INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update November 2017: Canada

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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, and clean technologies in general. Developments include:

Federal

- Transport Canada commissioned a study of the deployment of Fuel Cell trains in Canada. The project's objective is to interview experts in industry, government, and academia, and to identify prerequisites to deploying **hydrogen-powered railways** ("hydrail") in Canada.
- The completion of a series of consultations for the creation of a **national Zero Emission Vehicle (ZEV) strategy** under the Pan-Canadian Framework on Clean Growth and Climate Change. Similar consultations have informed policy makers engaged in the development of a low carbon fuels strategy and carbon taxes.
- The creation of a **$1.26B** Strategic Innovation Fund (SIF) which spur innovative R&D and expansion of businesses in Canada.
- Infrastructure Canada is more than quadrupling its investments in green infrastructure, from $5B in Budget 2016 to **$21.9B** in Budget 2017 (more info). To further support green initiatives, on top of the original $5B in 2016, Infrastructure Canada will commit:
    - $5B through the Canada Infrastructure Bank, a newly-established arm's length Crown Corporation with the goal of investing at least $35B into large, revenue-generating infrastructure projects over 11 years;
    - $9.2B through **Integrated Bilateral Agreements** to co-invest in green projects with provinces and territories; and,
    - $2.8B through various national green programs.
- Separately, Infrastructure Canada will invest **$400M** to the Arctic Energy Fund for energy security in rural and northern communities.
- The announcement of a **$2B** Low Carbon Economy Fund to help fund projects that reduce GHG emissions, support jobs and innovation, and increase energy efficiency
    - **$1.4B** allocated to support provinces in reaching GHG emission reduction goals;
    - **$600M** allocated to the creation of a Low Carbon Economy Challenge which will be open to both public and private sectors.
- Nine consortiums were selected as finalists for the **$950M** Innovation Supercluster Initiative; relevant consortiums include the:
    - Smart, Sustainable and Resilient Infrastructure (SSRI) Supercluster;
    - Mobility Systems and Technologies for the 21st Century Supercluster; and,

- Clean, Low-energy, Effective, Engaged and Remediated (CLEER) Supercluster: Powering Clean Growth Through Mining Innovation.

Provincial: British Columbia

- A new government was formed in British Columbia, led by a partnership between the **New Democratic Party** and the **Green Party**. Relevant priorities include:
  - Carbon tax rates no longer need to be carbon neutral, and will be increased by $5/tonne per year until rates reach $50/tonne in April 2021;
  - The $40M Clean Energy Vehicle Program, providing support for ZEV purchase incentives and the development of HRSs, remained unchanged in the transition;
  - Create a roadmap for innovative energy conservation and production in BC; and,
  - Reinvigorate the Innovative Clean Energy fund to boost investments in ground-breaking energy technologies and climate change solutions.

Provincial: Ontario

- The Government of Ontario established an **Electric and Hydrogen Vehicle Advancement Partnership** through which industry and academia can work with governments to advance ZEV and reduce GHG emissions through various programs
  - e.g. Only EHVAP members can be offered rebates through the updated Electric Vehicle Incentive Program ($3,000-14,000 in purchase incentives).
- The Government of Ontario created a **Municipal GHG Challenge Fund**, which allows Ontario municipalities to apply for up to $10M in grants for GHG-reducing projects, including zero-emission fleets. The sharing ratio of the project can be as low as 0%.
- Target of 5% of all new passenger vehicles sold to be BEVs or FCEVs by 2020.

Provincial: Quebec

- The public consultation period for Quebec's **ZEV Mandate**, the first of its kind in Canada, ended in August; comments are being reviewed, and implementation is to begin in 2018.
- Toyota Canada is working with Quebec by investing in a pilot network of multi-fuel stations, including hydrogen fuel. A separate MOU was signed to jointly study the market requirements for the development of H2 infrastructure and the introduction of FCEVs.

Municipal

- As a signatory to the **C40 Fossil Fuel-Free Streets Declaration**, the City of Vancouver has pledged to: 1) procure only zero-emission buses from 2025, and 2) ensuring a major area of the city is zero emission by 2030.
  - Other signatories include; Paris, London, Los Angeles, Copenhagen, Barcelona, Quito, Cape Town, Seattle, Mexico, Auckland and Milan.
- Action items include:
  - Procuring ZEVs for city fleets as soon as possible;
  - Publicly report every two years on the progress made towards these goals; and,
  - Collaborate with suppliers and businesses to accelerate the shift to ZEVs.

2. Hydrogen and Fuel Cell R&D Updates

- Leading HFC experts at Simon Fraser University were appointed as Canada Research Chairs and received $5.2M in funding to research polymer membranes. One of their membranes has been tested and will be sold through a spin-off, Ionomr Innovations Inc.
- In partnership with Nisshinbo Holdings, Ballard Power Systems developed the world's first commercialized Non-Precious Metal Catalyst, and has successfully integrated the catalyst into a stack used for ultra-lightweight applications (Press release).

3. Demonstration and Deployment Updates

- **Ballard Power Systems** reached numerous deployment achievements such as:
  - Signed a Development Agreement with Siemens to design a 200kW FC for Siemens' new Mireo commuter platform. To be deployed in 2021(Press release);
  - Supply contracts with companies worldwide for the deployment of over 400 fuel cell electric buses and trucks, including an extended partnership with Zhongshan Broad-Ocean Motor Co., building on Ballard's China strategy (Press release);
  - Involvement in the planning of the Shanghai Fuel Cell Vehicle Development Plan, and the potential contribution to various deliverables, including the construction of 2 demo areas and the annual production of 3000 FCEVs (Press release);
  - Protonex Technology Corporation, Ballard's fully-owned subsidiary, received approval from the US military to enter full-rate production status for its Mobile solider Power Program of Record (Press release); and,
  - Protonex sold its first fuel cell stack for drones to FlyH2, a South Africa-based developer of FC UAVs, to be used for infrastructure monitoring (Press release).
- **Hydrogenics** also continues to increase the deployment of heavy-duty applications:
  - Signed a US$50M agreement with China's Blue-G New Energy Science & Technology to integrate 1,000 hydrogen fuel cells on city buses (Press release);
  - Working with UPS to deploy 17 FC delivery trucks in the US by 2018 year-end; truck unveiled at the 2017 Advanced Clean Transportation Expo (Press release);
  - Supplying fuel cells to Alstom for an additional 14 hydrogen fuel cell multiple-units (with options for 33 more) to be used in Lower Saxony (Press release).
- An Electric Vehicle Discovery Centre was built in Toronto, at which visitors can learn about how EVs work and related subsidies, and test-drive various models for free.
- Loop Energy developed a fuel cell range extender system which is now fully functional and operational in a heavy-duty terminal tractor in China (Press release).
- Daimler announced the pre-production of its GLC F-Cell, a FCEV with a fuel cell stack developed by **AFCC** and manufactured by MBFC in Burnaby, BC (Press release).
- Manitoba-based **New Flyer Industries Inc.** and its subsidiary, New Flyer of America, launched its Vehicle Innovation Centre in Minnesota, featuring North America's first innovation lab for advanced bus technology, including HFC technologies (Press release)
- Canadian Tire Corporation, Ltd. is expanding its Bolton Distribution Centre to enable on-site hydrogen production via electrolysis to power its forklifts. The distribution centre is set to be operational by the end of 2017. (Press release).

4. **Events and Solicitations**
   - **GLOBE Forum 2018** (Vancouver, BC) – March 14-16, 2018
     A biennial conference and trade show which attracts over 3,500 senior delegates from over 50 countries to discuss environmental issues and solutions. Prime Minister Justin Trudeau and seven of his Ministers participated in the previous GLOBE Forum in 2016.
   - **10th Clean Energy Ministerial** and **4th Mission Innovation Ministerial** (TBA) – 2019
     The CEM and MI are both int'l ministerial meetings focused on transitioning the world to a low carbon future. In 2019, the meetings will be co-located in Canada (Press Release).
   - **Storage Solutions from Canada Pavilion** (Dusseldorf, Germany) – March 13-15, 2018
     As part of Energy Storage Europe 2018, Canada will host the third edition of its "Storage Solutions from Canada" pavilion.
   - Additionally, the CHFCA and a delegation will be present at the following events:
     - **Int'l Hydrogen & Fuel Cell Conference** (Pune, India) – December 10-12, 2017
     - **FC Expo 2018** (Tokyo, Japan) – February 28-March 2, 2018
     - **Hannover Messe** (Hannover, Germany) – April 23-27, 2018
     - **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**
   - Metrolinx, Ontario's provincial transit agency, commissioned a major study to assess the feasibility of using hydrail to electrify the GO Transit network. The electrification of the regional express rail is estimated to cost $13.5B (Press Release).
     - Ontario hosted a one-day Hydrail Symposium in Toronto (November 16, 2017).
   - Loop Energy received $8.3M to be used to develop a next generation fuel cell range extender for port drayage trucks and other heavy duty applications (Press Release).
   - The British Columbia Ministry of Energy, Mines, and Petroleum Resources made a $1.5M contribution to the Hydrogen Energy Technology Corporation (HTEC) for the development of 3 HRS's in Greater Vancouver. The first station is expected to be completed by January 2018, and the other two are at the design stage. Discussions for three additional HRS's are underway (News Article).
   - 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**
   - Transport Canada sent one if its Mirai FCEVs to Argonne National Laboratory (US) for dynamometer testing to help develop codes and standards and may bring the Mirai to Vancouver to assist with further metering requirements.
   - Various federal departments have initiated dialogue to review codes & standards for H2 metering to enable retail sales. Future discussions will engage industry and international partners.

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Summary Country Update November 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[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] (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)

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Hydrogen Refueling Stations	Capacity	Dispensing Pressure	Production Method
South Granville, Vancouver, British Columbia (HTEC – Estimated completion in January)	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
GTA, Ontario (Location to be announced)	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, Quebec (WEH Gas Technology)	TBD	70 MPa	On-site Electrolysis