The Hydrogen Village: Building Hydrogen and Fuel Cell Communities

PATH – San Antonio, Texas

2007/03/19

Hydrogen & Fuel Cells Canada

Natural Resources Canada

What *is* Hydrogen Village?

The Hydrogen Village is an end user-driven, market development program.

- Started in 2004
- Collaborative public-private partnership of more than 35 companies.
- Broad cross-section of industry and end users
- Administered through Hydrogen & Fuel Cells Canada.
- Funding from NRCan's CTFCA program and the Ontario MRI.

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What *is* Hydrogen Village?

Mission:

To ***accelerate the sustainable commercialization*** of hydrogen and fuel cell technologies.

Objective:

To **seek out and develop Markets** for Hydrogen and Fuel Cell technology.

- **Develop markets for the benefit of all stakeholders**
- Create opportunities for **early deployments** throughout the Greater Toronto Area (GTA).

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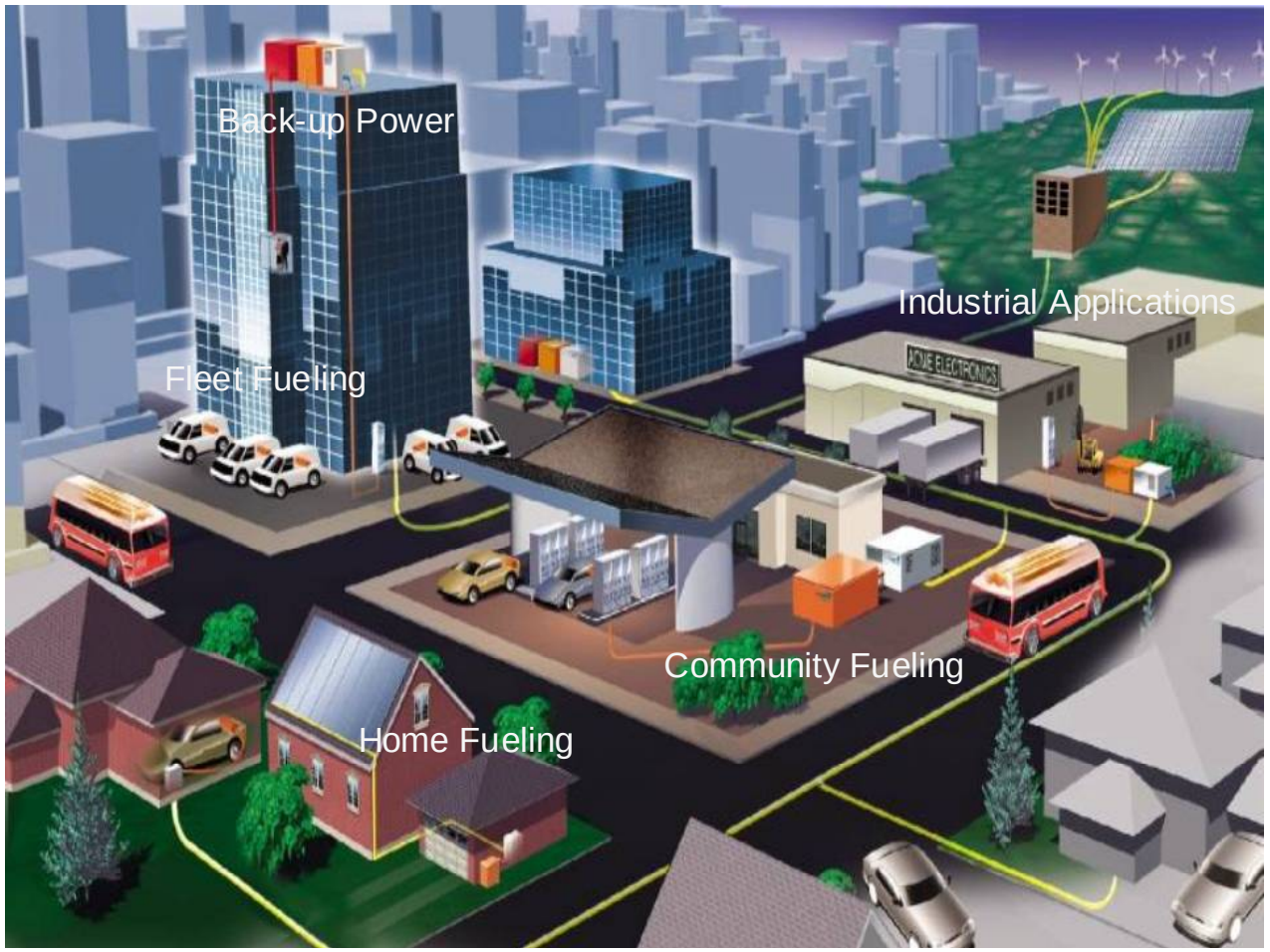
The Hydrogen Village



Hydrogen Village Goals

1. To deploy technology.
   - Ensure technology deployments (stationary, mobile and transportation) fit within the context of existing community infrastructure and activity
2. To develop a coordinated, integrated hydrogen delivery infrastructure.
   - Support the principles of conservation and sustainability
3. To create awareness in three key areas:
   - Public and Corporate policy
   - Codes/ Standards/ Regulations: Opportunity for real world implementation and feedback on developing codes and standards
   - General public awareness through educational institutions and the media

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Hydrogen Village Goals

4. To develop market support infrastructure.
   - Supply chain, service capability, and knowledge base needed to support a sustainable market
5. To contribute to the complementary growth of other centers Throughout the region.

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Hydrogen Village Membership

www.hydrogenvillage.ca

- Air Liquide
- Angstrom Power
- Astris Energi
- Bell Canada
- BET Services
- Bruce Power
- Canadian H2 Energy
- City of Mississauga
- City of Toronto
- CRESTech
- Technologies
- Decoma International
- Dynetek
- Enbridge
- Energy QBD
- FCRC
- Fuel Cell Technologies
- FTI International
- General Hydrogen
- Giffels Engineering
- Hydrogenics
- John Deere
- Kinectrics
- KPMG
- National Research Council
- Price Waterhouse Coopers
- Purolator Courier
- Questair
- Rogers Cable Communications
- Sarnia/Lambton Economic Development
- Toronto Electric
- U of T Mississauga
- University of Waterloo

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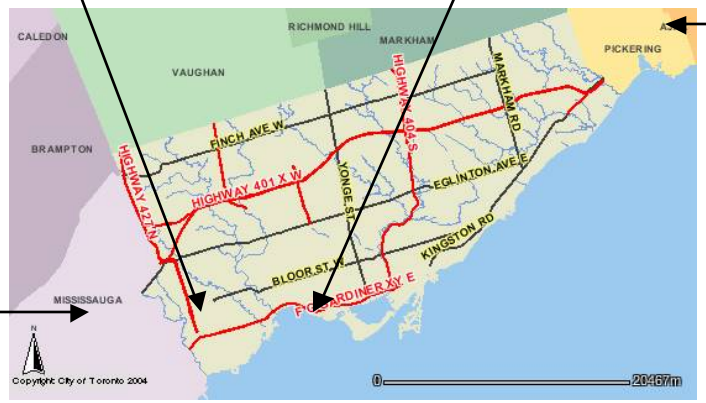
Hydrogen infrastructure

- Toronto is already developing a Hydrogen refueling infrastructure.
- Hydrogen refueling infrastructure projects are located to facilitate strategic development of the refueling system in support of future end use application deployments



GM

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Projects

- Funding for several projects has been announced through several Canadian funding initiatives(H2EA, CTFCA, SDTC).
- Seven applications projects have been approved and built.
- Twenty projects are currently under development.

1. Supply Chain Development

i. Fuelling infrastructure: Production, Storage and delivery, Handling and dispensing

ii. End use technology: Energy conversion technologies, Application integration

2. Awareness

i. Education and Awareness: Codes, Standards and Safety, Education, Outreach and Public Policy, Renewables and Conservation

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Installed:
Hydrogen Production and Refueling at Exhibition Place

- Facility opened August 24, 2004
- 65 kg/day electrolyser linked to wind power from urban wind turbine
- 60 kg storage
- CaFCP Protocol compatible dispenser
- Partners: Hydrogenics, City of Toronto, Exhibition Place, h2EA, CTFCA

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Installed:
Hydrogen FC Powered Utility Vehicles

- Four vehicles are now in regular active service at Exhibition Place. Two new vehicles were delivered on Aug 22nd, 2006 (first two in April, 2005)
- 12 kW PEM FC/ Ultracapacitor Hybrid.
- Units provide both on and off board power
- Partners: Hydrogenics, John Deere, h2EA, Exhibition Place, City of Toronto

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Installed:
Fuel Cell Fork Lifts at FedEx and GM

- Two fork lifts deployed in 24/7 high-demand operations
- 12 kW PEM FC/Ultracapacitor hybrid power train
- Indoor hydrogen generating and refueling facility installed at GM
- Transportable hydrogen refueling facility at FedEx facility at Pearson International Airport
- Forklifts remain in use at Hydrogenics
- Partners: SDTC, CTFCA, Hydrogenics, GM, FedEx, Nacco

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Installed:
Hydrogen FC Delivery Vehicles and Refueling at Purolator

- Hybrid FC/Electric drive train – 65 kW FC, 120 kW Battery
- Regular runs on highway and in inner city
- Refueling facility located at Purolator – west end of Toronto
- **Completed full season of commercial service May-November 2007**
- Partners: CTFCA, H2EA, Hydrogenics, Purolator

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Installed:
Fuel cell back-up power system

- Back-up Power system for a Bell telecommunications switching station in Burlington.
- In operation as of February 16, 2006
- DC output, 8kW HyPM XR fuel cell power module
- Partners:Hydrogenics, Bell, Emerson Network Power, h2EA

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Installed:
UTM SOFC

- Electric Power and space/water heating in a residential application
- 4 X 5 kW SOFCs in townhouse-style student residences at UTM
- Natural Gas feedstock with Hydrogen feedstock in later phase
- In operation as of April 19, 2006
- **Plans and funding now in place to complete the Hydrogen only phase of operations – expected to begin late winter 2007**
- Partners: Air Liquide, FCT, H2EA, OPG, UTM

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Installed:
Backup power for Interlink

- Unit went on line week of August 14. 2006
- 20 kW Unit located in an office in an 80 year old office tower
- Special room approved for hydrogen storage
- Fuel cells located in office space
- Longer run time than equivalent volume/footprint of a battery based system.
- Partners: APC (Denmark), H2EA, Hydrogenics, Interlink

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Projects under development

Transportation Applications:

- Small fleets operating in downtown core (Partnership formed, business case completed, conducting market surveys, and assembling MOUs)
- Shuttle buses (Developing proposals for end-use customers and two Station Infrastructure sites)
- Utility vehicle applications (Meetings with customer groups, proposal under review with Ontario MRI – second round of revisions)

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Projects under development

Portable and Stationary Applications:

UPS/BPS Power (FC and ICE):

- Critical Ops equipment (discussions underway, Preliminary proposal issued)

Micro grid supply (FC):

- Telecommunications systems (discussions underway, Preliminary proposal issued)

Battery replacement:

- Handheld equipment (City is assessing opportunity)

Grid Management

- Project development for a grid optimization project

Hydrogen House (Follow-on to CNE)

- Meetings held and proposal being assemble to combine this with a "Sustainable Condo" display.

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Projects under development

- **Studies**
  - Bruce Power
    - High temp thermo-chemical H2
    - Optimal production methods and design, siting, and power distribution for retail facilities
    - **Policy/Education Barriers**
  - Hydrogen District
    - **Overcoming Barriers to Market Development**
    - Market research
    - **Station Location**
    - Vehicle matrix

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Recent Communications Activities

- **Website**
  - Website yielding 14 hits per day for a total of >4000 hits to date
  - On line Survey yielded 140 responses to date (~3.5%)
  - Undergoing updates
- **Significant Tours**
  - 20 per year
- **Outreach**
  - > 40 presentations/year
  - 15 booths and workshops
  - CNE

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Thank you

For more information, please contact:

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www.hydrogenvillage.ca