INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update May, 2016: Brazil

The IPHE Secretariat requests each IPHE member submit a one-page narrative update on fuel cell and hydrogen (FCH) activities. Please only report actions and developments since the last Country Update and leave Sections blank if there have been no new developments.

Please complete this form and send to secretariat@iphe.net by 29 April 2016.

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Covered Period	June, 2013 to May, 2016

1. New Policy Initiatives on Hydrogen and Fuel Cell

Reduction of import tax rate to zero for hydrogen FCEV. For hybrid electric vehicles, the import tax was reduced to rates between 0 and 7%, depending on the energy consumption.

2. Hydrogen and Fuel Cell R&D Update

An R&D program on solid oxide fuel cells (SOFC) is under development at LabH2-Coppe/UFRJ (Federal University of Rio de Janeiro), including synthesis of electrocatalysts for SOFC anodes, development, characterization and electrochemical tests of multifunctional SOFC anodes allowing the direct utilization of carbonaceous fuels such as anhydrous methane or ethanol without carbon coking and clogging. A special development utilizes the SOFC as a reactor for the electrochemical conversion of methane into C2-type hydrocarbons, producing electricity and heat as byproducts. Patents have been deposited and papers have been published.
SOFC testing benches for long-term operation of SOFC single cells, short stacks and stacks were developed for the direct utilization of carbonaceous fuels preventing carbon deposition in the system components. Patents have been deposited.

A 3-year project was carried on the Laboratory LaMPaC/UFMG (Federal University of Minas Gerais), to develop a 1 kW SOFC prototype with investments of US$1.5 million.
Another project being carried out at UFMG consists on the development and architectures of solid oxide fuel cells with the objective to improve efficiency of Auxiliary Power Units (APU) to be used in aircrafts.

Petrobras has a hydrogen production R&D program with three main objectives (1) reduce the cost and increase the productivity of large scale steam reformers. That objective is been achieved by the development of new catalysts (6 patents), simulation models and monitoring and optimization softwares. (2) Development of catalysts for production of hydrogen from alternative sources like ethanol and residues from oil refineries (2 patents). (3) New process to produce H2, like gasification of heavy refining streams and thermo-neutral reforming of liquid hydrocarbons (2 patents).

3. Demonstration and Deployments Update

The project “Hydrogen Fuel Cell Buses for Urban Transport in Brazil” was successfully concluded on March 31, 2016. The Brazil FCB project was developed under the fuel cell bus

commercialization support program established by the UNDP and GEF, respectively the executing agency and main financial agency. The project was co-financed by the Brazilian government and also had contributions from a strong consortium of private companies, consisting of AES Eletropaulo, Ballard Power Systems, EPRI, Hydrogenics, Marcopolo, Nucellsys, Petrobras Distribuidora and Tuttotrasporti. After the construction and tests of the first prototype, a new improved design was developed and three buses were built and tested in the São Paulo Metropolitan Corridor. Two of the HFC buses operated regularly in the corridor along with conventional diesel buses and trolleybus.

There is another HFC Bus Program under development in Rio de Janeiro. This includes now testing of the third prototype of the LabH2-Coppe/UFRJ hybrid HFC bus. Laboratory tests comprised onboard energy consumption analysis and compliance with safety requirements. Real utilization tests included daily operation at the UFRJ campus and evaluation of public acceptance for the new technology.

A hydrogen fueling station is under installation at the UFRJ campus with the following characteristics: onsite production of hydrogen by water electrolysis; use of solar energy from an on-site solar power plant; hydrogen compression system to 450 bar with storage and dispenser allowing the daily hydrogen supply to up to five buses.

Itaipu Binacional (IB), Eletrobras and Fundação Parque Tecnológico Itaipu (FPTI) constructed a pilot plant equipped with a 10 Nm^3/h electrolyser and a 6 Kw Fuel Cell. This plant is part of a R&D project that will study the production of hydrogen in hydropower plants, its purification, compression, storage, transport and final use. The results will be implemented in future Eletrobras' projects.

4. Events and Solicitations

The Materia Symposium (http://www.simposiomateria.com.br) is going to be held in Rio de Janeiro on November 27th to December 3rd, 2016. This is a Latin-American congress that takes place periodically since 1996 and in this XIV version will approach the theme of Materials and Energy with the objective to prepare the Latin-American scientific community for the 22nd World Hydrogen Energy Conference -WHEC (http://www.labh2.coppe.ufrj.br/whec/normal_eng.php), which will be held in Rio de Janeiro on June 17th to 22nd, 2018.
The 22nd WHEC 2018 will be a major event on the hydrogen energy area to be held in Brazil in 2018.

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

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Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
Fuel Cell Vehicles[1]				
FC Bus		As of May, 2016, 3 HFC buses and 1 hybrid HFC bus in test		
Fuel Cell Trucks[2]				
Forklifts				
H_2 Refueling Stations	**Target Number**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
70 MPa On-Site Production				
70 MPa Delivered				
35 MPa On-Site Production		As of May, 2016, 1 hydrogen production and refueling station		

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

		being tested. One more is being constructed.		
35 MPa Delivered				
Stationary	**Target Number[3]**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
Small[4]				
Medium[5]				
Large[6]				
District Grid[7]				
Regional Grid[8]				
Telecom backup				
H_2 Production	**Target[9]**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
Fossil Fuels[10]				

[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

Water Electrolysis[11] (PEM, Alkaline, SOEC)		As of May, 2016, 1 hydrogen production (water electrolysis) and refueling station being tested. One more is being constructed.		
By-product H_2				
Energy Storage from Renewables	**Target[12]**	**Current Status**	**Partnership, Strategic Approach**	**Policy Support**
Power to Power[13] Capacity				
Power to Gas[14] Capacity				

[11] Please indicate if targets relate to a specific technology (PEM, Alkiline, SOEC)
[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)