



The emerging green hydrogen industry in Brazil¹

Nivalde de Castro²

Roberto Brandão³

Thereza Aquino⁴

New demands and possibilities for productive activities arise abruptly and radically in historical moments of economic disruption. This fact makes it difficult to see future scenarios, since the past is not a safe reference for formulating projections.

Based on this presupposition, it is stated that the world is going through a disruptive moment due to global warming. This fact can be well exemplified by the daily increase in extreme temperatures in Brazil, with adverse consequences such as the water crisis.

The fight against this global challenge created the concept and strategy of Energy Transition. This can be defined as the evolution of an energy matrix with predominance of fossil resources (coal, oil and natural gas) - origin of greenhouse gases (GHG) and the main cause of global warming - towards a matrix of renewable sources.

The strategies in favor of Energy Transition are centered on the three D's: decarbonation, decentralization and digitalization. Therefore, international agreements are being signed to guide public policies, investment catalyst programs and regulatory actions. Such measures have been taken by countries that, historically, developed during the First Industrial Revolution, main polluting loci.

From the specific point of view of the transition, the main and crucial question is that the renewable sources will assure the decarbonation process, and consequently guarantee that net zero emissions are reached by 2050. Therefore, the designed scenarios by the main research institutions such as IEA and IRENA indicate the

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² Professor at the Institute of Economics at UFRJ and coordinator of the GESEL - Electric Sector Studies Group

³ Senior Researcher at GESEL-UFRJ

⁴ Professor at the UFRJ School of Engineering, associate researcher at GESEL, having been infrastructure superintendent at BNDES

expansion of the productive capacity of solar and wind power as well as of the important production of green hydrogen generated by those sources.

In this sense, it's presumed that, in front of this perspective, green hydrogen will be the next energetic world commodity by replacing oil barrels as the global reference of energy costs.

From this analytic frame, the main theme of this short and straightforward article is the emerging industry of green hydrogen with a focus on Brazil. This is justified by the country's unique competitive advantages for the development of the green hydrogen industry due to basically seven factors, exposed hereafter.

The first one is the wind and solar renewable sources power, superior to 1,300 GW according to studies made by the Energetic Research Company. In comparative terms, according to the Electric System National Operator, Brazil's total installed capacity is 172 GW, as compared to the 20 GW from wind power and 4.5 from solar power.

Based on these parameters, as well considering the high dimension of the 145,000 kilometers high tension transmission net. These dimensions point to exceptional conditions in terms of electricity costs, reassuring green hydrogen competitive production in comparison to the rest of the world, given that electric power represents around 70% of green hydrogen production costs in the electrolysis technology, the most efficient one.

The second factor is the reliability of the regulatory and economic national model of new electricity production sites contracting. The auctions for new investments on the captive market were always very competitive, normally with more offers than demands, resulting in huge discounts. In parallel, with the growth of the free market, the bilateral contracts are signed as a consistent and safe way to contract electricity, which guarantees the competitive price of the renewable energy offer. In brief, a new parameter free frontier of generation and transmission, constituting an emerging and electrical intense industry.

The third factor is the performance of big players in the Brazilian Electricity Market. They are global economic groups (Engie, EDP, Enel, State Grid, and Iberdrola) and national ones (Energisa, Equatorial, Cemig, Copel, and Celesc), with strategic view and financial and business capacities to invest on the creation of the value chain of green hydrogen industry, which will be one of the greatest consumers of electrical power, therefore qualified in the electrical intense segment. But also opening possibilities of new business opportunities.

The fourth factor refers to favorable conditions for the green hydrogen consumption in a growing scale, seem the potential demand from national industry's important sectors, whether it's for converting their matrices that consume nonrenewable energetic resources, or mainly to produce inputs and goods that need to become green to face competition and overcome the barriers that are being created in the

international market for non-sustainable products, as is the case for the iron, chemical, cement market, among others.

The fifth factor is a competitive component very favorable to Brazil. It's the availability of oceanic ports, which some are associated with industrial complexes from sectors mentioned above. In this manner, are worthy of mention the industrial complexes of Camaçari and Port of Pecém, as the last one is already incorporated in an ambitious program from Ceará's government. Even other ports that still don't have industrial complexes, such as Açu and Macaé, can and must qualify as green hydrogen production centers for exportation.

The sixth factor refers to the possibility of creating an industrial pole to manufacture gear for green hydrogen production, storage and transportation throughout specific industrial policies. Due to the positive and competitive perspectives, groups like Siemens Energy will have interest in this strategy focused also in the Latin American Market. It may be taken as an analogy, ignoring the gender and degree differences, the arrival of automobile industry in Brazil in the decade of 1950, within the scope of the Goals Plan from the forever admired and admirable President Juscelino Kubitschek.

And lastly, the seventh factor is related to the funding capacity that the Brazilian economy has to support the development of an emerging industry such as the green hydrogen. In this context, for example, the National Bank for Development is already performing studies about this industry, seeking alignment with their traditional loan lines that certainly will be able to be adjusted. In the private market the incentivized debentures will be able to be used following the success experience of electrical power generation and transmission projects.

Ultimately, by the way of a wider conclusion, it is evident that the sum of these seven factors really transcends the exclusive actions and decisions of the Brazilian Electrical Sector. In the green hydrogen value chain, the interface with the electrical sector is restricted to the renewable energy offering based on its solid and consistent regulatory framework. However, the value chain beginning from the green hydrogen production sites is more affected by the industrial policies, under the responsibility of the Economy Ministry.

There aren't, on the other hand, the needed conditions and climate to advance in the discussion of an industrial policy in function of the economic crisis that Brazil is facing due to the negative inflation fees, unemployment and Gross Domestic Product (GDP). Besides, 2022 being an electoral year is another unfavorable element.

In this manner, it's up to the economic agents to guide this process of the creation of the green hydrogen emerging industry with support from the state institutions to advance and to develop studies that will subsidize and base the development of industrial policies from 2023. In this direction a strategy for 2022 supported by state institutions (IPEA, BNDES, BNB, FINEP, Universities and Research Centers) can

contribute to the qualified debate that normally is present in presidential elections in the proposals formulated to be examined by all candidates, independent of the partisan political positioning, in view of the national benefits that the emerging green hydrogen industry will bring to Brazil, above everything.