Roundtable Meeting
IPHE – Hydrogen and Fuel Cells Stakeholders

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Newton Pimenta

Brazilian Reference Center for Hydrogen Energy

Hydrogen Laboratory / University of Campinas

R&D work is essential

- Ongoing R&D work on renewables, H2, FC, and Batteries are essential for restructuring the existing energy systems.
- National R&D creates competitive benefit for countries and companies.
- Brazilian Ministry of Science and Technology:
  - Program of Science, Technology and Innovation for H2 and FC: PEMFC, H2 Production, SOFC, System Integration, Users
- Brazilian Ministry of Mines and Energy:
  - Roadmap for H2 and FC (IPHE)
  - Fuel Cell Bus Project (UNDP, Brazil, several Companies)

Hydrogen Fuel Cell Buses for Urban Transportation in Brazil

- Price below US$ 1 million
- 3 new buses will be built in 2012
- 10 to 30 new buses are under bidding
- Licensing the H2-FC bus and the H2 Fuel Station occurred smoothly: Transit Department, Environmental Agency and Fire Brigade
- EMTU has experience with trolley buses and CNG vehicles

Eletropaulo BALLARD EPRI HYDROGENICS Marcopolo
NUCELLSYS PETROBRAS tutto trasporti FINEP GEF
EMTU SECRETARIA DOS TRANSPORTES METROPOLITANOS GOVERNO DE SÃO PAULO Ministério de Minas e Energia BRASIL GOVERNO FEDERAL

Renewables in Brazil

- Electricity: 85% comes from renewable sources, mainly hydropower

- Wind Energy: 29 MW in 2005; 1.5 GW in 2010; 12 to 22 GW by 2020
- Last auction, Aug/2011: US$ 58/MWh (Wind < Biomass < NG)
- Wind (100 m) surpassed Hydropower potential: 350 x 261 GW
- Several important turbine suppliers have installed factories in Brazil

- PV Energy: R&D resources can now be used in PV plants (0.2% to 0.4% of Net Operating Income);
- 18 companies sent proposals: 1 to 3 MW

- Transport: 25% Bioethanol ; 22% Gasoline; 50% Diesel (B5); 3% NG

Unicamp´s projects: renewables, H_2, PEMFC

Project	Start	End	Partnerships	10^6 USD
Hybrid Wind-PV System with Energy Storage by means of Electrolytic H2 and Electrical Energy Conversion by Fuel Cells	Apr/11	Mar/14	CHESF Unicamp, UFC , Aqua Genesis	1,25
Auxiliary unity for power generation with PEM fuel cell fed with H_2 from ethanol	Jul/10	Jun/13	AES-Tietê Unicamp, Hytron	1,79
Study of H_2 production and power generation by means of water electrolysis and fuel cell using non-guaranteed energy from AES-Tietê's hydroelectric power plants	Feb/10	Jan/12	AES-Tietê Unicamp Hytron Aqua Genesis	1,09
Analysis of distributed generation sources control and their impact on the CPFL's grid - PD128 - Phase 2	Apr/09	Mar/12	CPFL Unicamp Hytron	1,67
Development and tests of a pressurized bipolar alkaline water electrolyser	Mar/08	Abr/11	Finep Unicamp	0,10
Power generation and synthesis gas production from biomass gasification	2005	2008	Finep Unicamp	0,59

Remarks

- H_2 Production:
  - Ethanol reforming (BRA); Biomass Gasification; Renewables
  - H_2 can be a bonus for Hydro, Wind and PV plants, but electrolyser cost is an issue.
  - Study of cases to make distributed H_2 viable are tailor made.
  - Sharing H_2 with traditional applications can help reduce costs

- Transport:
  - EV and HV are important steps towards H2-FCV
  - H2-FC buses and fleets will come first than private vehicles (BRA)
  - Adding H2 to NG can stimulate the H_2 production.