International Partnership for Hydrogen and Fuel Cells in the Economy

Country Update: Brazil

30th IPHE Steering Committee Meeting

Pretoria, South Africa

6 December 2018

Country Update: Brazil

- New National Program launched in October 2018:

"**Science, Technology and Innovation Plan for Renewables and Biofuels**"

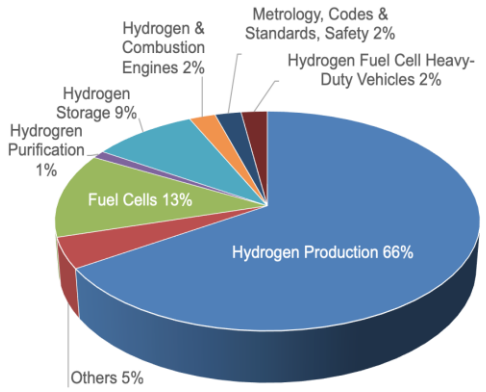
2018 – 2022

Projects and Policies on:

- hydrogen production using biomass and excess offer of electrical energy from renewable intermittent sources, to foster:
  - energy storage;
  - sustainable mobility;
  - the distributed cogeneration of electrical energy and heat;
  - Syngas to the synthesis of renewable fuels
    - biogas, biomethane, bioethanol, biodiesel, biokerosene and renewable hydrocarbons for aviation
  - HR formation and R&D&I networks

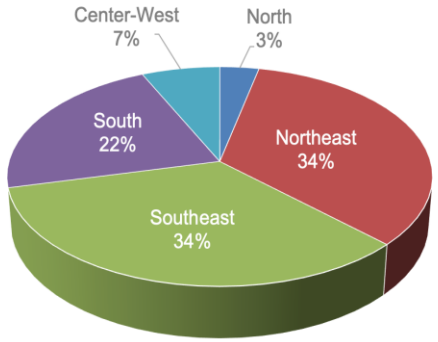
Country Update: Brazil

The Hydrogen Chain Matrix in Brazil



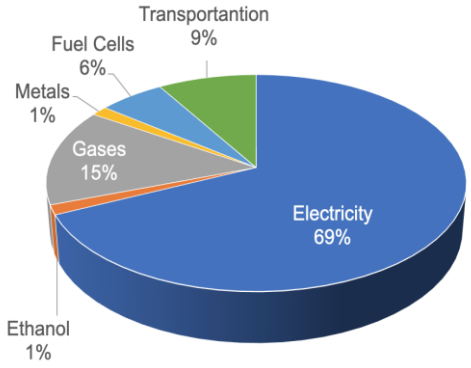
Source: ABH2 (Brazilian Hydrogen Association)

Hydrogen Technologies R&D centers by region in Brazil



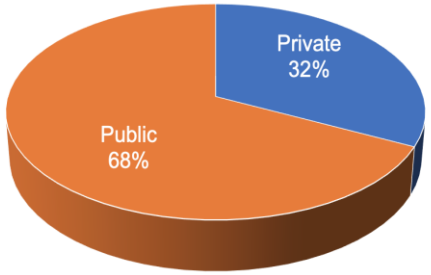
Source: ABH2 (Brazilian Hydrogen Association)

Share of Brazilian Companies Developing Hydrogen Energy Technologies per Sector



Source: ABH2 (Brazilian Hydrogen Association)

Share of Brazilian Companies Developing Hydrogen Energy Technologies per Ownership



Source: ABH2 (Brazilian Hydrogen Association)

Country Update: Brazil

Science-based technological developments made by companies

- **Electrocell** (www.electrocell.com.br): delivers to the National Institute of Technology (www.cnpq.br) in December 2018 a 5 kW PEM fuel cell made in Brazil.

- **Tracel** (www.tracel.com.br): made the following demonstrations during the WHEC2018:
  - An uninterrupted energy generation system using a solar power plant (50 kW_p) integrated with an electrical energy storage system and a hydrogen-fueled power plant generation using a 10 kW PEM fuel cell;
  - The last version of their proprietary equipment for the power train and the auxiliary and control systems of a hybrid electric-hydrogen fuel cell city bus.

- **Hytron** (www.hytron.com.br): demonstrated during the WHEC2018 a methane reformer for the production of purified hydrogen from biogas or natural gas.

- **Itaipu** Hydroelectric Power Plant (www.itaipu.com.br): demonstrated production of hydrogen by electrolysis using energy that would otherwise be spilled by the dam.

Country Update: Brazil

"Science and Engineering of Hydrogen-Based Energy Technologies", 438 p, **Elsevier**, Nov. 2018.

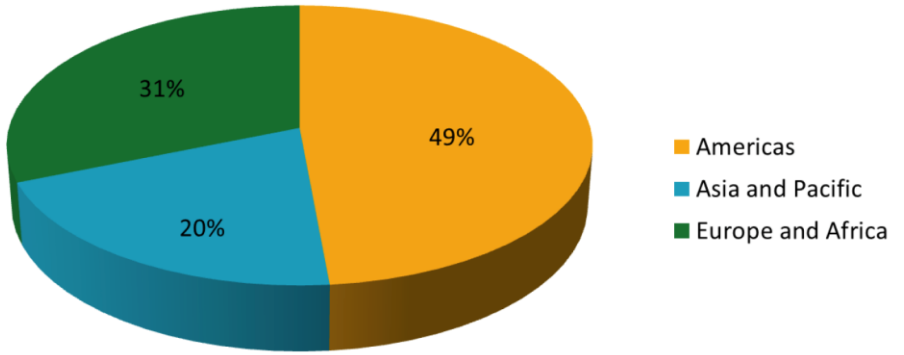
The book presents the following chapters:

- **Chapter 1**: P.E.V. de Miranda, "**Hydrogen Energy: Sustainable and Perennial**".
- **Chapter 2**: A. Coralli, B.J.M. Sarruf, P.E.V. de Miranda, L. Osmieri, S. Specchia, N.Q. Minh, "**Fuel Cells**".
- **Chapter 3**: V. Singh, D. Das, "**Potential of Hydrogen Production from Biomass**".
- **Chapter 4**: M. Carmo, D. Stolten, "**Energy Storage Using Hydrogen Produced from Excess Renewable Electricity: Power to Hydrogen**".
- **Chapter 5**: H. Uchida, M.R. Harada, "**Hydrogen Energy Engineering Applications and Products**".
- **Chapter 6**: A.V. Tchouvelev, S.P. Oliveira, N.P. Neves Jr., "**Regulatory Framework, Safety Aspects, and Social Acceptance of Hydrogen Energy Technologies**".
- **Chapter 7**: David Hart, "**Roadmapping**".
- **Chapter 8**: R. Steinberger-Wilckens, B. Sampson, "**Market, Commercialization, and Deployment – Toward Appreciating Total Owner Cost of Hydrogen Energy Technologies**".

Country Update: Brazil

WHEC 2018 - At a Glance

- **Total participants WHEC 2018: 784 - 51 countries**
- Conference with **485** presentations: 23 Plenaries; 35 Keynotes; 295 Oral; 132 Posters
- In Paralell:World Bioenergy Symposium; 6 Workshops 3 Round Tables: Innovation; Energy Policies; Vehicles Policies; 6 Workshops.
- Trade fair with 35 exhibitors
- Four Technical Tours
- Evening event: Brazilian Night

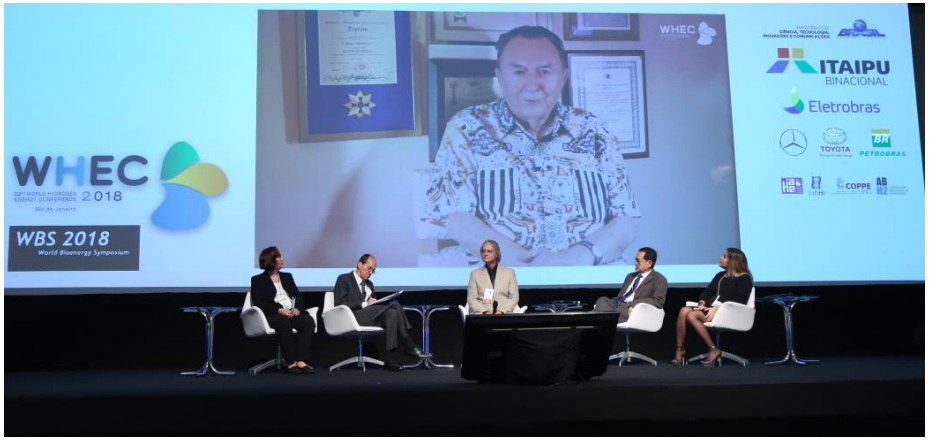


Country Update: Brazil

„Power and biomass to hydrogen“

Topic	Paper Presentations [%]
1. Hydrogen energy	8.4%
2. Fuel cells	22.0%
3. Science and technologies of hydrogen and hydrogen-rich fuels production from biomass	27.0%
4. Energy storage using hydrogen produced from excess renewable electricity: Power to hydrogen	19.7%
5. Hydrogen energy engineering application and products	13.4%
6. Market, commercialization and deployment: Total owner cost of hydrogen energy technologies	3.6%
7. Regulatory framework, safety aspects, public policies and social acceptance of hydrogen energy technologies and roadmapping	4.6%
8. Others	1.3%

Country Update: Brazil



- HYPOTHESYS2019, Foz do Iguaçu, at Itaipu April 24th to 26th, 2019

Country Update: Brazil

- **ABNT** (http://www.abnt.org.br) issued on June 2018 the technical standard **ABNT IEC/TS 62282-1:2018**, entitled **"Fuel cell technologies Part 1: Terminology".**
- For the year 2019 ABNT has planned to:
  - to apply to become an ISO TC-197 P-member;
  - to issue the following new standards:
    - ISO/TC 197/WG 05 Gaseous hydrogen land vehicle refuelling connection devices;
    - ISO/TC 197/WG 15 Gaseous hydrogen - Cylinders and tubes for stationary storage
    - ISO/TC 197/WG 18 Gaseous hydrogen land vehicle fuel tanks and TPRDs
    - ISO/TC 197/WG 19 Gaseous hydrogen fuelling station dispensers
    - ISO/TC 197/WG 20 Gaseous hydrogen fuelling station valves
    - ISO/TC 197/WG 23 Gaseous hydrogen fuelling station fittings
    - ISO/TC 197/WG 24 Gaseous hydrogen fuelling stations – General requirements
    - ISO/TC 197/WG 25 Hydrogen absorbed in reversible metal hydride
    - ISO/TC 197/WG 26 Hydrogen generators using water electrolysis
    - ISO/TC 197/WG 27 Hydrogen fuel quality
    - ISO/TC 197/WG 28 Hydrogen quality control.