

June 2003

## NRCan Hydrogen and Fuel Cell R&D Program



by

Vesna Scepanovic, Ph.D.

A/Program Manager, Hydrogen & Fuel Cells

CANMET Energy Technology Centre

Natural Resources Canada



# The PEI Wind-Hydrogen Symposium

June 2003

**NRCan has been the key government player in the development of the Canadian hydrogen and fuel cell industry.**

- Provides funding support for applied research and development to Canadian Industry and to universities (R&D Program)
- Provides funding for the demonstration of hydrogen fuelling systems for fuel cell vehicles (CTFCA)
- Provides funding support for the development of codes and standards (R&D Program and CTFCA)

# The PEI Wind-Hydrogen Symposium

June 2003

## History of Government Support

### pre 1983

- NRC and DND (through PERD)

### post 1983

- NRCan, DND, Industry Canada (TPC)

NRCan	\$67M
NRC	\$34M
TPC	\$40M
WD	\$13M
DND	\$12M
NSERC	\$13M
IC	\$4M
Total	\$183M

**Federal funding to date for fuel cell development: \$183 million**

**Current NRCan Hydrogen and Fuel Cell R&D program: \$4 million/year**

**Current federal support: \$40 million/year**

# The PEI Wind-Hydrogen Symposium

June 2003

## History

1980

1990

2002

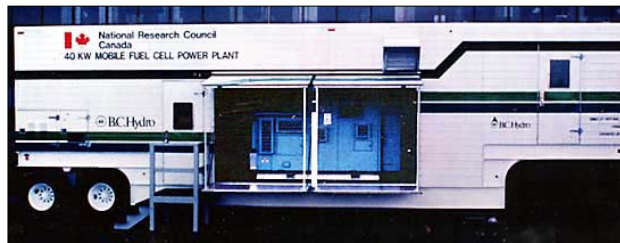


1985

NRCan

Direct Investment

1987  
1<sup>st</sup> private  
placement for Ballard



1993

1<sup>st</sup> Fuel Cell bus

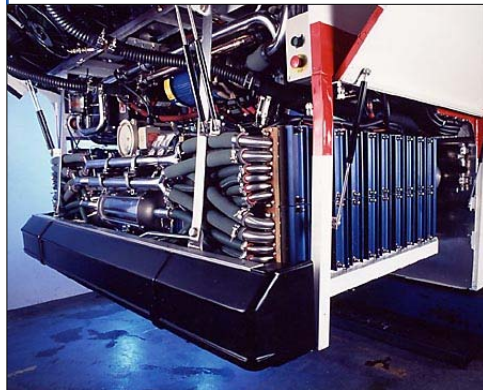


Natural Resources  
Canada

Ressources naturelles  
Canada

### History

1980



1996

World's 1<sup>st</sup> full-size  
40 ft. fuel cell bus

1990



1996

Hydrogen refueller

2002

# The PEI Wind-Hydrogen Symposium

June 2003

## History

1980

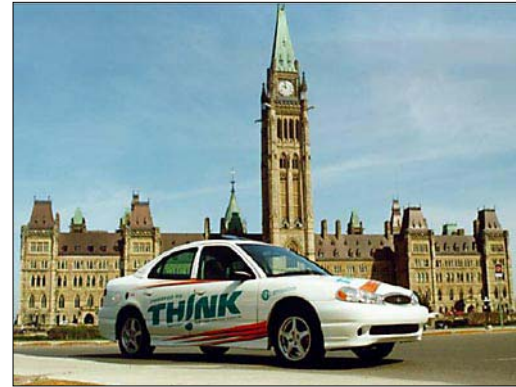
1990

2002



1997

Demos of 3 fuel cell buses in  
Vancouver & 3 in Chicago



2000

P2000 in Ottawa



Natural Resources  
Canada

Ressources naturelles  
Canada

### Hydrogen R&D Program Elements

- **Hydrogen production**
- **Hydrogen utilization**
- **Hydrogen storage**
- **Hydrogen Safety**
- **Codes and Standards**
- **Communications**



## Production

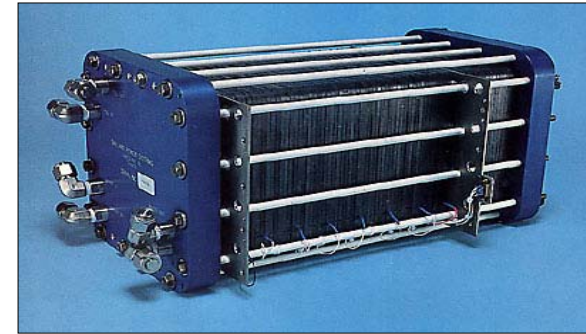
- development of electrolyzers from a “personal fuelling” size to large industrial sizes





### Utilization, including Fuel Cells

Fuel cell engine development  
for buses →



Development of a platform for  
fuel cell integration into  
homes →



## Storage

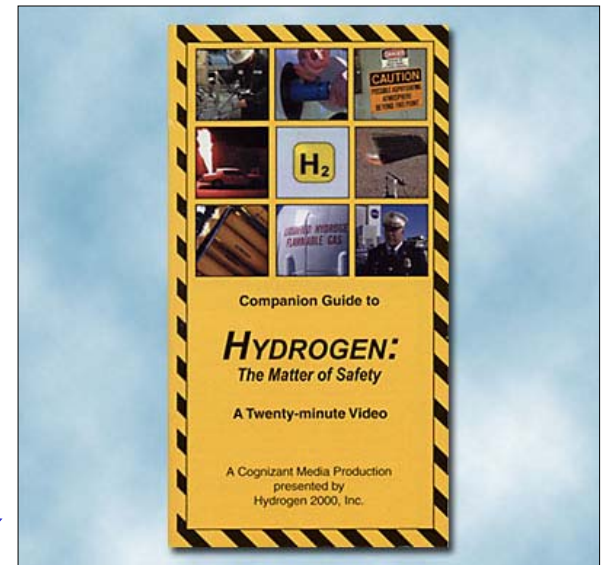
- Compressed hydrogen (5000 psig, 10,000 psig)
- Magnetic refrigeration – liquid hydrogen
- Storage in carbon and hydride nanomaterials R&D

Mobile hydrogen fuelling station →



## Safety; Codes and Standards

- Hydrogen sensor development
- Safety assessment of hydrogen fuel cell systems – modeling
- Finite volume simulation of hydrogen flares
- Support for international codes and standards work
- Production of a hydrogen safety video and hydrogen safety book

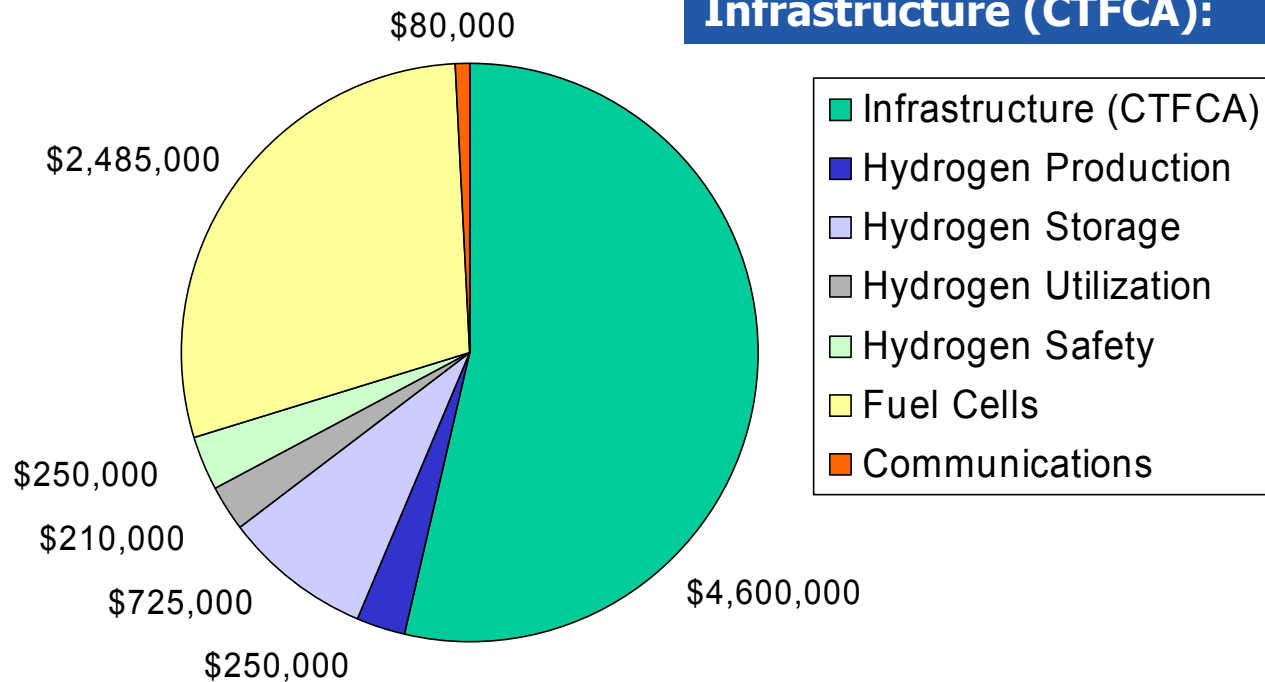


# The PEI Wind-Hydrogen Symposium

June 2003

## Annual NRCan Budget for Hydrogen, Fuel Cell and Infrastructure Activities

**Hydrogen and fuel cell R&D: \$4 million**  
**Infrastructure (CTFCA): \$4.6 million**



### Recent Highlights

#### IMW Industries Ltd.

- High-pressure H<sub>2</sub> fuelling station
- 5,000 and 10,000 psig compressors/dispensers
- TEAM project

#### HERA

- H<sub>2</sub> storage systems - alkali alanates

#### UQTR/HRI

- H<sub>2</sub> storage in carbon nanostructures

#### Dynetek

- 5,000 psig fuelling trailer - TC Certification pending
- 10,000 psig storage cylinders



### Recent Highlights

#### FCC/Ford

- 5 Ford Focus fuel cell vehicles
- 3 year Vancouver demo
- TEAM project



#### Palcan

- Improve MEA current density
- Mass manufacturing process



#### Hydrogenics

- 10kW power module
- Off-road applications & APUs





### Recent Highlights

#### Hybrid Fuel Cell Transit Bus

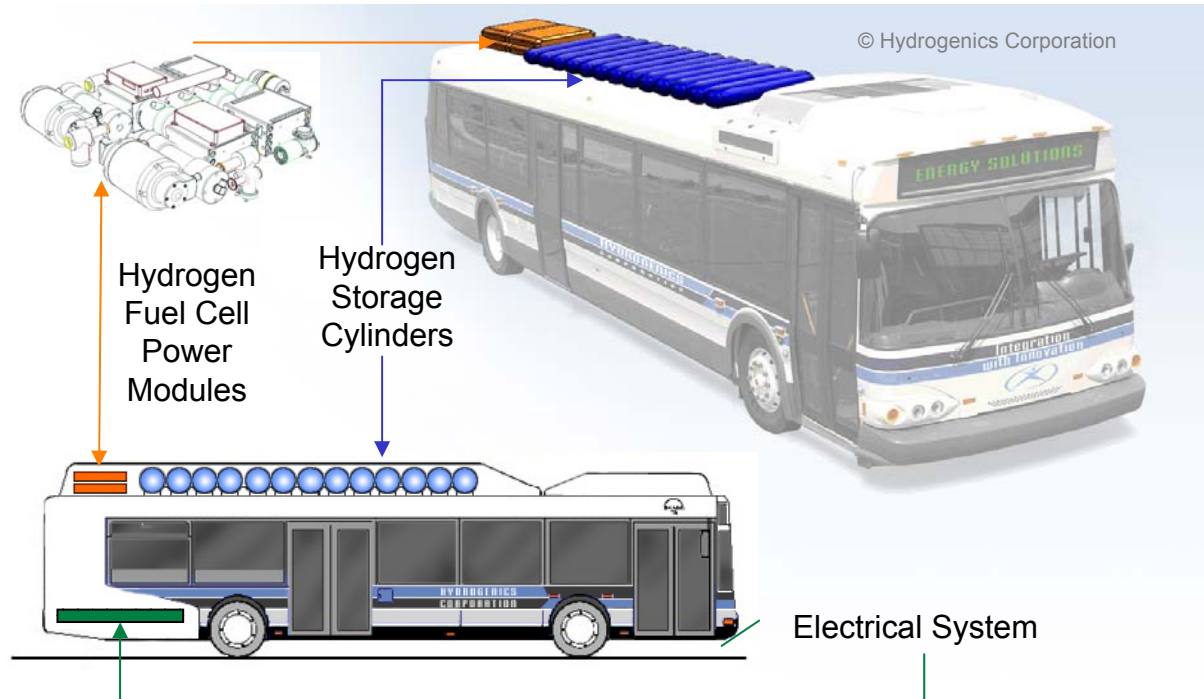
- Hydrogenics, Manitoba, New Flyer, Dynetek, ISE Research, Maxwell Technologies
- Improve efficiency 25%
  - ultracapacitors and weight optimization
- To be demonstrated in Winnipeg 2005



# The PEI Wind-Hydrogen Symposium

June 2003

- NRCan and Manitoba government funding
- Industry partners
- Vehicle to grid component



# The PEI Wind-Hydrogen Symposium

June 2003

## H<sub>2</sub> & FC activity centers

