



Green Hydrogen's Contributions to the Energy Transition: Perspectives and Prerequisites

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August 8th, 2022

Este documento foi preparado pelo MME e apresenta as melhores estimativas com base nas informações disponíveis. Não há garantia de realização para os valores previstos ou estimados. O conteúdo apresentado está sujeito a tratamento e interpretações.

10 Years Brazilian Energy Plan – PDE 2031

Insertion of hydrogen in the PDE 2031



Chapter 12 – Hydrogen

The role in the energy transition and in decarbonization (hard to abate sectors and energy storage); Initiatives in Brazil: R&DI, Programs, Documents, CNPE Resolutions; Technical Potential in Brazil; Projects Announced; etc.



Figure 12 - 6: Potential

Estimative of resource availability potentials is a key step to indicate opportunities to be assessed in any market.

Box 12 - 2: What different potentials mean?

Remaining Technical Potential is 1.8 Gt H₂/year (2050 horizon annualized), of which 96% renewable H₂

Hydrogen domestic market & market potential in Brazil

Existing and new markets

By 2031, ~2/3 of carbon emissions in the Brazilian Energy Sector (529 MtCO₂eq) will be in Industry and Transport yet [EPE - PDE 2031]



Fertilizers



Refinery



Methanol



Mining & Metallurgy



Food & Others



Energy Storage



FC Forklift



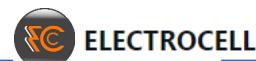
Transport



Biorefinery



Local & global players / suppliers



Ministério de Minas e Energia



Government support to Hydrogen R&DI is not new...

Long-term commitment to hydrogen brought results

Programs, Plans, White Papers, Resolutions

MCTI 2002



MME 2005



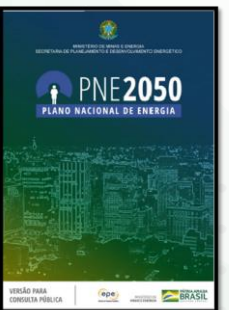
MCTI 2010



MCTI 2018



MME-EPE 2020



EPE 2021



CNPE nº 2 2021



CNPE nº 6 2021



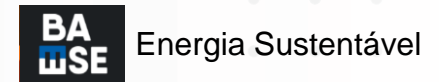
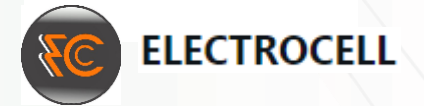
Capacity building



Public and public oriented investments R&DI reached R\$ 200 millions – 1% of energy R&DI (1999-2018)

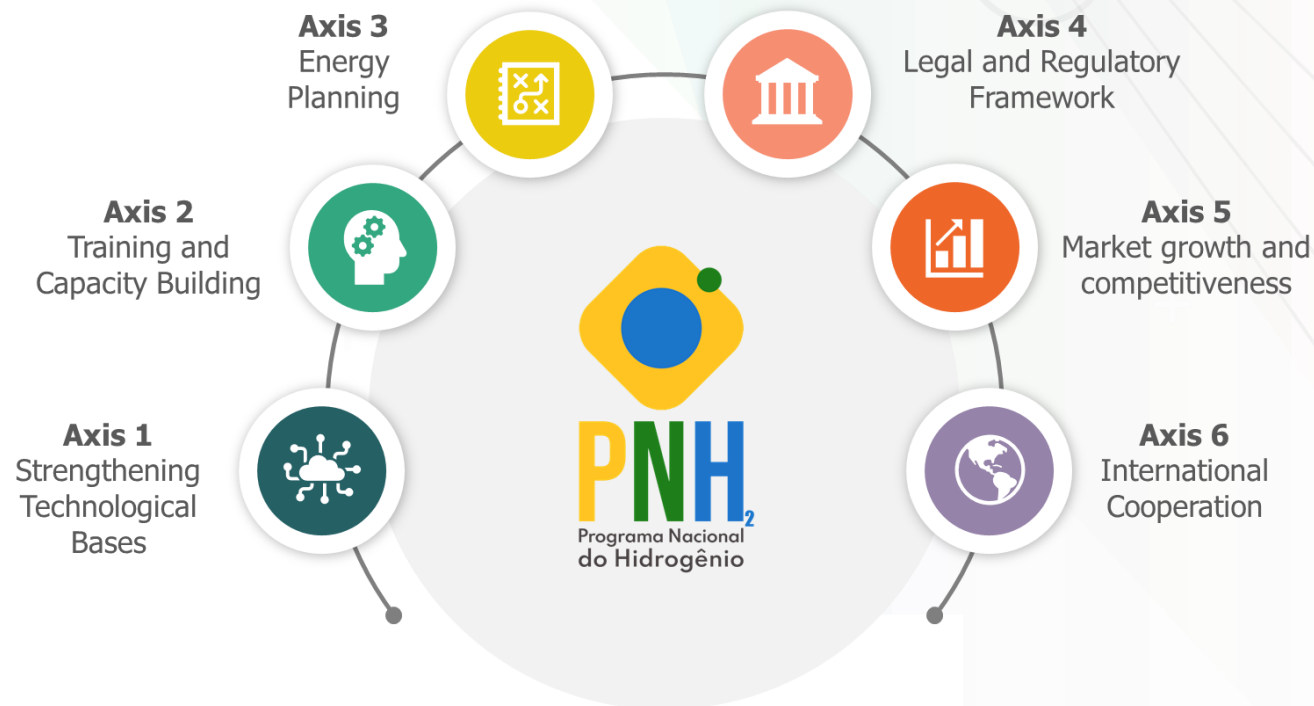
CNPE Resolution nº 2, Feb, 10, 2021 Guidelines for energy R&DI public & public oriented funds to allocate resources in priority areas, which includes hydrogen.

Start-ups



Market design and policy in 2021

Brazil's National Hydrogen Program – PNH₂



CNPE Resolution nº 6, April, 20, 2021

MME must present proposal for Directives on the **National Hydrogen Program**, in collaboration with MCTI, MDR and support of EPE.

PNH₂ (August, 2021 and June, 2022)

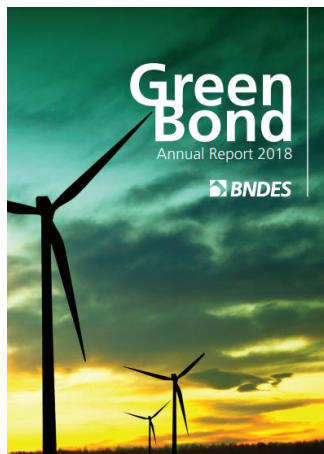
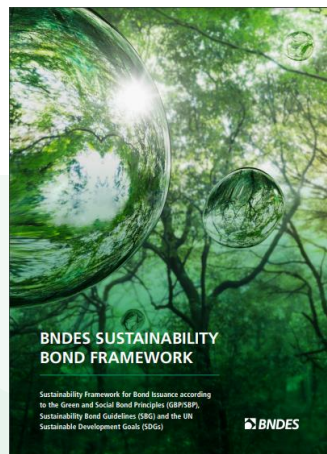
Designed to mobilize public and private sectors, as well as academia, together with international cooperation, to accelerate the development of a comprehensive and competitive hydrogen market.

Financial support for renewables & low carbon H₂ (not exclusive to)

In addition to R&DI funds, BNDES, FINEP, private sector, capital market and foreigner investors provide a broader range of opportunities to finance green investments



The Brazilian development bank




DIÁRIO OFICIAL DA UNIÃO
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Órgão: Presidência da República

DESPACHO DO PRESIDENTE DA REPÚBLICA

MENSAGEM

Nº 97, de 26 de março de 2021

Senhor Presidente do Senado Federal,

Comunico a Vossa Excelência que, em face da rejeição pelo Congresso Nacional do veto parcial ao Projeto de Lei Complementar nº 135, de 2020, transformado na Lei Complementar nº 177, de 12 de janeiro de 2021, que "Altera a Lei Complementar nº 101, de 4 de maio de 2000, para vedar a limitação de empenho e movimentação financeira das despesas relativas à inovação e ao desenvolvimento científico e tecnológico custeadas por fundo criado para tal finalidade, e a Lei nº 11.540, de 12 de novembro de 2007, para modificar a natureza e as fontes de receitas do Fundo Nacional de Desenvolvimento Científico e Tecnológico (FNDCT), e incluir programas desenvolvidos por organizações sociais entre as instituições que podem acessar os recursos do FNDCT", acabo de promulgá-lo, nos termos da Constituição, motivo pelo qual ora restituo dois exemplares dos respectivos autógrafos.

Este conteúdo não substitui o publicado na versão certificada.



Financial support for renewables & low carbon H₂ (not exclusive to)

Hint of BNDES products for hydrogen



EN | ES | ACESSIBILIDADE

BNDES O banco nacional do desenvolvimento

FINANCIAMENTOS TRANSPARÊNCIA DESENVOLVIMENTO SUSTENTÁVEL CONHECIMENTO IMPRENSA

MENU

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Investimento em instalações e/ou serviços para refino de petróleo, biorefinarias, produção de hidrogênio e estocagem de derivados de petróleo e combustíveis

Apoio à implantação, expansão, modernização, construção, integração e montagem de refinarias, biorefinarias, para a produção de combustíveis sintéticos, hidrogênio e derivados de petróleo e biorefinarias, para a produção de combustíveis sintéticos, hidrogênio e derivados de petróleo e combustíveis.

Quem pode solicitar

O que pode ser financiado



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FINANCIAMENTOS TRANSPARÊNCIA DESENVOLVIMENTO SUSTENTÁVEL CONHECIMENTO IMPRENSA

MENU FINANCIAMENTO

BNDES FUNTEC - FUNDO DE DESENVOLVIMENTO TÉCNICO-CIENTÍFICO - BNDES APOIO À INOVAÇÃO

Search bar

BNDES Funtec - Fundo de desenvolvimento técnico-científico - BNDES Apoio à Inovação

Apoio financeiro não reembolsável a projetos de pesquisa aplicada, desenvolvimento tecnológico e inovação em Instituições Tecnológicas, selecionados de acordo com os focos de atuação definidos pelo



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MENU FINANCIAMENTO

FUNDO CLIMA - SUBPROGRAMA ENERGIAS RENOVÁVEIS

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Fundo Clima - Subprograma Energias Renováveis

Apoio a investimentos em geração e distribuição local de energia renovável, no desenvolvimento tecnológico e na cadeia produtiva do setor de energias renováveis.

Quem pode solicitar

O que pode ser financiado

Como solicitar

Hydrogen is a key issue in the Brazilian energy agenda

High-level Dialogue on Energy & International Partnerships

HIGH-LEVEL DIALOGUE ON ENERGY
MINISTERIAL THEMATIC FORUMS
21-25 June 2021 | Virtual

MINISTERIAL THEMATIC FORUMS FOR THE HIGH-LEVEL DIALOGUE ON ENERGY

CO-HOSTED BY: Member State Global Champions for the High-level Dialogue on Energy
CO-CONVENED BY: Dialogue Secretary-General and Dialogue Co-Chairs
IN PARTNERSHIP WITH: Co-Leads of the Technical Working Groups
WITH TECHNICAL SUPPORT OF: UN-ENERGY

Brazilian Hydrogen Energy Compact Side Event
June 24th, 2021
15:15 - 16:30 EST (NY)
16:15 - 17:30 GMT-3 (BSB)
[Join us here](#)

United Nations
HIGH-LEVEL DIALOGUE ON ENERGY
UNITED NATIONS, NEW YORK, SEPTEMBER 2021

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Brazil

GH2 Country Portal - Brazil

Green Hydrogen Vision

Brazil will be a key player in the global hydrogen market. Brazil has great opportunities to harness its huge clean energy potential in order to foster a low carbon hydrogen industry, catalyzing a low-carbon economy in the country, particularly in hard-to-abate sectors. Green hydrogen will have a relevant role in achieving the Brazilian vision for energy transition and net zero economy. Focusing on low carbon hydrogen in Brazil will also allow the development of projects with hybrid technological approaches and business models, providing additional pathways to market green hydrogen. Moreover, Brazil has a significant domestic market potential for low carbon hydrogen and it has robust logistics for export to the main international markets. In this context, the vision of Brazil is to develop a competitive low carbon hydrogen economy.

<https://gh2.org/countries/brazil>

HYDROGEN INITIATIVE
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

German-Brazilian Energy Partnership

US-Brazil Energy Forum For World Commerce and Development

GREAT for PARTNERSHIP
BRITAIN & NORTHERN IRELAND

India and Brazil on Bio-energy Cooperation

BRICS ENERGY RESEARCH COOPERATION PLATFORM

Hydrogen is getting momentum in Brazil

Strategies and plans have been announced for fuel cell based on ethanol (R&DI and Strategies)



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Home > CRAFTSMANSHIP > Technology > Technology Archive > Future Technology > e-Bio Fuel-Cell

e-Bio Fuel-Cell

A fuel cell system that generates electricity from bioethanol to power a vehicle

e-Bio Fuel-Cell is a fuel cell system that uses bioethanol (100% ethanol or an ethanol-blended water) as a fuel source to generate electricity through the Solid-Oxide Fuel Cell (SOFC). The generated electricity charges the battery which provides power to the vehicle.

Bioethanol is made from resources such as sugar cane and corn. Converting this resource into electrical power emits some CO2. Because the plants that produce these resources achieve a "carbon neutral cycle" that produces zero net C

In countries where bioethanol is widely used (such as Brazil) existing infrastructures with few restrictions.



SUGAR AND ETHANOL

BRAZIL SHOULD EXPORT ETHANOL FUEL CELL, SAYS VOLKSWAGEN LATIN AMERICA CEO

May 26, 2021 Posted by Ruth Hillard
Week 202123

For Volkswagen Latin America CEO Pablo Di Si, Brazil should be an exporter of ethanol technologies, such as the fuel cell, both to neighboring countries and to the European continent and emerging powers like China and India.

Brazil's ethanol producers push back on EVs

Published date: 22 March 2021

Share:



Brazil's ethanol industry is working with the automotive industry to develop hybrid and hydrogen fuel-cell cars that run on the biofuel, bucking a global trend toward plug-in electric vehicles.

"There's a lot of talk about electric cars – they have good marketing," says Andre Rocha, president of Goias state ethanol industry association Sifaeg. "But we need to redirect these discussions because ethanol is the future."

Brazilian ethanol experts say plug-in EVs in t with fossil fuel-based power generation such higher.

ESTADÃO #

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Notícias

Toyota terá Prius flexível e testará Mirai no Brasil

Prius será o primeiro híbrido flexível do mundo e Mirai poderá ter célula a etanol

Tiãoliveira, de Tóquio
27 de out. 2017 - 4 minutos de leitura



Toyota vai testar Prius flexível
Crédito: Foto: Rafael Arbery/Estadão

MURRAY ADVOGADOS

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BOSCH BETS ON ETHANOL IN ELECTRIC CAR



The CEO of Bosch in Latin America, Basilei Boteho, told Valor Monday that Brazil can again have a prominent role in the development of a new energy solution: the hydrogen fuel cell. Separating hydrogen from ethanol to produce electricity by chemical process, within the vehicle itself, avoids the need to charge the hydrogen cylinder and the use of batteries. The Brazilian prominence cited by Mr. Boteho refers to the so-called "flex" technology, which allowed the use of ethanol, gasoline or the mixture of the two fuels in the same tank. Bosch has a global plan to invest €1 billion in the hydrogen project between 2021 and 2024. For Mr. Boteho, in Brazil, while the hydrogen from ethanol technology does not advance, it is possible to compensate for the lost time in the development of the electric car through the intensification in the production of hybrids that can be fueled with ethanol. It is necessary to think of a "bridge," he said, to insert Brazil in the world context that accelerates the electrification of transport.

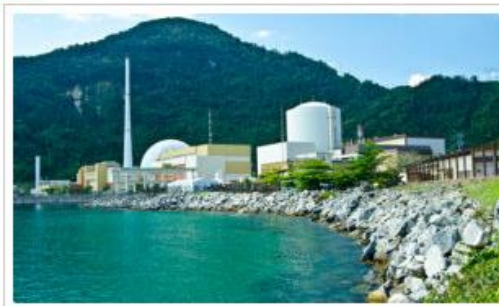
Source: Valor International
<https://www.valor.com.br/internacional/briefs>

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Hydrogen is getting momentum in Brazil

Strategies and plans have been announced for hydrogen in power sector



Eletronuclear plans to purify the hydrogen gas produced in Angra I & II (potential 150-300 kg of H₂/day, raising to 500 kg/day with Angra III in the future).



PTI/Itaipu Binational R&DI in hydrogen



Sep, 20, 2021 – Raizen (JV Cosan-Shell) announced a 5-years deal with Yara to sell biomethane (20 thousand m³/d) for hydrogen and green ammonia production.



Aug, 10, 2021 - Enterprize Energy and Rio Grande do Norte State signed a MOU to produce green hydrogen and green ammonia from wind energy.



Furnas started producing hydrogen in Itumbiara Hydropower-Solar PV plants under P&D ANEEL Project



Aug, 12, 2021 – Unigel announced it will built a green ammonia unit at its plants in Camaçari/BA, by 2022-23 (by converting a closed unit).



Sep, 20, 2021 - Neoenergia and Ceará State signed a MOU to implement a project using public transport vehicles powered by green hydrogen.

Hydrogen is getting momentum in Brazil

High scale green H₂ projects have been announced (over US\$ 20 billion)
(under technical and economical evaluations)



Fortescue and Açu Port, in Rio de Janeiro State, signed a MOU to develop green hydrogen Projects (plant of 300 MW => 250 kton of green ammonia)

Fortescue also signed a MOU to develop green hydrogen Plant in Pecém Port in Ceará State

Shell and Açu Port signed a MOU to have a 10 MW green hydrogen pilot-plant at Açu Port, in Rio de Janeiro State in 2025. Future phases might total 100 MW up to 2029.



Energix, Pecém Port and Ceará State signed a MOU to develop a green H₂ Project (600 kton H₂ - US\$ 5.4 billions)

Qair, Pecém Port and Ceará State signed a MOU to develop green H₂ Projects (Plants of 540 MW, investment of US\$ 3.8 billions).

White Martins (Linde / Praxair) and Ceará State signed a MOU to have facilities in the Green Hydrogen Hub at Pecém Port

Qair and Suape Port, in Pernambuco State, signed a MOU to develop green and blue H₂ Projects (Plants of 540 MW - US\$ 3.8 billions).

Neoenergia and Pernambuco State signed a MOU to develop a green H₂ pilot-plant in Suape Port.

Other projects at BA, RN and ES



Potential to be a key player in hydrogen market

- ✓ Huge **natural endowment** for hydrogen production
- ✓ **Government commitment** to hydrogen
- ✓ Sound **regulation & business environment** in energy sector
- ✓ Fair **human capital, technological skills & logistics** to key international markets
- ✓ Policies to get benefits from **national competitive advantages**, while **creates new ones**
 - ✓ **Renewables are blue-chip**, but natural gas and nuclear also matters (zero-carbon + CCUS)
- ✓ **Technological neutrality** rather than lock-in
- ✓ **Existing Market** and **market potential**
- ✓ Wide **international partnerships**

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