HYDROGEN ECONOMY DEVELOPMENT IN SOUTH KOREA: LESSONS TO LEARN

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Overview

This research is devoted to the analysis of the experience of South Korea in the establishment of the "hydrogen economy" – an economic and industrial structure using hydrogen as the main source of energy supply. Since the early 2000s, the country aimed at introducing hydrogen into different sectors of its economy. However, this process was not smooth. In the paper, we explain, why Korea's first "Master Plan for Realization of Environment-Friendly Hydrogen Economy" unveiled in 2005, failed to achieve its targets. We describe the evolution of the motivation of the key Korean stakeholders to introduce hydrogen over time (from attempts to avoid risks of the "peak oil" and energy diversification in the early 2000s to managing emissions in the 2020s). We also show what main lessons the country learned along the road, and how it builds upon them now.

The Paris Agreement of 2015 gave a new impetus to South Korea's hydrogen plans, which have been well covered in several key documents over the last few years. However, achieving a hydrogen-based energy system, which is called a "hydrogen economy", is in the very early stage of development and faces a lot of technological, infrastructural, and economic challenges.

South Korea has limited possibilities for producing clean and low-carbon hydrogen domestically. Therefore, historically being a country heavily dependent on energy imports, even after the introduction of hydrogen in its energy system, South Korea is set to continue being a large-scale importer of energy. In this context, the paper argues that South Korea should continuously seek international cooperation to secure a stable supply of carbon-free hydrogen and solve technical challenges along the whole hydrogen value chain. Through international cooperation, South Korea will not only need to seek hydrogen supply but also end-user markets for H_2 vehicles and fuel-cell products. Strengthening the partnership between South Korea and traditional energy exporters like the Kingdom of Saudi Arabia will provide vast opportunities to both countries in this fledgling but fast-developing new market.

At the same time, South Korea is anticipated to become one of the key players in the formation of the hydrogen market with strong government support and active initiatives from the private sector. The detailed analysis of the country's hydrogen strategies and the current status of development of the hydrogen economy provide a meaningful understanding of the present and future of the hydrogen industry in the country and lessons to learn for the other countries planning to bet on hydrogen.

Methods

This research uses a case study method to analyze the role of hydrogen in the economic, environmental, and strategic goals of South Korea's energy sector. We analyse the country's aims and strategies regarding hydrogen enshrined in several key documents over the last few years, as well as the experience of its industrial companies.

The experience of South Korea is important for both energy importing countries that are undergoing the process of the energy transition, and energy exporting countries that need to understand the strategies of their customers attempting to diversify their energy balances.

Results

The research results show that from its unsuccessful experience the country carried out 2 main lessons. First, to achieve long-term nation-scale targets, all the plans and support must be carried out simultaneously and continuously for decades at all levels of regulation (both nationwide and local). Second, hydrogen should make economic sense and be price-competitive so that it could expand its presence in the market without long-term government support.

We also show that international cooperation is key to achieve the targets set by the South Korean government – and traditional exporters of energy to South Korea like Saudi Arabia are likely to occupy the emerging hydrogen niche.

Conclusions

The paper presents lessons to learn from South Korea's experience to introduce hydrogen economy. It also argues that South Korea should continuously seek international cooperation to secure a stable supply of carbon-free hydrogen and solve technical challenges along the whole hydrogen value chain. Through international cooperation, South Korea will not only need to seek hydrogen supply but also end-user markets for H_2 vehicles and fuel-cell products. Strengthening the partnership between South Korea and traditional energy exporters like the Kingdom of Saudi Arabia will provide vast opportunities to both countries in this fledgling but fast-developing new market.

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