

HYDROGEN MARKET BACKGROUND: BRAZIL, EUROPE AND ITALY

Climate change is a key risk factor that needs to be tackled to reduce uncertainty in the global development landscape, protect the people and the environment, and ensure democratic and sustainable access to energy. In this sense, the United Nations Conference on Climate Change in the United Kingdom 2021 (COP 26) released the “Glasgow Climate Pact”, which is a new fundamental piece to accelerate actions towards the goals of the Paris Agreement and the Sustainable Development Goals (SDG). Moreover, during COP 27 the “Sharm el-Sheikh Implementation Plan” reiterates “that the impacts of climate change will be much lower at the temperature increase of 1.5 °C compared with 2 °C and resolves to pursue further efforts to limit the temperature increase to 1.5 °C”.

In this context, cooperation between countries to conceive, structure, develop and implement innovative solutions in the energy market is essential to achieve “net zero” by 2050. As stated by the IEA (2021a) ¹, without international cooperation this transition would be implemented in much more time.

It is worth mentioning that “Latin America is home to a large hydrogen industry that may be on the verge of an unprecedented transformation, driven by ambitious targets for reducing greenhouse gas (GHG) emissions, technological developments, and taking advantage of abundant resources and competitiveness in the region. The hydrogen industry will be able to undergo this transformation on two fronts: replacing the current supply of hydrogen with low-carbon hydrogen production technologies and expanding the use of hydrogen for new applications (IEA 2021b) ²”. In addition, the IEA report (2021b) “Hydrogen in Latin America, from near term technologies to large scale” reaffirms the fundamental role of international cooperation in the hydrogen market.

In this scenario, according to CNI (2022)³, “Brazil has characteristics that place it in a privileged position to be competitively inserted in the sustainable hydrogen value chain. On the supply side, the country has a variety of renewable resources (wind, solar, ethanol and hydraulic energy) for the production of hydrogen via electrolysis and steam reforming of natural gas, and both routes can be used to boost its industrial development. On the demand side, Brazil's geographic position and

¹ IEA, *Net Zero by 2050 A Roadmap for the Global Energy Sector*, May, 2021a.

² IEA, *Hydrogen in Latin America From near-term opportunities to large-scale deployment*, 2021b.

³ Confederação Nacional da Indústria. *Hidrogênio sustentável: perspectivas e potencial para a indústria brasileira* / Confederação Nacional da Indústria. – Brasília : CNI, 2022. 137 p.: il

continental dimension expand the possibilities for hydrogen to be explored both in the internal market – in the industrial and transport chain – and in the external market, through exports especially to Europe”.

Furthermore, Brazil has abundant fossil and waste biomass resources that, along with CCUS (Carbon capture, utilization and storage), can be used to produce low carbon hydrogen and, in the case of biomass, eventually with negative carbon emissions. Another already identified, but unexplored, route that could represent a significant share of the hydrogen chain in the future is the extraction of natural hydrogen in Brazil.

Specifically, according to Castro et. al (2021)⁴, in the near future, Brazil has all the elements to be a producer of hydrogen for national and international demand (multiple end uses), thanks to its renewable energy potential (more than 1.3 million MW of solar and wind energy), low prices of renewable energies, mature institutional and regulatory structure, competitive bidding processes and national extension of the electrical system. Furthermore, according to Bloomberg NEF⁵, Brazil has the potential to produce hydrogen using renewable energy at one of the lowest normalized costs, around \$1.5-3.37/kgH₂.

Brazil is already showing important market movements with planned investments on the scale of USD\$ billion in industrial centers, located, for example, in ports, such as Pecém, Açú, Suape, among others, and in industrial areas, such as the UNIGEL factory in Camaçari. The consolidation of this market will bring socioeconomic benefits (e.g., job creation, attracting investments, encourage innovation and technology, etc.), environmental benefits (e.g., GHG reduction in “hard-to-abate” industrial sectors) and it will consolidate the country as a global leader for the energy transition.

In this sense, hydrogen production, on the one hand, can transform Brazil into a strategic player in the world market of this commodity, and on the other hand, it can favor domestic consumption with the consolidation of technological solutions that contribute to the energy transition, such as the expansion of hydrogen-powered transport.

A strategic partner in the consolidation of this nascent market is Europe. According to CNI (2022) “the European Union is committed to promoting the gradual decarbonization of the economy by 2030 and reaching “net zero” in 2050, according to the recent European Green Deal (EC, 2021)⁶.

4 CASTRO N., SANTOS V. e AQUINO T., O Brasil e as estratégias da Alemanha para o Hidrogênio Verde, Artigo publicado pelo Broadcast da Agência Estado de São Paulo em 16 de setembro de 2021, GESEL, Instituto de Economia UFRJ.

5 Bloomberg NEF, Energy Transition Factbook Prepared for the 13th Clean Energy Ministerial, 2022.

6 EUROPEAN COMMISSION - EC. A European Green Deal. 2021a. Disponível em: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.

The European strategy points to hydrogen as one of the energy pillars to achieve the decarbonization targets”.

Specifically, as the European Commission (2020)⁷ points out, in the first phase of the implementation of the hydrogen strategy (2020 – 2024), the strategic objective is to install at least 6 GW of renewable hydrogen electrolyzers in the European Union (EU) and production of up to 1 million tons of renewable hydrogen, to decarbonize existing hydrogen production. In the second phase, from 2025 to 2030, hydrogen must become an intrinsic part of an integrated energy system with the strategic objective of installing at least 40 GW of renewable hydrogen electrolyzers by 2030 and the production of up to 10 million tons of hydrogen renewable in the EU. In a third phase, starting in 2030 and up to 2050, renewable hydrogen technologies must reach maturity and be deployed on a large scale to reach all sectors that are difficult to decarbonize, where alternative solutions may not be viable or have higher costs.

With the advent of the Russian and Ukraine conflict, Europe has decided to move away from the dependence of Russian fossil fuel with different actions to promote energy security detailed in Initiative called “RepowerEU”. In this context Hydrogen acquired a more strategic role, and Europe decided to double the ambition of hydrogen from 10 million tons to 20 million tons in 2030, half from internal production and half from imports from foreign countries⁸.

In industrial and business terms, this strategy foresees, at least in the first phase, the insertion of hydrogen through the industrial ecosystems of Hydrogen Valleys⁹, within a smart specialization framework. Such industrial systems decentralize the way of producing, transforming, transporting and end-uses of hydrogen, strengthening local hydrogen clusters and contributing to the hydrogen market penetration¹⁰. The second and third phases envisage the industrialization and large-scale diffusion of hydrogen technologies and the development of the global hydrogen market.

In Italy, according to MISE (2021)¹¹, the Government foresees the application of hydrogen in the transport sector for the next decade, in particular freight transport (for example long-haul trucks),

⁷ EC, European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A hydrogen strategy for a climate-neutral Europe, Brussels, 8.7.2020 COM (2020) 301 final

⁸ More information available in the following link: https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen_en

⁹ According to Weichenhain et al. (2021), there are four key elements that a Hydrogen Valley must have: 1) Large in scale, i.e. investment on the scale of billions of euros; 2) Integrated value chains (production, transformation, transport and final use); 3) A specific geographic territory; 4) Provision of hydrogen for multiple end uses 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

¹⁰ However, to expand the hydrogen market, market growth must be promoted, in which there will be a need for more investments in infrastructure to move from a decentralized offer (Hydrogen Valley) to a more comprehensive one, even though such models are complementary and can go hand in hand (complementary)b.

¹¹ MISE, Strategia Nazionale Idrogeno Linee Guida Preliminari, Ministero dello Sviluppo Economico, 2021

railways and industry, with specific reference to segments in which hydrogen is already used as an input, for example, in the chemical sector and oil refining. In addition, hydrogen blending into the gas grid can be used to anticipate and stimulate growth in the hydrogen market. “Hydrogen valleys” ecosystems, that include both hydrogen production and consumption, could also be strategic for hydrogen diffusion by 2030, leading to a possible application of hydrogen in other sectors. Finally, some small-scale pilot projects are also planned in other sectors, for example local public transport, biomethane or steel.

In terms of investments, according to MISE (2021), to start the low-carbon hydrogen economy in Italy, and meet the demand target of hydrogen penetration in final energy consumption (2%), is needed up to 10 billion euros of investments between 2020 and 2030 (to which must be added investments for the diffusion of renewable energies). The Italian Recovery Resilient Plan foresees the financial support of Hydrogen projects along the whole value chain for a total value of 3.64 billion to be implemented before 2026.

International cooperation between Brazil and Europe, specifically with Italy, in the hydrogen industry, needs to keep up with market developments, considering the peculiarities and competitive advantages of the countries and stimulating innovation and sustainability, taking into account several key elements:

- Integrated and global value chain approach;
- Decarbonization of energy matrices;
- Encouraging national energy security;
- Global industrial standards;
- Infrastructure availability;
- Training and employment;
- Innovation ecosystems;
- Transfer and absorption of knowledge;
- Financial instruments and sustainable finance; and
- Regulatory and legal framework.

Finally, cooperation between Brazil and Italy can be a strategic partnership to shape a prominent and innovative market – the hydrogen market – to help achieve climate change targets and maintain the countries' competitiveness over time.