EasyChair Preprint

№ 8861

Contributions to the Development of a Hydrogen Economy in Brazil

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September 22, 2022

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1. Introduction

The energy transition is a structural and irreversible process of transformations in the world energy matrixes, mostly fossil and greenhouse gas (GHG) emitters, to clean and renewable matrixes. The search for technological, renewable or low carbon alternatives capable of integrating intermittent renewable sources and sectors that are difficult to reduce emissions becomes, therefore, a strategic factor capable of simultaneously meeting climate goals and energy security.

In this decarbonisation context, green or low-carbon hydrogen (H2) emerges as a potential key energy vector for the ongoing transition (PARRA et al., 2019; IEA, 2021). On a global scale, the centrality of H2 stems from the movement of countries towards the goals set out in the Paris Agreement, signed in 2016, whose main objective is to limit temperature increase to 1.5°C.

In this way, the H2 economy has been structuring itself as a new economic paradigm based on the large-scale use of H2 as a central energy vector to meet the growing demand for energy and reduce GHG emissions (CGEE, 2010; PANDEV et al., 2017). Currently, about 35 countries around the world already present H2 strategies and regulatory roadmaps to support the development of a green, low-carbon H2 economy. Moreover, every day, new projects, international cooperations and technological and regulatory innovations are being announced.

In line with global initiatives, Brazil has presented significant advances regarding the structuring of an H2 economy. In 2020, the Energy Research Company (EPE) published the National Energy Expansion Plan 2050, presenting H2 as a disruptive and strategic technology for the Brazilian energy sector. In 2021, the government presented guidelines for a National Hydrogen Program (PNH2). At the same time, several memoranda of understanding and projects in the national territory are being developed, following a gradual approach to the insertion of this vector. Since Brazil presents unique characteristics for the development of the H2 economy, considering its capacity of expansion and operation of renewable energies and the presence of a land, pipeline and maritime transport infrastructure, it is considered a player with high potential to export green H2, as well as to develop its internal market.

Given this context and considering that Brazil is still in the development stage of its national strategy, the central objective of this article is to contribute to the formulation of actions and policies that support the consolidation of an H2 economy in Brazil.

2. Methodology

The article proposes an international benchmark study of the green and low-carbon H2 economy, according to economic, regulatory, financing mechanisms and national decarbonisation targets. For this purpose the study carried out a broad survey of measures and actions directed to hydrogen promotion in several countries with consolidated national strategies for the development of a H2 economy.

In a first stage, the countries were selected according to their positioning in the H2 economy and the availability of documents such as national strategies, roadmaps, regulatory innovations, standardization and certification, among others. The second stage of selection involved the categorization of countries according to: (i) the potential for H2 exports; (ii) potential for H2 imports; (iii) potential for self-sufficiency in H2.

From the Brazilian perspective, the countries were categorized as competitors, consumers, partners or even identified as "H2 models", for being considered models already advanced in technology or financing mechanisms for developing green and low-carbon H2 economies. In total, 12 countries were selected for this analysis, namely: Australia, Canada, Germany, Japan, Morocco, Netherlands, Norway, South Korea, United Arab Emirates, United Kingdom and United States.

3. Expected Outcomes

The article hopes that the proposed benchmark study will provide a survey of the main lessons, inspirations and perspectives of the international experience for the development of the H2 economy in Brazil, considering the particularities, potentialities and challenges of the Brazilian scenario. In this way, it will be possible both to position Brazil in this trajectory of development of an H2 economy and to elaborate a set of recommendations and proposals for actions that will help Brazil in the structuring and consolidation of its national strategy.

4. Conclusions

In conclusion, it is important to highlight that the countries analysed have followed a planning structure based on the valuation of regional specificities. Thus, the need to reduce energy dependence and, simultaneously, the visualization of strategic advantages in a market in formation are basic elements of the countries' long term vision.

Considering the emerging state of the H2 Economy in Brazil, it can be observed that its structuring has been made from the organization of programs, roadmaps, international cooperation, research and innovation, followed by H2 pilot and demonstration projects. Still, the need to establish public policies for the development and consolidation of an H2 value chain in the country is evident, with emphasis on the definition of public policies and guidelines directed towards H2, in the regulatory sphere, including the establishment of well-defined goals, norms, and standards.

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