

Innovative Energy Climate Action

Part 4:
***THE BRAZILIAN
HYDROGEN
MOVE***

Feb 2022

Discussion paper

**Authors: Andrea Raccichini, Marco Contardi,
Marco Saverio Ristuccia**

PART 4: THE BRAZILIAN HYDROGEN MOVE

February 2021: launch of the Green Hydrogen Hub in the State of Ceará, Northeast of Brazil¹. A pioneer initiative that gathers Ceará Government, Industry Federation of Ceará (FIEC), Federal University of Ceará (UFC) and Pecém Port Complex (CIPP S/A). The main objective is to reduce emissions, seize new business opportunities and job creation for Ceará State. The Green Hydrogen Hub saw the signing of a memorandum of understanding between Ceará government secretariats, Pecém Port Complex, FIEC and UFC, as well as, the creation of a Work Group on the theme, where all the partners are represented.

Moreover, the Ceará government signed another memorandum of understanding with the Enegix Energy Company, for green hydrogen production in the Pecém Port Complex². Specifically, the company will invest US\$ 5,4 billion, with an expected production of 600 million kg of green hydrogen per year. The project is expected to take 3-4 years to build. Since the creation of the hub, other companies have shown its interest to invest in green hydrogen projects within the Pecém Port Facility³. For example, Ceará government has signed other relevant memorandums of understanding with:

- ▣ White Martins⁴ company;
- ▣ Fortescue Future Industries Pty Ltd (FFI)⁵ – investment of US\$ 6 billion;
- ▣ Qair Brasil – investment of US\$ 6.95 billion;
- ▣ Transhydrogen Alliance Consortium – investment of US\$ 2 billion⁶
- ▣ AES Brasil – feasibility studies for green hydrogen production facilities, with an estimated investment of US\$ 2 billion⁷.

Besides that, Ceará government signed an agreement with Neoenergia for the production of feasibility studies of urban transportation solutions fueled with green hydrogen and,

¹ Please visit the following website: <https://www.ceara.gov.br/2021/02/19/governo-do-ceara-e-instituicoes-parceiras-lancam-hub-de-hidrogenio-verde/>

² Please visit the following website: <https://pressroom.enegix.energy/129246-enegix-energy-to-build-us54-billion-green-hydrogen-facility-in-brazil>

³ In this article, are listed companies that signed agreements with Ceará hub up to January 2021. Furthermore, according to ABH2 (2022) there are other announced investments in Ceará hub, from others firms such as Diferencial Energia, H2Helium, Hytron/Neuman & Esser (NEA) Group, Eneva, Engie Brasil Energia and Total Eren. Eventually, in the future, other companies will sign other agreements.

⁴ Please visit the following website: <https://www.ceara.gov.br/2021/04/19/complexo-do-pecem-e-white-martins-assinam-memorando-de-entendimento-para-implantacao-do-hub-de-hidrogenio-verde-no-ceara/>

⁵ Please visit the following website: <https://www.ceara.gov.br/2021/07/07/hub-de-hidrogenio-verde-acordo-entre-governo-do-ceara-e-a-fortescue-preve-investimentos-de-u-6-bi-e-3-300-empregos/>

⁶ Please visit the following website: <https://www.ceara.gov.br/2021/10/27/hidrogenio-verde-em-roterda-governo-do-ceara-assina-memorando-que-preve-investimento-de-2-bilhoes-de-dolares/>

⁷ Please visit the following website: <https://petronoticias.com.br/aes-brasil-assina-memorando-com-o-ceara-preve-investimentos-2-bilhoes-hidrogenio-verde/>

with EDP Brasil for the installation of a pilot project of a green hydrogen plant – gas production of 250 Nm³/h, investment attraction of R\$ 41,9 million, ready to produce in December 2022⁸.

The bulk of investments will cover the entire value chain of green hydrogen (production, transformation, transportation and end uses) attending multiple final uses (energy, mobility, ammonia, industrial, etc.) in a national and international scale.

Figure 1 – Pecém Port: Distance in days from Ceará to the World



Source: PECEM 2020

Such industrial experience is paradigmatic for Brazil hydrogen market. It can be considered as the “First Green Hydrogen Valley⁹” of Brazil, within the Smart Specialization¹⁰ Strategies for Sustainability (S4) approach (see article Part 3). In fact, the Green Hydrogen Hub has hydrogen valley characteristics, such as:

⁸ Please visit the following website: <https://www.ceara.gov.br/2021/09/20/governo-do-ceara-e-neoenergia-assinam-memorando-para-projeto-de-transporte-publico-movido-a-hidrogenio-verde/>

⁹ According to Weichenhain et al. (2021), there are four key elements that a Hydrogen Valley has to have: 1) Large in Scale; 2) High Value Chain Coverage; 3) Supply of More than one sector; 4) Geographically defined scope.

¹⁰ The Smart Specialization Platform defines Smart Specialization as a “place-based approach characterized by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and on an Entrepreneurial Discovery Process (EDP) with wide stakeholder involvement. It is outward-looking and embraces a broad view of innovation including but certainly not limited to technology-driven approaches, supported by effective monitoring mechanisms”. Lately, such place-based innovation strategy has been re-oriented its trajectory by including recent sustainable development policies’ goals of the European Union: “Green Deal” in 2019, and after COVID-19 crisis, the green and digital recovery. Thus, smart specialization strategies have to be channeled for Sustainability. McCann and Soete (2021) depicts such change: “a shift in policy logic from Smart Specialization Strategy (S3) to smart specialization strategies for sustainable and inclusive growth (S4+) would change the logic on which regional development strategies would be based in Europe”. In other words, we move from a S3 approach to a Smart Specialization Strategies for Sustainability (S4).

- ▣ Large in scale, with a portfolio of projects of billions of investments, in this case mostly private;
- ▣ Covering the entire value chain (production, transformation, transportation, end uses);
- ▣ Geographically located (Pecém Port Complex);
- ▣ Multiple sectors are encompassed (mobility, ammonia, industrial, energy, etc.).

Moreover, such Brazilian hydrogen valley can be considered within a S4 approach. In fact, the Ceará experience gathers investments in a strategic area of intervention – green hydrogen, a sustainable industry – identified by both public and private stakeholders on an existing industrial experience – Pecém Port. Furthermore, such stakeholders leverage existing and new territorial socioeconomic capabilities by continuously fostering sustainable and innovative processes. Indeed, the Ceará Green Hydrogen Hub shows key strategic factors of a hydrogen valley in a S4 approach, such as:

- ▣ **Location:** Pecém Port is in a strategic location for import/export trade (near to Europe, United States and Africa). Moreover, Ceará state has a big renewable energies potential, which is key for electrolyzers for green hydrogen production (onshore wind energy of 94 GW and offshore of 117 GW, solar energy of 643 GW, with daily complementarity between wind and solar energies)¹¹;
- ▣ **Infrastructure’s availability and industrial facilities:** the Pecém Port Complex is already a strong industrial facility with strong dedicated infrastructures that spur Ceará and Brazilian development. Within an area of 13.337 hectare, it is composed by an Industrial Area, a Port and an Export Processing Zone (*Zona de Processamento de Exportação – ZPE*);
- ▣ **Knowledge capabilities:** The presence of local universities such as Federal University of Ceará (UFC) and industry associations, such as the Industry Federation of Ceará (FIEC), are key to foster innovation and industrial solutions for the novel industry of green hydrogen;
- ▣ **Cooperation:** Green Hydrogen Hub is based on a multi-stakeholder cooperation model between public and private institutions. Such feature is crucial for governance and management of the initiative, bringing stability over time.

The short description of the Ceará “Green Hydrogen Hub” highlights that **the Brazilian**

¹¹ Please find more information here: <https://www.ceara.gov.br/2021/09/20/governo-do-ceara-e-neoenergia-assinam-memorando-para-projeto-de-transporte-publico-movido-a-hidrogenio-verde/>

market for green hydrogen is buoyant and it has a big potential. Spreading experiences like this all over Brazil will contribute for the green hydrogen industry to go from a technological readiness market stage to a market penetration one¹² (see article Part 2). It is worth noting that, though in a smaller scale and limited scope, there are already ongoing similar Ceará experiences¹³, that are occurring in the Brazilian green hydrogen market, like the Açú Port¹⁴, Suape¹⁵, Furnas¹⁶, Rio Grande do Sul¹⁷, Rio Grande do Norte¹⁸, Minas Gerais¹⁹, Piauí²⁰, Cubatão²¹, Bahia²² and other key sectors²³.

Giving a broader and strategic overview of such industrial experiences, it is worth to mention that **the green hydrogen market in Brazil will be part of one of the least carbon-intensive energy matrices in the world**, according to IEA (International Energy Agency)²⁴.

12 According to IRENA (2020) there are three policy stages, as follow: 1. Technology Readiness: At this stage, green hydrogen is a niche technology with little use except in demonstration projects; it is mostly produced on-site with limited infrastructure development. The largest barrier to greater use is cost. The main role of policy makers is to encourage and accelerate further deployment of electrolyzers. 2. Market Penetration: At this stage, some applications are operational and able to prove what green hydrogen can do and at what cost. Scaling up these technologies and developing experience through learning-by-doing reduces costs and helps close the profitability gap. This stage also begins to see benefits from synergies between applications, increasing hydrogen demand and realising economies of scale for production and infrastructure. These synergies can take place in industrial clusters, hydrogen valleys (e.g. cities) or hubs (e.g. ports). 3. Market Growth: At this stage, green hydrogen becomes a well-known and widely used energy carrier and is close to reaching its full potential. It has become competitive both on the supply side and in its end uses. Direct incentives are no longer needed for most applications and private capital has replaced public support in driving hydrogen growth. There is full flexibility in converting hydrogen to other energy carriers, making it possible to use the most convenient alternative depending on the specific conditions in each region. The power system has been decarbonised and only green hydrogen is being deployed. Most natural gas infrastructure has been repurposed to transport pure hydrogen. For further information, please read IRENA (2020)

13 Please visit the following site: <https://www.h2verdebrasil.com.br/en/projects/?pais%5B%5D=269>

14 Please visit the following site: <https://portodoacu.com.br/fortescue-future-industries-e-porto-do-acu-unem-forcas-para-desenvolver-planta-de-hidrogenio-verde-no-brasil/>

15 Please visit the following websites: <http://www.suape.pe.gov.br/pt/noticias/1522-complexo-de-suape-e-neoenergia-firmam-parceria-para-produzir-hidrogenio-verde-em-pernambuco> <http://www.suape.pe.gov.br/pt/noticias/1571-presidente-da-qair-visita-suape-e-conhece-infraestrutura-portuaria-para-futuro-projeto-de-hidrogenio-verde>

16 It is worth to mention the construction of a green hydrogen plant in a hydroelectric facility, located in Itumbiara (MG/GO), by using photovoltaic technologies (floating and on-land). On December the 8th 2021, it was launched such green hydrogen plant that produces 1 MW. This green hydrogen plant, it is the result of a research and development project of ANEEL (Agência Nacional de Energia Elétrica) developed by Eletrobras Furnas, Base-Energia Sustentável, PV Solar, Paulista State University (UNESP), Campinas University (Unicamp), National Service for Industrial Learning of Goiás (Senai-GO), University of Brandenburg (Germany) and the Electric Energy Research Center (CEPEL). The investment for the plant was of R\$ 45 million. For further information, please visit the following website <https://www.canalenergia.com.br/noticias/53196109/furnas-inaugura-planta-de-geracao-de-hidrogenio-verde>

17 Rio Grande do Sul and White Martins signed a memorandum of understanding in December 2021 to produce green hydrogen and green ammonia in the southern state of Brazil. Please find more information here <https://epbr.com.br/white-martins-assina-memorando-para-hidrogenio-verde-no-rs/>

18 Please visit the following website to get more information: <https://g1.globo.com/rn/rio-grande-do-norte/noticia/2021/08/11/governo-assina-acordo-para-producao-de-energia-eolica-no-mar-hidrogenio-verde-e-amonia-no-rn.ghtml>

19 „Mines of Hydrogen“ initiative started in 2021 and it is supported by Minas Gerais Government and FIEMG (Minas Gerais Industries Federation). Please find more information here: <https://www.gov.br/mme/pt-br/assuntos/noticias/ministro-participa-de-lancamento-do-programa-minas-do-hidrogenio>

20 Nexway, Comerc's energy efficiency company, and Casa dos Ventos announced a partnership to develop green hydrogen (H2V) production projects in Brazil. Please find more information here: <https://epbr.com.br/casa-dos-ventos-e-comerc-preveem-us-4-bi-em-projeto-de-hidrogenio-verde-no-piaui/>

21 Please find more information here: <https://forbes.com.br/forbesagro/2021/09/raizen-fecha-com-yara-1a-venda-de-biometano-de-longo-prazo/>

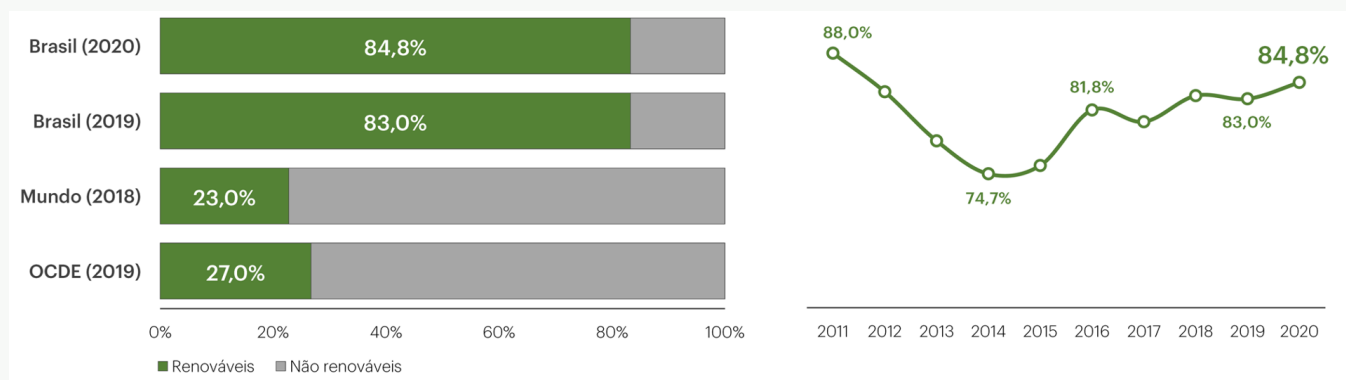
22 Unigel will produce green ammonia in Bahia State. Please find more information here: <https://valor.globo.com/empresas/noticia/2021/12/23/unigel-vai-produzir-hidrogenio-verde-no-pais-a-partir-de-2023.ghtml>

23 Moreover, there are several other initiatives related to green hydrogen in key sectors such as transportation (Fuel Cell Buses prototypes), aviation (Embraer), synthetic fuels and bioenergy, according to ABH2 (2022).

24 Please visit the following website to get more information: <https://www.iea.org/countries/brazil>

Statistics of the National Energy Balance (BEN) – elaborated by EPE (*Empresa de Pesquisa Energética*) – show that in 2020, the renewable share in Brazil power generation matrix reached 84,8%, being far cleaner than the world and OECD countries power matrixes (Figure 2). Renewable energies technologies deployed in the Brazilian market are mostly hydro, wind, solar and biomass, and non-renewable energies consist mostly of oil, gas, coal and nuclear²⁵ sources.

Figure 2 – Share of renewable energies in the Brazil Power Matrix 2020 (%)



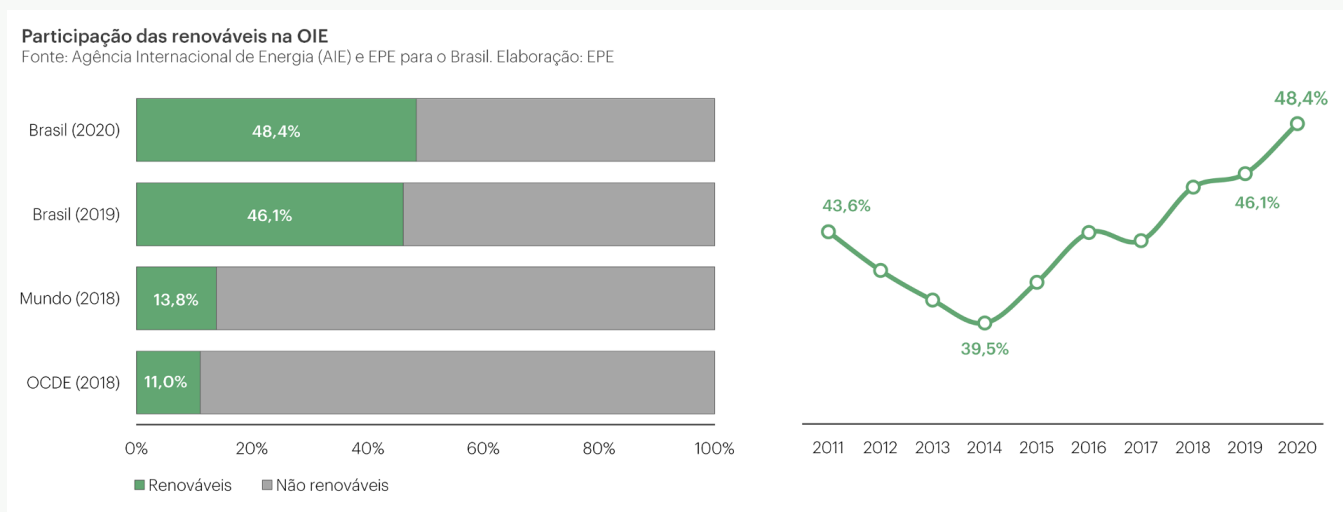
Source: *Balanco Energético Ministério de Minas e Energia*, Relatório Síntese 2021, Ano base 2020 (EPE, 2021). *Energy Balance, Ministry of Mines and Energy from Brazil*, Synthesis Report 2021, Base Year 2020 (EPE, 2021). Subtitles translation from top to bottom Brazil (2020); Brazil (2019); World (2018); OECD (2018). Dark green – Renewables. Grey – Non-renewables.

Moreover, in terms of energy matrix, the renewable share is continuously increasing and it reached, in 2020, the share of 48,4%, as reported by the statistics of the Brazilian energy ministry²⁶, whereas biomass and biodiesel positively performed and oil and its derivatives bounced back by 5.6% in 2020.

²⁵ To get information update in real-time please visit the following website: <https://bit.ly/2IGf4Q0> ANEEL SIGA - Sistema de Informações de Geração da ANEEL.

²⁶ Please visit the following website to get more information: <https://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/balanco-energetico-nacional-interativo>

Figure 3 – Share of renewable energies in the Brazilian Energy Matrix (%)



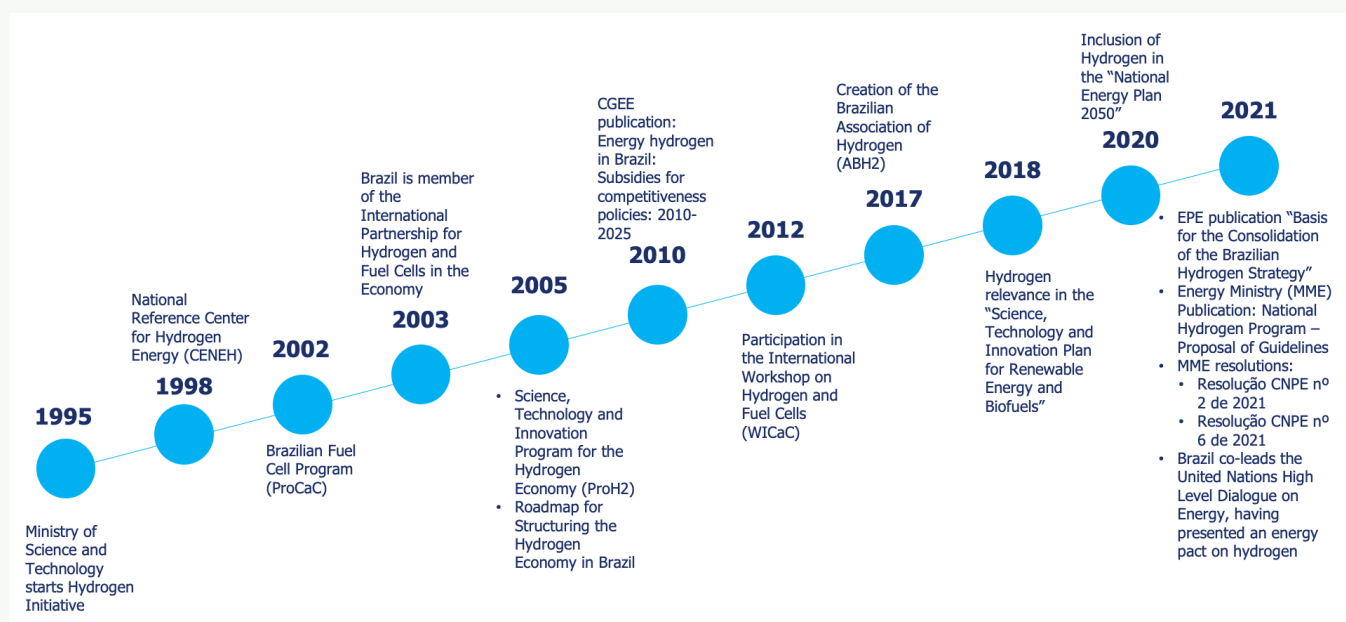
Source: *Balanco Energético Ministério de Minas e Energia, Relatório Síntese 2021, Ano base 2020* (EPE, 2021). *Energy Balance, Ministry of Mines and Energy from Brazil, Synthesis Report 2021, Base Year 2020* (EPE, 2021). Values related to the Internal Supply of Energy. Subtitles translation from top to bottom Brazil (2020); Brazil (2019); World (2018); OECD (2018). Dark green – Renewables. Grey – Non-renewables.

Furthermore, the Brazilian energy sector has already successful experiences in creating novel markets as the wind and solar industries can show. These successful stories are important because they show that Brazil institutional, regulatory and market ecosystem are ready to incorporate an entrant sector – green hydrogen.

Thus, the green hydrogen market in Brazil, together with other energy resources, will be strong allies to achieve the Brazilian environment commitments (COP 26) – 50% reduction in greenhouse gas emissions by 2030 and carbon neutrality by 2050 – and to foster energy sector competitiveness, while contributing to the global target of keeping 1.5C. Indeed, the Glasgow Climate Pact affirms that there will be a further effort of the parties – including Brazil – to revisit 2030 emission reduction targets in 2022 (COP26, 2021), where hydrogen could play a relevant role for the energy sector contribution.

Within such scenario, Brazilian hydrogen has already its own story. Since 1995, the Brazilian government has been dealing with such energy carrier by creating knowledge, public programs (PNH2), national associations (ABH2) and participating in relevant international committees (CENEH). Though, after the Pre-salt discovery – among other things – hydrogen strategic interest has declined over time (MME 2021). New interest bounced back only in recent years.

Figure 4 – Hydrogen Story in Brazil: Timeline



Source: MME 2021, FGV graphic adaptation

The 2020 Brazil "National Energy Plan 2050" included hydrogen in its energy strategy (MME & EPE, 2021) along with other renewable energies.

The energy carrier is pinpointed as a disruptive technology that can strongly contribute to decarbonise the national energy matrix (*idem*).

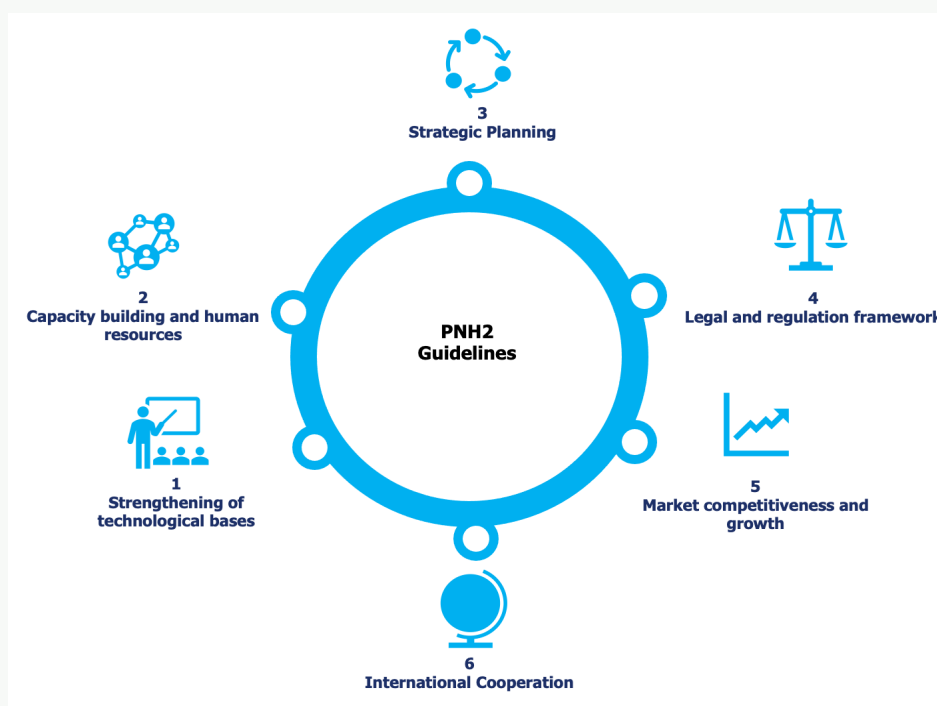
In 2021, the Ministry of Energy of Brazil issued a resolution (*Resolução CNPE nº 2 de 2021*) that prioritizes research, innovation and development funds for hydrogen, among other energy sources. Another relevant resolution, issued by the same ministry, is "*Resolução CNPE nº 6 de 2021*", that deals with determination for the proposal of guidelines for the National Hydrogen Program – *Programa Nacional do Hidrogênio, Proposta de Diretrizes (PNH2)*.

PNH2 program aims to significantly contribute to Brazil's trajectory of sustainable development through the increase of national competitiveness and the share of hydrogen in the Brazilian energy matrix, considering its economic, social and environmental role for development (MME, 2021). Moreover, according to MME and EPE (2021), national hydrogen strategy needs to leverage Brazil energy competitive advantage, by taking into account all sort of Brazilian energy resources. So, within an energy transition horizon, hydrogen strategy needs all hydrogen shades, it is a "rainbow" hydrogen strategy²⁷.

²⁷ It is worth noting that, in terms of renewable sources to produce green hydrogen, Brazil has abundant resources of solar and wind, but it also has bioenergy sources that are key to boost green hydrogen markets in internal lands area where biomass resources can be more abundant, for example.

Given that, PNH2 pinpoints six (06) guidelines to foster hydrogen in Brazil as the following figure highlights.

Figure 5 – PNH2 Guidelines



Source: MME 2021, FGV graphic adaptation

Each of the guidelines have to be tackled in a holistic manner in order to support Brazilian hydrogen market penetration, given a strong market potential depicted by Brazilian industrial experiences shown in this article. A consistent market penetration will need national efforts together with international dialogues and partnerships.

Hence, **the European hydrogen valley model, in a Smart Specialization Strategies for Sustainability (S4) fashion, (see article Part 3) could be transferred and absorbed by Brazil industrial landscape, adapted, as needed, according to national specificities and peculiarities.**

In this manner, several PNH2 guidelines can be boosted. For instance, the “International Cooperation” pillar that considers the international element crucial for a complete technological cycle, industrial development and consolidation of the hydrogen economy in Brazil (MME, 2021). Through the hydrogen valley model, it is possible to support other pillars too, such as: Pillar 1 “Strengthening of technological bases”, Pillar 2 “Capacity building and human resources” and Pillar 5 “Market competitiveness and growth”. Indeed, implementing the hydrogen valley model – in a S4 approach – could contribute to support Brazilian hydrogen market penetration by:

- ▣ Deepen international dialogue on hydrogen;
- ▣ Foster international industrial partnerships in Brazilian hydrogen value chain;
- ▣ Join international debate forums and committee on hydrogen;
- ▣ Foster research, innovation, capacity building and technological transfer on hydrogen;
- ▣ Attract international funding and private investments;
- ▣ Place Brazil in global hydrogen value chains.

The next article will describe the potential and strategic partnership between Brazil and European countries on hydrogen valley model in a S4 approach to get win-win results and contribute to global energy transition.

BIBLIOGRAPHIC REFERENCE

PART 4

ABH2, H2 Brazil Status 31.01.2022, Monica Saraiva Panik, Diretora ABH2

COP26, COP26 the Negotiations Explained, UN Climate Change Conference UK 2021 in partnership with Italy, UK Government, 2021

EPE, Balanço Energético Ministério Minas Energias, Relatório Síntese 2021, Ano base 2020, Ministério de Minas e Energia (MME) e Empresa de Pesquisa Energética (EPE).

IRENA (2020), Green Hydrogen: A guide to policy making, International Renewable Energy Agency, Abu Dhabi

IRENA (2020b), Reaching Zero With Renewables: Eliminating CO2 Emissions From Industry and Transport in Line With the 1.5°C Climate Goal, International Renewable Energy Agency, Abu Dhabi.

IRENA (2020c), Reaching zero with renewables: Eliminating CO2 emissions from industry and transport in line with the 1.5oC climate goal, International Renewable Energy Agency, Abu Dhabi. ISBN 978 - 92 - 9260 - 269 – 7 Available for download: www.irena.org/publications

MCCANN, P. and SOETE, L., Place-based innovation for sustainability, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-20392-6, doi:10.2760/250023, JRC121271.

MME, Programa Nacional do Hidrogênio, Proposta para Diretrizes, Julho 2021

MME & EPE, Bases para a Consolidação da Estratégia Brasileira do Hidrogênio, Nota Técnica, No EPE-DEA-NT-003/2021

UN, Glasgow Climate Pact, Conference of the Parties serving as the meeting of the Parties to the Paris Agreement Third session Glasgow, 31 October to 12 November 2021, Organization of work, including for the sessions of the subsidiary bodies Proposal by the President Draft decision -/CMA.3 Glasgow Climate Pact, 2021

WEICHENHAIN UWE, MARKUS KAUFMANN, ANJA BENZ, GUILLERMO MATUTE GOMEZ, European Union (EU), Hydrogen Valleys Insights into the emerging hydrogen economies around the world Luxembourg: Publications Office of the European Union, 2021 © FCH 2 JU, 2021

PECEM, Complexo Industrial e Portuário, Port of Rotterdam e Governo do Estado de Pará, 2020

WEF, The Global Risks Report 2021, 16th Edition, is published by the World Economic Forum. © 2021 – All rights reserved. ISBN: 978-2-940631-24-7



We are an institution of a technical, scientific, educational and philanthropic nature, founded on December 20, 1944, as a legal entity subject to private law. Our purpose is to act in the field of the social sciences, particularly economics and administration, as well as to contribute to environmental protection and sustainable development.

Headquarters

Praia de Botafogo, 190, Rio de Janeiro – RJ CEP 22257-900, Tel: (21) 3799-4747, www.fgv.br

First President and Founder

Luiz Simões Lopes

President

Carlos Ivan Simonsen Leal

Vice Presidents: Francisco Oswaldo Neves Dornelles (licensed), Marcos Cintra Cavalcanti de Albuquerque

Board of Directors

Chairperson: Carlos Ivan Simonsen Leal

Deputy Chairpersons: Francisco Oswaldo Neves Dornelles (licensed), Marcos Cintra Cavalcanti de Albuquerque

Board Members: Armando Klabin, Carlos Alberto Pires de Carvalho e Albuquerque, Cristiano Buarque Franco Neto, Ernane Galvêas, José Luiz Miranda, Lindolpho de Carvalho Dias, Márcilio Marques Moreira, Roberto Paulo Cezar de Andrade

Alternate Board Members: Aldo Floris, Antonio Monteiro de Castro Filho, Ary Oswaldo Mattos Filho, Eduardo Baptista Vianna, Gilberto Duarte Prado, José Ermírio de Moraes Neto, Marcelo José Basílio de Souza Marinho

Board of Trustees

Chairperson: Carlos Alberto Lenz César Protásio

Deputy Chairperson: João Alfredo Dias Lins (Klabin Irmãos & Cia.)

Board Members: Alexandre Koch Torres de Assis, Jorge Iribarra (Souza Cruz S/A), Antonio Alberto Gouvêa Vieira, Carlos Eduardo de Freitas, Cid Heraclito de Queiroz, Eduardo M. Krieger, Estado da Bahia, Estado do Rio de Janeiro, Estado do Rio Grande do Sul, José Carlos Cardoso (IRB-Brasil Resseguros S.A), Luiz Chor, Luiz Ildelfonso Simões Lopes, Marcelo Serfaty, Marcio João de Andrade Fortes, Miguel Pachá, Isaac Sidney Menezes Ferreira (Federação Brasileira de Bancos), Pedro Henrique Mariani Bittencourt, Ronaldo Vilela (Sindicato das Empresas de Seguros Privados, de Previdência Complementar e de Capitalização nos Estados do Rio de Janeiro e do Espírito Santo), Willy Otto Jordan Neto

Alternate Board Members: Almirante Luiz Guilherme Sá de Gusmão, Carlos Hamilton Vasconcelos Araújo, General Joaquim Maia Brandão Júnior, José Carlos Schmidt Murta Ribeiro, Leila Maria Carrilo Cavalcante Ribeiro Mariano, Luiz Roberto Nascimento Silva, Manoel Fernando Thompson Motta Filho, Solange Srour (Banco de Investimentos Crédit Suisse S.A), Olavo Monteiro de Carvalho (Monteiro Aranha Participações S.A), Patrick de Larragoiti Lucas (Sul América Companhia Nacional de Seguros), Ricardo Gattass, Rui Barreto



Director of FGV Europe

Dr. Cesar Cunha Campos

Advisor of Finance and Compliance

Francisco Eduardo Torres de Sá

EDITORIAL CREDITS

Strategic Coordination

Dr. Cesar Cunha Campos

Authors

Andrea Raccichini

Marco Contardi

Marco Saverio Ristuccia

Editorial Coordination

Andrea Raccichini

Sara Amaro Pais

Paul Thomas Woodhouse

Graphic Design

Paul Thomas Woodhouse

Proofreading

Sara Amaro Pais

Notice

All statements expressed by Fundação Getúlio Vargas employees, in which they are identified as such, in articles and interviews published in the media in general, exclusively represent their opinions and not necessarily FGV's institutional position.