INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update April, 2017: Canada

Name	Eric H. Barker
Contact Information	eric.barker@canada.ca , 604-666-1426
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1. New Policy Initiatives on Hydrogen and Fuel Cell

Federal government: A number of items in the March 2017 Canadian federal budget reinforced the government`s position that a competitive economy and environmental protection are linked. Priorities include: Pan Canadian Green Infrastructure Bilateral Agreements ($1.6B); Financing support for Canada's clean technology sector ($1.4B); Sustainable Technology Tech Fund ($400M); clean technology research, development & demonstrations ($230M); support for deployment of emerging renewable energy technologies nearing commercialization ($200M); clean energy vehicle infrastructure development ($120M); greenhouse gas reduction regulations ($75M) Clean Technology Data Strategy ($14.5M); Clean Growth Hub ($12M).

Over the past six months, the following action items have been taken:

- Release of the Pan-Canadian Framework on Clean Growth and Climate Change, a national strategy on reducing emissions across all sectors of the economy. Of particular interest are the sections on:
  - Setting emissions standards;
  - Creation of a potential national ZEV strategy by 2018;
  - Creation of a national fuel standard with a focus on alternative fuels such as hydrogen, including a commitment to support the development of related charging/hydrogen refuelling infrastructure; and
  - Carbon pricing. While four provinces already have a carbon pricing policies in place, all provinces must adopt one by 2018. For those who do not, the federal government will introduce a carbon pricing system for them.
- $950M announced for the development of innovative "super clusters" expected to have broad economic and environmental impacts. Extensive consultations with leading innovators from industry, academia and other levels of government have taken place, nationally.
- An increasing number of federal, provincial and municipal governments are reengaging with the HFC industry and related initiatives.
- The Government of Canada (GoC) has committed to the development of a national HFC Roadmap (2016/2017).
- An Economic Analysis and Modelling of Retail Hydrogen Refuelling Station (HRS) Infrastructure project has been completed.
- The GoC announced a $1.65M contribution towards the construction of two publically available HRSs in the Greater Toronto Area (GTA – Mississauga & Markham). HRS development and operation partners include Hydrogenics Corporation and Enbridge Gas. Additional HRS commitments to follow.
- The 2016 "Canadian Hydrogen & Fuel Cell Sector Profile" has been translated and available on the Canadian Hydrogen and Fuel Cell Association website in English and French.

- Transport Canada's FCEV environmental and safety performance evaluations are ongoing.
- Natural Resources Canada (NRCan), Transport Canada and the US Department of Energy have reengaged in HFC Codes & Standards related discussions. A North American workshop was hosted in Ottawa, March 2017.

Provincial governments

The **Government of British Columbia (BC)** continues to support the introduction of clean energy vehicles (CEVs) in the Pacific region through product purchase and infrastructure development incentives. FCEVs are eligible for a $6,000 rebate and EVs $5000. The BC CEV program is also providing support towards the development of a new retail HRS in the Vancouver area and potentially in Victoria, the capital of BC. Nearing the end of its funding, an additional $40 million was announced in February 2017 to extend the CEV program.

The Zero Emissions Vehicle (ZEV) mandate which was announced by **Quebec** in October, 2016 will come into effect September 2017. Automakers will be required to meet a ZEV sales target of 3.5% of total annual sales, with the expected result of an increased variety of ZEVs with lower prices for end consumers. This percentage will rise to 15.5% by 2020, helping to ensure Quebec's target of 100,000 ZEV vehicles on the road by 2020 is achieved. Quebec is the first province in Canada to adopt a ZEV mandate, setting a potential model for the rest of the country to adopt.

Pan-Canadian Framework on Clean Growth and Climate Change
Developed in consultation with the provinces and territories (November 2016), this Framework is leading to increased collaboration across the nation. In implementing the Framework, federal, provincial and territorial governments will review progress annually to assess the effectiveness of their collective actions and ensure continual improvement. First Ministers commit to report regularly and transparently to Canadians on progress towards GHG-reduction targets, on building climate resilience, and on growing a clean economy.

2. Hydrogen and Fuel Cell R&D Update

In an effort to encourage various levels of government to support the adoption of FCEVs in Canada, automotive OEMs have come together and formed the Canadian Fuel Cell Electric Vehicle (FCEV) Coalition. Members include: Toyota, Hyundai, KIA, Honda, Daimler and BMW.

In June 2017, the Catalysis Research for Electrolyte Fuel Cells Network (Carpe-FC) will host their 5th and last technical workshop in Vancouver to discuss their latest research in catalyst layers for polymer electrolyte fuel cells. Carpe-FC is a pan-Canadian academic network with active participation from 8 universities, 4 SMEs, an industry association, and three government departments. The government of Canada contributed $5M over 5 years to support their efforts.

3. Demonstration and Deployments Update

In July, 2016, **Air Products** opened a new $300M hydrogen production plant in Strathcona County, Alberta, in the centre of Alberta's industrial heartland. The facility has the capacity to produce 4.2 million cubic metres of hydrogen daily and is tied into a 50km of hydrogen pipeline linking it directly to customers along with Air Products two other hydrogen plants on "refinery row". The hydrogen is produced from steam methane reforming and there's a

possibility that the carbon produced could be stored in Shell Canada's $1.3B Quest Carbon Capture & Storage facility.

Ballard Power Systems has closed a deal with Chinese Zhongshan Broad-Ocean Motor Co. providing them the rights to manufacture fuel cell modules in three strategic regions in China, including Shanghai. The deal has an estimated value of $25 million in revenue to Ballard over the initial 5-year term. This marks a central piece in their China strategy, premised on the establishment of a comprehensive local fuel cell supply chain and related ecosystem to address the fast-growing clean energy bus and commercial vehicle markets.

In the past 6 months Ballard has also signed deals to provide 30 of its FCveloCity 85 kilowatt fuel cells for bus projects across North America and Europe.

4. Events and Solicitations

Hydrogen & Fuel Cells 2017 Summit - HFC2017: June 5 – 6, 2017, Vancouver, BC. A biennial conference, hosted by the Canadian Hydrogen and Fuel Cell Association (CHFCA) to increase awareness of the economic, environmental and social benefits of hydrogen and fuel cells.

Globe 2018: March 14 – 16, 2018, Vancouver, BC. A biennial international conference and trade show which attract over 3,500 senior delegates from over 50 countries to discuss environmental issues and solutions. Prime Minister Justin Trudeau and 7 of his Cabinet Ministers participated in the previous Globe event (2016).

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

The Government of Canada recently committed to investing and additional $120M ($165M in total) into the deployment of low carbon refuelling and charging infrastructure (electric, hydrogen & natural gas). To date, a contribution of $1,625,000 was announced for the construction of two public hydrogen refuelling stations in partnership Hydrogenics Corporation and Enbridge in the Greater Toronto Area. Two additional stations are expected to be announced shortly.

Under the Pan-Canadian Framework on Clean Growth and Climate Change, British Columbia and the Government of Canada have agreed to work together to spur the development and commercialization of new technologies that will reduce emissions and create employment. This includes the creation of a $40M Partnership to support the development of clean energy projects and technologies.

Sustainable Development Technology Canada (SDTC) recently announced 1) a $10 million non-repayable contribution to AFCC towards the development of a commercial automotive fuel cell stack along with 2) a $7M non-repayable contribution to Loop Energy towards the development of FC range extender for heavy duty port vehicles.

Summary Country Update April 2017: Canada

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
Fuel Cell Vehicles[1]	N/A	20	Vehicle roll-out for next 2 years to focus on 2 urban centres: Greater Vancouver and the Greater Toronto region. Quebec to follow.	Provincial product purchase incentives. Federal infrastructure incentives.
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	Approximately 400	Industry partnerships.	Commercial sales
H_2 Refueling Stations	**Target Number**		**Partnerships, Strategic Approach**	**Policy Support**
70 MPa On-Site Production	N/A			
70 MPa Delivered	5	3	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 Number[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 tonnes per year		
Water Electrolysis[11]	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)

(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 Filling Stations (Nationwide)

Total of 11 hydrogen filling stations

Station	Capacity	Dispensing Pressure	Production Method
Vancouver, British Columbia (HTEC – public station under development, location to be announced	TBD	70 MPa	Electrolysis
Greater Vancouver (Public station 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 25 MPa: 4700 kg Storage at 25 MPa: 2400 kg	35 MPa	Methane/Natural Gas
Greater Toronto Area (GTA), Ontario (Location to be announced)	100kg	70MPa	Electrolysis
GTA, Ontario (Location to be announced)	60kg	70MPa	Electrolysis
GTA, Ontario (Canadian Tire – 74 FC forklifts)	TBD	35 MPa	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, Quebec (WEH Gas Technology)	TBD	70 MPa	On-site Electrolysis