cells

Hydrogen Highway ™

The Hydrogen Highway™ represents a hydrogen fueling infrastructure project demonstrating a wide variety of fuel cell applications and and will provide a global showcase at the 2010 Olympic Games in Whistler, British Columbia



Includes the Vancouver Fuel Cell Vehicle Project, the Hydrogen High-Pressure Valve Development Project and the Hydrogen-Powered Delivery Van Project

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Hydrogen Village

HYDROGEN Village

The Hydrogen Village is a public-private partnership committed to accelerating and sustaining the application and commercialization of hydrogen and fuel cell technologies.

Over 36 public and private sector members contributing to the development of the first Village for the Greater Toronto Area starting in late 2004

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Canadian Industry Activities

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Canada and the World

Multilateral

- IPHE
- IEA - Working Parties, Implementing Agreements, analysis and modeling
- OECD – Energy Working Groups
- North American Energy Working Group – S&T Experts Group
- APEC
- Cooperative agreement between U.S. Fuel Cell Council, Fuel Cell Commercialization Conference of Japan, Fuel Cells Canada, and World Fuel Cell Council/Fuel Cell Europe

Bilateral

- NRC MOUs with Chinese Universities
- Natural Resources Canada MOU with California Air Resources Board
- Energy R&D MOU between NRCan and the US DOE
- West Coast Governors GHG Emission Reduction Program
- Northwest Energy Technology Collaborative
- Canada-US Technology Partnering Initiative (TPI)

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Canada's Expectations for IPHE

IPHE Roles:

- Knowledge management function
- Identify similar interests in other member countries and building technical connections
- Make use of existing international collaborative efforts to strengthen the engagement within a broader community and avoid duplicating effort
- Coordinate international efforts to develop a global hydrogen economy including demonstration and deployment activities
- Expand participation of high level stakeholders and decision-makers as well as financial and insurance organizations
- Act as a source for objective messaging - address public issues and concerns
- Raise the profile of the potential for a hydrogen economy

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Canada's Priority Areas for IPHE

Moving Technology Forward

- Full spectrum of fuel cell and hydrogen applications
- Research, development and deployment
- Access to R&D and deployment funding internationally

Working Together To Remove Barriers

- Strategic collaboration on major initiatives
- Codes and standards
- Marketplace framework and intellectual property issues

Accelerating Development of the Hydrogen Economy

- Multitude of hydrogen pathways and hydrogen storage
- Safety and public confidence

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Key Messages – Canadian Industry

1. **Role of IPHE in Commercialization**
   - Next step after demonstration
   - Consistent global approach
     - Fiscal policy
     - Government procurement policy
     - Regulatory – eliminate barriers to product introduction
     - Collaboration to increase market pull

2. **Breakthrough Research Still Required, Collaboration Required to**:
   - Reduce unit costs
   - Improve reliability
   - Hydrogen storage
   - Renewable energy pathways

3. **Transition Technologies Facilitate Development of Hydrogen Economy**
   - Hybrid technologies
   - Various fuelling paths

Canadian Concepts of the Hydrogen Economy

Hydrogen Sources and Methods

- Electrolysis from hydro, nuclear, wind, biomass, and solar power

- Thermal plants with CO2 captured and sequestered

– High temperature thermochemical production from Nuclear sources

– Steam reforming of natural gas and methanol

– Gasification

Distribution

– Primarily distribution of electrons

– Natural gas to distributed hydrogen production stations

– Major cities: Pipeline distribution of hydrogen from central production plants over short distances

– Smaller cities: H2 produced on-site

– Distributed energy systems could be used in both larger and smaller cities to produce power and H2

Major Users

– Transportation

– Large scale electrical generation

– Portable electrical generation

– Chemical industry, heavy oil industry (oil sands)

– Portable/micro/electronics

– Distributed Generation

Conversion through end-use products and transition technologies

-Fuel cells

-Hybrids

Canada's Goals

- Stimulate early market demand
  - Demonstrations, public information programs, early purchase programs
- Improve product quality while reducing cost
  - Identify barriers and strategies to overcome them,
  - increase collaborative R&D, demonstrations to support cost and performance value propositions,
  - establish a supply chain forum

- Financing
  - Develop incentives to share risk, identify and pursue development and deployment partners
  - Ensure that companies are well capitalized
- Supporting Infrastructures
  - Develop human resource strategy, include training component in demonstrations, develop curriculum material for education, develop fueling infrastructures including hydrogen storage, establish codes and standards

"A clear message of the Commercialization Roadmap is that action must be taken now…"

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Appendix

Canadian Programming

Recent Announcement

- $215 million, over five years, dedicated to the Hydrogen Economy, October 2003

- Investments of approximately $70M annually into the sector over next 5 years

  $60 million, Early Adopters

  $20 million, R&D

  $85 million, Industry Portfolio Partners (reallocation)

  $50 million Sustainable Development Technology Canada targeted to H2

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Key Federal Programs

Technology Partnerships Canada

h2 Early Adopters

CANMET Energy Technology Centre - Ottawa

Public Works and Government Services Canada

NSERC CRSNG Natural Sciences and Engineering Research Council

Canadian Transportation Fuel Cell Alliance

Institue for Feul Cell Innovation

TEAM Technology Early Action Measures

Team Canada Inc - Équipe Canada Inc

PERD Program of Energy Research and Development

National Research Council Canada / Conseil national de recherches Canada

SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA

IRAP-PARI
Industrial Research Assistance Program

Social Sciences and Humanities Research Council of Canada

Western Economic Diversification Canada / Diversification de l'économie de l'Ouest Canada

Technology Early Action Measures (TEAM) and Program of Energy Research and Development (PERD)

TEAM

- $56 million component of the Climate Change Action Fund (CCAF)
- Offers additional support to federal programs that fund technology projects to reduce GHG emissions while sustaining economic/social development
- Help Canada meet its commitments under Kyoto

PERD

- Federal, interdepartmental program
- Funds R&D supporting sustainable energy future
- Concerned with all aspects of energy supply and use, with the exception of nuclear energy

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Natural Resources Canada – R&D and Canadian Transportation Fuel Cell Alliance

Natural Resources Canada | Ressources naturelles Canada

Hydrogen and Fuel Cell R&D Program

- Funding of hydrogen and fuel cell R&D and demonstrations for over 20 years
- Program addresses: fuel cells, hydrogen production, storage, safety and utilization
- Works with industry, universities, other levels of government and internationally to form consortia and implement projects to develop hydrogen and fuel cell technology

Canadian Transportation Fuel Cell Alliance

- $33 million over 7 years
- Focuses its efforts on showcasing refuelling demonstration projects, evaluating different fuelling routes for light, medium and heavy-duty fuel-cell vehicles, monitoring the resulting greenhouse gas emission reductions, and developing the necessary supporting framework for the fuelling infrastructure, including technical codes and standards, training, certification and safety
- 5 working groups: Communications, Light Duty Vehicles, Medium/Heavy Duty Vehicles, Standards and Codes, Studies and Assessments

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Sustainable Development Technology Canada

- Allocation of $550 million to eligible recipients developing sustainable technologies over a 5 year period. This includes a mandate expanded to add clean soil, clean water with an additional $200M endowment
- Focus on near-term technology solutions for climate change with the objective of closing the commercialization gap
- Development and demonstration of climate change and air quality technologies; 10 year term

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National Research Council Canada | Conseil national de recherches Canada

- NRC through its Hydrogen and Fuel Cell Research Program carries out fundamental and applied Hydrogen and Fuel Cell R&D at its institutes across Canada in partnership with universities, OGDs, and industry.
- The program lead Institute for Fuel Cell Innovation in Vancouver additionally provides fuel cell testing and evaluation expertise and facilities (including a one-of-a-kind environmental chamber), incubation/acceleration services and technical support and facilities for demonstration projects.

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Natural Sciences and Engineering Research Council and Social Sciences and Humanities Research Council of Canada

NSERC CRSNG

Investing in people, discovery and innovation
Investir dans les gens, la découverte et l'innovation

- Supports collaborative university/private sector research projects
- Initiative to support the establishment of 5 University Chairs in Hydrogen and fuel cell technologies

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

- Granting agency for research and training in the social sciences and humanities related to the development of a hydrogen economy.

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National Defence

National Defence | Défense nationale

- Provides leading edge science and technology to Canadian forces
- Strengthens and supports the Canadian Defence Industrial Base through financial and scientific support for relevant industry-initiated research projects
- Issues R&D contracts for tender
- Demonstrates technologies

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Environment Canada

Environment Canada Environnement Canada

- Brokers projects on 'Environmental Technologies' including H2 / Fuel Cells
- Evaluates the environmental footprint of technologies
- Performs emission testing and monitoring of innovative technologies
- Engages on the governance of federal RD&D funding programs
- Advances the uptake of cleaner technologies

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Western Economic Diversification (WD)

Western Economic Diversification Canada | Diversification de l'économie de l'Ouest Canada

- Collaborates to encourage a cluster of manufacturers and service suppliers for existing and new fuel-cell systems developers, and related balance of plant technologies.
- WD and province of BC have invested $13 million in fuel cell technology demonstrations implemented in partnership with Fuel Cells Canada
- Provides support to the national industry association Fuel Cells Canada (FCC)

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Technology Partnerships Canada – R&D Program

Technology Partnerships Canada | Partenariat technologique Canada

- TPC's R&D program invests strategically in research, development activities to encourage private sector investment and technology commercialization

- TPC's R&D investments cover promising Canadian environmental technologies, ranging from improved conservation of energy, water and non-renewable resources, to the development of clean production technologies (including clean car technologies), the reduction of waste and harmful emissions, and clean-up and restoration technologies that address environmental degradation

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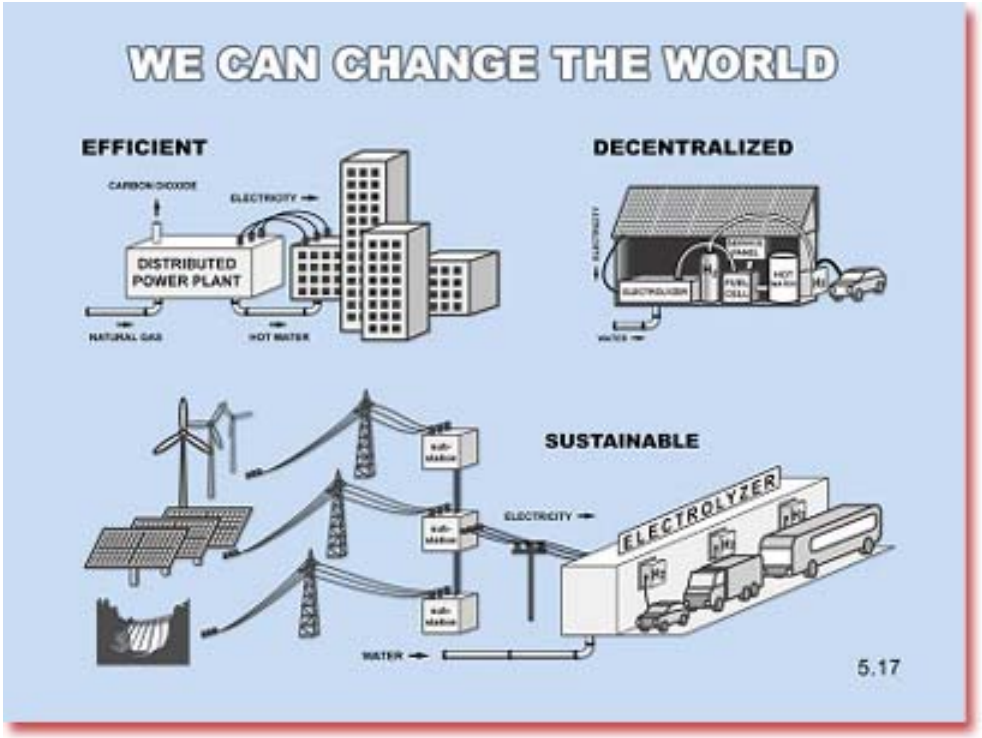
Technology Partnerships Canada H2 Early Adopters Program

- Funding of $50M over 5 years
- Partnership with industry to foster the early adoption of H2 technologies
  - Demonstrate microcosms of the hydrogen economy such as the “hydrogen highways” and “hydrogen villages”
  - Develop H2 Infrastructure, codes and standards, skilled resources and an integrated supply chain
  - Accelerate acceptance of hydrogen technologies



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