THE POTENTIAL EFFECT OF HYDROGEN PRODUCTION: CASE STUDY OF SAUDI ARABIA

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Overview

The energy transition from fossil fuel to renewable energy has been the focus in tackling climate change. Since the Paris Agreement was signed back in 2016, several countries have been pursuing strategies to mitigate the environmental pollution from energy generation based on fossil fuels. A few technologies have been impressively developed, reducing the cost and also increasing its efficiency, for example solar photovoltaic cells, solar farm, and wind turbine. However, the issue of the intermittency of renewable energy persists. Although the solution is straightforward, by developing energy storage, yet there has been lack of breakthrough mainly because of substantial cost that deemed large scale storage to be economically infeasible. In turn, hydrogen comes in as an alternative due to its gaseous form and storability. Hydrogen has not been thoroughly researched, especially in the economics literature due to the fact that the claim of hydrogen as a solution to energy transition has only been recently promoted.

Saudi Arabia, being one of the countries with an economy that relies quite heavily on hydrocarbons, is interested to show its commitment to Paris Agreement by striving to harness renewable energy resources and simultaneously boost its economic growth. The Kingdom has started developing several renewable energy projects that mainly uses solar PV. However, hydrogen as an alternative energy source has recently come under spotlight because of the Kingdom's competitiveness of hydrogen production from natural gas. Saudi Arabia could potentially be a major player in the upcoming global hydrogen economy. However, how hydrogen production would affect other domestic sectors remains unanswered. Can the Kingdom's economy support large scale hydrogen? This research provides insights to the potential of hydrogen production and its linkages to other sector as well as the readiness of the Kingdom's economy.

Methods

There are several methods of producing hydrogen that are differentiated by colors. Green hydrogen is a hydrogen production with water electrolysis by using electricity generated from renewable energy such as solar and wind energy. Blue hydrogen is a hydrogen production from fossil fuels but involves carbon capture. There are other colors such as grey and teal, but only blue and green hydrogen will be considered in this research.

In order to accurately measure the impact of hydrogen production on other sectors within the Kingdom, an input output analysis is carried out using a method that was developed by Leontief (1966). The analysis is done by using the most recent input output table that is published in OECD website (2022). The table is based on the economic activities in 2018 with 46 different sectors. The effect of hydrogen production is determined by adding a new sector, which is hydrogen. The linkages of hydrogen and other sectors will be based on the production cost of each technology, green and blue hydrogen, published by IEA (2019). Saudi Arabia already has hydrogen production for its manufacturing industry, but without carbon capture (also called grey hydrogen). For the analysis, we will assume that the current grey hydrogen will not be altered and the newly produced hydrogen will be exclusively for exports.

Results

Based on the preliminary input output analysis results, the impact of hydrogen production to the economy of Saudi Arabia will depend on magnitude of the production. Some institutions have forecasted that the demand for hydrogen could grow significantly in the coming years, such as Dii & Roland Berger (2021), Hydrogen Council (2021), and IRENA (2019). A more important insight would be the domestic sectors that would have to grow significantly. They would have to be able to support hydrogen prodution. For blue hydrogen, the most affected sector would be transport that involves transporting natural gas as well as the hydrogen produced. Meanwhile, for green hydrogen, the sectors that have to grow would be the water supply, transport sector, and electricity. This would mean that the Kingdom would have to pursue renewable energy generation rigorously as well as appropriate management of water resources for electrolysis.

Conclusions

The input output analysis provides a working framework that could be replicated in other countries. In addition, it provides insights on policymakers regarding potential approach to hydrogen production, regardless of the

technology. For blue hydrogen, since the most affected sector would be transport and including the transport equipments, the government should devise plans for hydrogen production facilities that minimizes the transportation cost. Given that the hydrogen produced would strictly be for exports, the facilities should be near the international hub. As for green hydrogen, it may be slightly less attractive for Saudi Arabia since it requires further electricity generation from renewable energy sources and significant water resources for electrolysis. The government should strategize the management of water as well as renewable energy generation should they decide to pursue green hydrogen as well.

References

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