



Canada: H₂-FC Demonstration and Deployment

2009 Fuel Cell Seminar
November 19, 2009



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President

Canadian Hydrogen
and Fuel Cell Association

Importance of Hydrogen and Fuel Cells to Canada



- Hydrogen and fuel cells are a growing part of an integrated clean energy system. They **minimize the carbon impact** of fossil fuels and **optimize** renewable energy sources.
- Continued innovation in this sector advances national objectives of:
 - ✓ Economic development and job creation
 - ✓ Greenhouse gas emission reduction
 - ✓ Enhancing Canada's science and technology capacity
 - ✓ Reducing the environmental impact of our abundant fossil fuels



 **Hydrogen Highway**
L'Autoroute de l'hydrogène

The Vancouver
Fuel Cell Vehicle
Program

Le Programme de Vancouver sur les
véhicules à piles à combustible

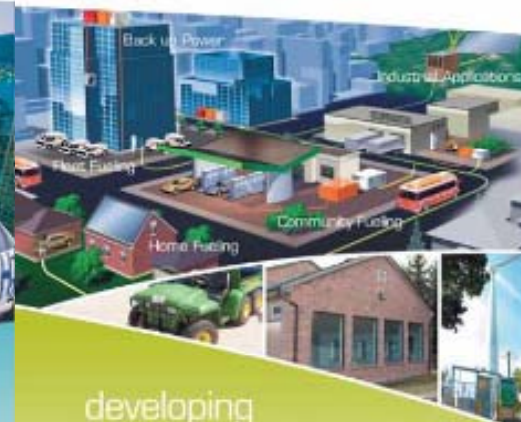

hydrogen village
Village de l'hydrogène



the route
to the future
la route
menant à l'avenir



driving
innovation
l'innovation
au volant



developing
hydrogen and fuel cell
communities
le développement de
collectivités basées sur l'hydrogène
et les piles à
combustible

Canada  Fuel Cells Canada
Piles à combustible Canada  Hydrogen Highway

Canada   Fuel Cells Canada
Piles à combustible Canada 

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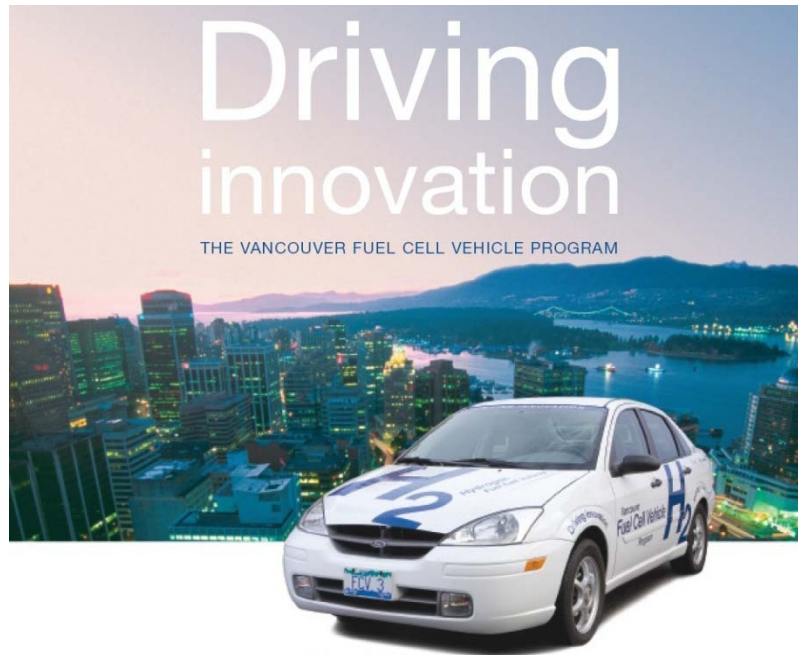
BC Hydrogen Highway

Key demonstrations:

- Network of six H₂ fueling stations
- Vancouver Fuel Cell Vehicle Program
- BC Transit fleet of 20 fuel cell buses
- Waste Hydrogen capture and purification facility
- Stationary power at a car wash
- 9 Hydrogen ICE pick ups
- 2 Ford ICE Shuttle buses
- 4 Hydrogen H-CNG buses
- Back-up and stationary power at the NRC's Institute for Fuel Cell Innovation



Vancouver Fuel Cell Vehicle Program



Canada



- 5 Ford Focus FCEVs with 5 years of operation (April 2005 to March 2010)
- More than 300,000 kilometres driven
- Highest media exposure of the five fleet deployments in N.A.
- Vehicles have exceeded design expectations and continue to operate well



Hydrogen Fueling Stations

Surrey Station

- Powertech Labs

Pacific Spirit Station at NRC-IFCI

- Linde, NRC-IFCI, Plug Power

Victoria Station

- Linde, Powertech Labs, BC Transit

Whistler, BC, Station

- Air Liquide, BC Transit

Port Coquitlam Station (HCNG)

- Clean Energy

Downtown Vancouver

- Powertech Labs



BC - Fuel Cell Electric Bus Fleet

- BC Transit will operate 20 fuel cell electric buses by 2009 in Whistler
- Sixth generation of fuel cell bus technology.
- 62% reduction in GHG emissions compared to diesel buses
- Largest H2 fuelling station in the world (1000 kg/day capacity)
- Fuel cell powered buses have traveled more than 2 million miles in revenue service, transporting more than 9 million throughout the world.



Project features Canadian technology and expertise from:

Air Liquide Canada
Ballard Power Systems
Dynetek Industries
Hydrogenics Corporation
New Flyer
Questair Technologies
Sacre-Davey Engineering



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The Hydrogen Village



What is the Hydrogen Village?

The Hydrogen Village is an **end user-driven** market development program in Metro Toronto aimed at accelerating the development and commercialization of hydrogen and fuel technologies.

- o Collaborative public-private partnership of more than 30 public and private organizations.
- o Managed the Canadian Hydrogen and Fuel Cell Association.
- o Funded by the Natural Resources Canada and the Ontario Ministry of Research and Innovation.



Objective of the Hydrogen Village

- Allow government to understand the technology and the results of their public investment using tax payer dollars.
- Public outreach: raise public awareness and deepen understanding of the technology
- Give investors an opportunity to see the technology, understand it and evaluate progress.
- Provide technology companies an early income stream along with a real-life test bed for evaluating their prototypes and products.
- Educate emergency responder and develop lessons learned for future development.



www.hydrogenvillage.ca

H2 Village Members

Air Liquide

Angstrom Power

Bell Canada

BET

Bruce Power

Canadian H2 Energy

City of Mississauga

City of Toronto

DMA Technical Services

Dynetek

Enbridge

Energy QBD

Electric Hydrogen

FTI International

Giffels Engineering

Hydrogenics

HyFI

H2Green

Interlink Connectivity

John Deere

Kinectrics

KPMG

National Research
Council

Price Waterhouse Coopers

Purolator Courier

Queen's University (FCRC)

Sarnia/Lambton Economic
Partnership

Toronto Electric

University of Ontario's
Institute of Technology

U of T Mississauga

University of Waterloo

Xebec



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Safe, Reliable, Back-up Power

- Back-up power system for a Bell Canada telecommunications switching station.
- DC output: 8kW - HyPM XR fuel cell power module
- 20 kW unit on the 5th floor office of an 80 year old office tower for an internet services company.
- Partners:
 - Hydrogenics
 - Bell Canada
 - Emerson Network Power

Note: Dantherm Power of Denmark is working in Toronto to deploy its fuel cell telecom back-up power products.



Fuel Cell Electric Fork Lifts

- 18 fork lifts working 24 hours per day, 7 days per week at GM Canada.
- 12 kW PEM fuel cell with Ultracapacitors
- Hydrogen generation and refueling inside
- Partners:
 - Hydrogenics
 - GM Canada
 - Natural Resources Canada
 - Sustainable Development Technologies Canada



Hydrogen from Wind Power

- 65 kg/day electrolyser linked to a wind turbine in central Toronto next to Lake Ontario.
- 60 kg storage
- Partners:
 - Hydrogenics
 - John Deere
 - City of Toronto
 - Exhibition Place
 - Natural Resources Canada
 - Giffles



Hybrid Fuel Cell Power Plant in Gas Utility Operation

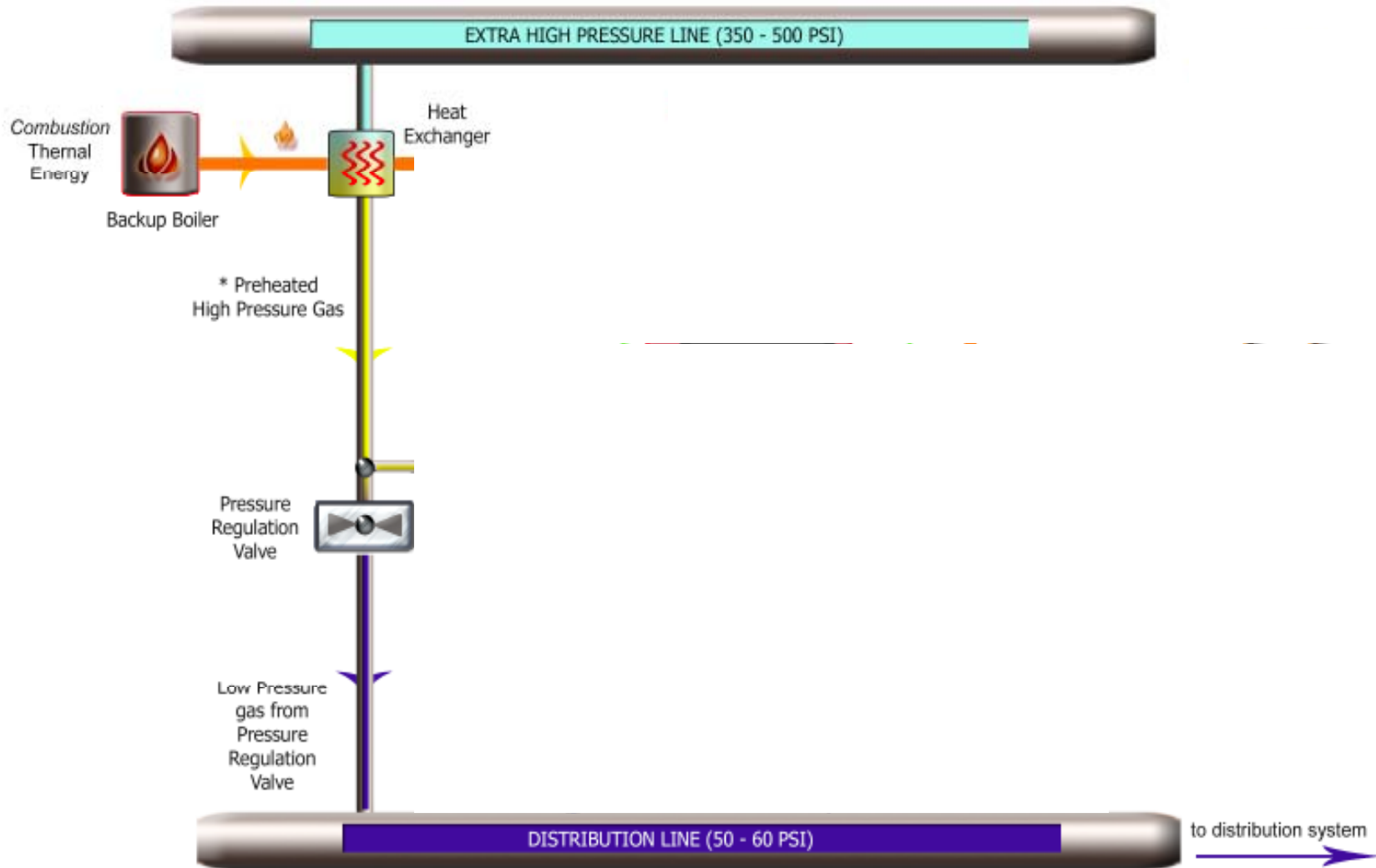
- 2.2 MW hybrid fuel cell power plant (= power for 1,700 homes)
- Partners:
 - Enbridge Gas
 - FuelCell Energy Inc.
 - Satcon
 - Natural Resources Canada



Enbridge Gas Stationary Power Plant - Toronto, Ontario

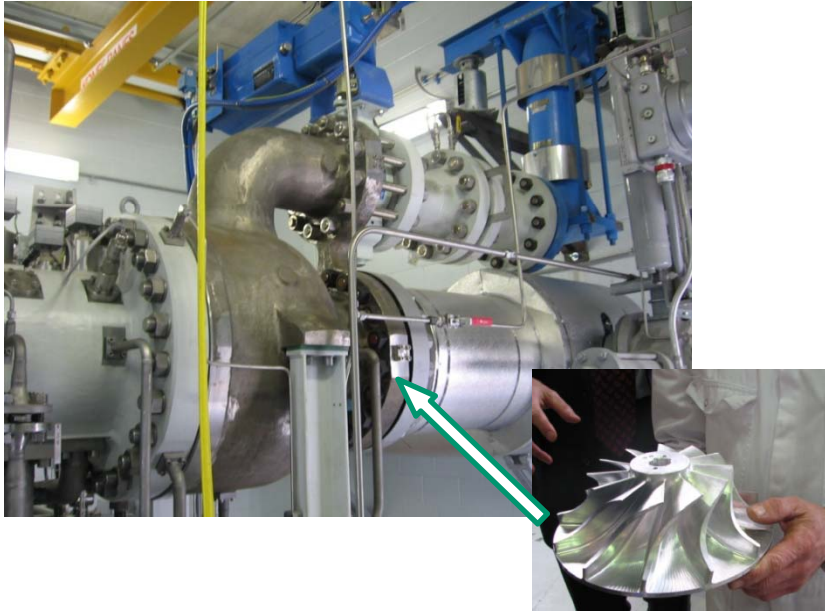


Natural Gas to Green Electricity – How Does it Work?



Source: Enbridge Gas

Hybrid Fuel Cell Stationary Power Plant



Enbridge Gas has integrated two low-carbon technologies:

- Recovery waste pressure from pipelines for power generation (1 MW Turbo-expander)
- Integrate 1.2 MW fuel cell from Fuel Cell Energy to eliminate combustion emissions and double the electricity generated
- Pilot plant fuel to electricity efficiency > 60%
Target: > 70%



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Paint Solvent to Clean Electricity

- Location: Ford Canada's auto manufacturing plant near Toronto
- 300 kW of green electricity - MCFC fuel cell from FuelCell Energy
- operates on paint fumes (volatile organic compounds) that were previously vented into the atmosphere
- Partners:
 - Ford Canada
 - FuelCell Energy
 - Industry Canada
 - Ontario Ministry of Economic Development and Trade





Hydrogen + Fuel Cells 2011

*partnerships for global
energy solutions*

International Conference + Exhibition
Vancouver, British Columbia, Canada
May 15 - 18, 2011 | www.hfc2011.com



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Thank You!

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