INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update May 2018: Canada

Name	Eric Barker
Contact information	eric.barker@canada.ca; +1 604 666-1426
Covered Period	December 2017 – May 2018

1. New Policy Initiatives on Hydrogen and Fuel Cells

Over the past six months, all levels of government have collaborated to encourage action in supporting hydrogen and fuel cells (HFC), and clean technologies in general. Developments include:

Federal Government

- The Government of Canada continues to focus efforts as outlined in the Pan-Canadian Framework on Clean Growth and Climate Change.
- Natural Resources Canada (NRCan) was allocated **$80M** for phase II of the Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative. The funds will be used to incent the development of Electric Vehicle (EV), Fuel Cell Electric Vehicle (FCEV) and Natural Gas (NG) fueling infrastructure in Canada over 4 years. Three Hydrogen Refueling Stations (HRSs) were supported under Phase I and up to 15 additional HRSs will receive support under Phase II.
- Transport Canada commissioned a study to identify the prerequisites for the deployment of safe, secure and effective HFC operations on railways ("**hydrail**") for both passenger and freight. The study concluded that: safety and regulatory norms for the storage and handling of hydrogen (H2) need to be formulated; first emergency responders need to be trained; corporate employees and the public need to be informed; and, that a regulatory hydrail group would be required to enable the safe implementation of hydrail in Canada.
- Canada's national **Zero Emission Vehicle (ZEV) Strategy** is to be release in 2018. Similar strategies are under development regarding low carbon fuels and carbon taxes.
- The **$1.26B** Strategic Innovation Fund (SIF) which aims to spur innovative R&D and expansion of businesses in Canada has received over 700 applications, some of which are for the development HFC solutions and infrastructure.
- Canada's **$950M** Innovation Supercluster Initiative competition has resulted in the selection of five consortia, some of which may choose to deploy HFC technologies:
    - Oceans Supercluster
    - Artificial Intelligence Supercluster
    - Advanced Manufacturing Supercluster
    - Protein Industries Supercluster
    - Digital Technology Supercluster

Provincial: British Columbia (BC)

- The first of six HRSs to open in BC at a Shell service station in Vancouver on June 15th, 2018 by Hydrogen Energy Technology Corporation (HTEC). The BC Ministry of Energy, Mines, and Petroleum Resources (MEMPR) made a **$1.5M** contribution towards the development of 3 of the initial HTEC's stations (News Article). Stations will be located in Vancouver (2), Burnaby (2), North Vancouver and Victoria.
- On April 1, 2018, the carbon tax was increased from $30/tonne to $35/tonne. Carbon taxes are to increase by $5/tonne/year until rates reach $50/tonne in April 2021.
- The BC government, in partnership with the BC Climate Solutions and Clean Growth Advisory Council, committed to developing and releasing a Climate Solutions and Clean Growth Strategy in the fall of 2018. The strategy will include a vision for climate action and clean growth, update legislated targets, and certain foundational actions and sectoral plans for transportation, buildings, communities and industry.
- BC's **$40M** Clean Energy Vehicle Program continues to provide support for ZEV purchase incentives and the development of HRSs.
- An additional **$2.5M** contribution was made to the zero-emissions specialty vehicles program. Zero-emission specialty-use vehicles include electric or hydrogen fuel cell motorcycles, low-speed utility trucks, transport trucks, passenger buses, forklifts along with airport and port service vehicles.
- **$1M** has been committed to help incent the deployment of FCEV fleets in BC.

Provincial: Ontario

- Ontario's first public HRS is to open in Mississauga before year end.
- Metrolinx released its hydrogen rail (**Hydrail**) Feasibility Study. Key findings include:
    - It should be technically feasible to build and operate the GO Transit network using HFC powered rail vehicles;
    - The overall lifetime costs of building and operating the Hydrail System are equivalent to that of a conventional overhead electrification system; and
    - The implementation of the Hydrail system of this scale and complexity is innovative and presents a different set of risks as well as benefits, as compared to conventional electrification.
- Metrolinx hosted an international Hydrail Symposium in November 2017 to discuss the opportunities and challenges of wireless electrification of rail systems.

Provincial: Quebec

- Quebec's ZEV Standard came into effect on January 11, 2018. Automakers covered by the standard will earn credits through the sale of zero-emission (ZEV) or low-emission (LEV) vehicles to residents in Quebec. Credits will be awarded in proportion to the efficiency of vehicles and the relative number of ZEVs sold in the province annually.
- Toyota Canada has committed to bringing 50 FCEVs to the market and is working with Quebec by investing in a pilot network of multi-fuel stations, including hydrogen.

- A separate MOU was signed to jointly study the market requirements for the development of H2 infrastructure and the introduction of FCEVs.

Municipal Governments

- The City of Vancouver, BC, has established an Electric Vehicle Expert Advisory Panel, which aims to study, evaluate and deploy additional light and heavy duty zero emission vehicles in their fleet. Fuel cell electric vehicles (FCEVs) are being considered along with plug-in electric vehicles (EVs).
- Several other Canadian municipalities are considering adding FC powered vehicles to their light and heavy duty fleets.

2. Hydrogen and Fuel Cell R&D Updates

The University of British Columbia's Clean Energy Research Centre is designing a next generation multi-fuel station to be built on campus. The retail station, which will include renewable hydrogen production/distribution, EV fast charging along with diesel and natural gas dispensing will also be used for research, development, demonstration and educational purposes.

3. Demonstration and Deployment Updates

The Canadian FCEV Coalition of automakers, made up of Honda, Hyundai, Kia, BMW, Mercedes-Benz and Toyota, will host public FCEV events in Vancouver and Victoria, BC (May 15-17, 2018). Participants will have an opportunity to meet with OEMs introducing FCEVs to the Canadian market, and test drive Toyota, Hyundai (Nexo), Honda FCEVs.

Ballard Power Systems

- Announced that a subsidiary of strategic partner Zhongshan Broad-Ocean Motor Co., Shanghai Edrive, has commissioned its FC engine manufacturing facility located in Shanghai, China. Shanghai Edrive will assemble Ballard's 30kW and 85kW FC engines at the facility under a technology transfer, licensing and supply arrangement. Catherine McKenna, Canada's Minister of Environment and Climate Change participated in the opening ceremonies.

- Developed a next generation high performance FC propulsion system to power unmanned aerial vehicles (UAVs) or drones. Ballard also received a follow-on contract from Insitu, a Boeing subsidiary, for extended durability testing of the next-generation 1.3kW FC propulsion system.
- Announced the deployment of 500 licensed HFC electric commercial trucks in Shanghai, China. Believed to be the world's largest deployment of FC commercial trucks.
- Signed a contract with CALSTART for a 30kW FC module to be used in a trial and development program involving UPS Class-6 delivery vans operating in California's South Coast Air Basin.
  Received a follow-on purchase order for the supply of SPM-622 Squad Power Manager Kits to support US Army Security Force Assistance Brigades (SFAB). Successfully integrated and tested two 30 kW modules in a hybrid marine application by a consortium that includes

Yanmar Co, National Maritime Research Institute and Japan Ship Technology Research Association (JSTRA).

Hydrogenics

- Hosted Canadian Prime Minister Justin Trudeau as he visited Beijing. Hydrogenics, along with their strategic alliance partner SinoHytec, had an opportunity to showcase a Foton FC powered bus which they co-developed. Hydrogenics and SinoHytec are promoting a fleet of 150 FC electric buses (FCEBs) in Zhangjiakou, the site of the 2022 Winter Olympic Games.
- Received a $7.8M order from an undisclosed customer to supply FC power systems for zero-emission vehicles in China.

The Maritime HFC project developed with the support of Sandia National Laboratories to test a HFC powered generator as an alternative to conventional diesel generators proved to be more efficient than the diesel generators currently used to provide power for refrigerated containers on land and on transport barges in Hawaii. The systems will now be deployed to power refrigerated containers onboard barges traveling between the Honolulu and Kahului harbors. Operational, safety and cost performance data to be used to develop business cases for using HFCs at other commercial ports.

HTEC

Partnering with Shell Canada to open Canada's first retail hydrogen refueling station in Vancouver, BC (June 15, 2018). This station will be the 1st in a six-station network HTEC is building in Greater Vancouver and Victoria to enable the deployment of the first 1000 FCEVs in BC.

4. Events and Solicitations

- 10th Clean Energy Ministerial and 4th Mission Innovation Ministerial meetings will be co-located in Canada in 2019. Dates and locations to be announced (Press Release).
- Canadian delegations will be present at the following events:
  - **WHEC 2018** (Rio de Janeiro, Brazil) – June 17-22, 2018
  - **World of Energy Solutions 2018** (Stuttgart, Germany) – October 2018
  - **China Int'l Hydrogen & Fuel Cell Conference and Exhibition** (China) – TBD

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

- The BC government announced they are investing $230,000 + an additional $60,000 of in-kind support through its electrical utility (BC Hydro) in a techno-economic feasibility study aimed at examining the potential for large-scale production of renewable hydrogen in BC. Participants include: ITM Power, BC Hydro, Chiyoda Corporation and Mitsui.
- The federal department of Western Economic Diversification announced a $670,000 contribution to the Canadian Hydrogen and Fuel Cell Association (CHFCA) to further support their member's international marketing and training efforts.

- The Government of Canada, along with the CHFCA, will support industry participation in priority events such as the upcoming WHEC 2018.

6. Regulations, Codes, and Standards Updates

Various federal departments have initiated dialogue to review codes & standards for H2 metering to enable accurate retail sales. Future discussions will engage industry, academia along with other IPHE members.

INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

Summary Country Update May 2018: Canada

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
Fuel Cell Vehicles[1]	N/A	17	Vehicle roll-out for next 2 years likely to focus on 3 urban centres: Greater Vancouver and the Greater Toronto region and Quebec.	Provincial product purchase incentives. Federal infrastructure incentives. ZEV Mandate (Quebec)
FC Bus	N/A	1 (Ballard)	Chinese Joint Venture	Chinese government incentives
Fuel Cell Trucks[2]	N/A	2 (under development)	Private Public Partnerships	Federal programs
Forklifts	N/A	Over 400	Industry partnerships.	Commercial sales
H_2 Refueling Stations	**Target Number**		**Partnerships, Strategic Approach**	**Policy Support**
70 MPa On-Site Production	N/A	2 (1 under development)	Public, private & academic partnership	Provincial program support
70 MPa Delivered	8	1	Private public partnerships	Federal and provincial (BC) program support
35 MPa On-Site Production	N/A	1	Academic research	Provincial Policy Support
35 MPa Delivered	N/A	5	Commercial sales	

[1] Includes Fuel Cell Electric Vehicles with Range Extenders
[2] As above

Stationary	Target[3]	Current Status	Partnerships, Strategic Approach	Policy Support
Small[4]	N/A			
Medium[5]	N/A			
Large[6]	1	Under development	Private public partnership	Ontario government program support
District Grid[7]	N/A			
Regional Grid[8]	N/A			
Telecom backup	N/A			
H_2 Production	**Target[9]**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
Fossil Fuels[10]	N/A	Approximately 3 million metric tonnes per year		
Water Electrolysis[11] (PEM, Alkaline, SOEC)	N/A	TBD		

[3] Targets can be units installed and/or total installed capacity in the size range indicated
[4] <5 kW (e.g., Residential Use)
[5] 5kW – 400 kW (e.g., Distributed Residential Use)
[6] 0.3MW – 10 MW (e.g., Industrial Use)
[7] 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)
[8] 30MW plus (e.g., Grid Storage and Systems Management)
[9] Target can be by quantity (Nm^3, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target
[10] Hydrogen produced by reforming processes
[11] Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)

By-product H_2		TBD		
Energy Storage from Renewables	**Target[12]**	**Current Status**	**Partnership, Strategic Approach**	**Policy Support**
Power to Power[13] Capacity				
Power to Gas[14] Capacity	2	200 kW PtG system with 300 kg of H2 (Raglan Mine, Quebec) 5 MW PtG under development (Enbridge/ Hydrogenics)	Private, public, partnerships	Federal and provincial policy support.

[12] Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity
[13] Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity
[14] Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)

Hydrogen Refueling Stations	Capacity	Dispensing Pressure	Production Method
South Granville, Vancouver, British Columbia (HTEC – Opening June 15, 2018)	120kg/day	70 MPa	Electrolysis
Burnaby, British Columbia (HTEC – Design and permitting in progress)	120kg/day	70 MPa	Electrolysis
Greater Vancouver (To be announced)	100kg	70MPa	Electrolysis
Surrey, British Columbia (Powertech Labs)	Storage at 45MPa: 60kg Storage at 85MPa: 60kg	35/70 MPa	On-site Electrolysis (24kg/d)
Burnaby, British Columbia (Ballard)	Storage at 25MPa: 4700 kg Storage at 25MPa: 2400 kg	35 MPa	Methane/Natural Gas
Greater Toronto Area (GTA), Ontario (Location to be announced)	100kg	70MPa	Electrolysis
Mississauga, Ontario (Under development)	60kg	70MPa	Electrolysis
Brampton , Ontario (Canadian Tire – 74 FC forklifts)	TBD	35 MPa	On-site Electrolysis
Bolton, Ontario (Canadian Tire – forklifts TBD)	TBD	TBD	On-site Electrolysis
Cornwall, Ontario (Walmart – 240 FC forklifts)	TBD	35 MPa	Electrolysis
Balzac (Calgary), Alberta (Walmart – 230 FC forklifts)	TBD	35 MPa	Electrolysis
Mississauga, Ontario (Hydrogenics)	Storage at 20MPa	35 MPa	Electrolysis
Trois Rivières, Québec (WEH Gas Technologies)	TBD	70 MPa	On-site Electrolysis