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Prospects of Hydrogen Economy in Central Asia and Azerbaijan

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Abstract

The paper/opinion considers key aspects for introduction and development of hydrogen as the "fuel of the future" in Europe, technologies, and specifics of its production. As well as prospects of Azerbaijan, Kazakhstan and Uzbekistan as producers and suppliers of hydrogen in industrial volumes.

Keywords: Hydrogen; Renewable energy; Wind energy; Electrolyzer; Water supply; Natural gas; Ammonia; Central Asia; Azerbaijan

Introduction

In May 2022, the European Union announced its intention to increase the use of hydrogen, as part of its new energy strategy, accelerating the "energy transition". It is planned to allocate 100 billion euros annually to achieve this goal. Central Asian countries and Azerbaijan can take part in the implementation of this plan. In this article/opinion, we tried to consider the nuances of hydrogen projects development, taking into account its physics and chemical properties, available technologies, as well as to find common ground and mutual interest of Azerbaijan, Kazakhstan and Uzbekistan in terms of the resource base, geographical location, creation of joint supply chains and utilizing human capital. The main objective of the new EU energy plan - ending dependence on Russian fossil fuels. In January 2023, the leaders of France and Germany announced the acceleration of investments in "fuel of future" and joining of Germany to the project of construction the hydrogen pipeline "H2Med", according to which by 2030 2 million tons of "green" hydrogen will be annually shipped from the Iberian Peninsula to France.

Caspian Countries has a role to play in the implementation of this plan. In December 2022, the Republic of Azerbaijan signed a framework agreement with Fortescue Future Industries (FFI) to develop renewable energy projects in the country with a total capacity of 12 GW. In parallel, the FFI announced its intention to supply 5 million tons of "green" hydrogen annually to Europe by 2030, signing the agreement with Germany Eon. Developers from the Middle East - MASDAR and ACWA Power - in January and February 2023 signed agreements with the State Oil Company of the Republic of Azerbaijan "SOCAR" on the joint development of renewable energy projects with a total capacity of 4 GW and 2.5 GW, respectively, including Green Hydrogen production projects. Earlier, in November 2022, the Swedish company Svedind Energy Group announced the signing of an investment agreement with the Government of the Republic of Kazakhstan on the construction and commissioning of the 20 GW "green" hydrogen production plant with capacity 2 million tons of hydrogen per year by 2032. The Republic of Uzbekistan also recently signed an agreement with ACWA Power for development of "green" hydrogen and ammonia production projects [1-10].

Today, according to the International Energy Agency, the world's annual production of hydrogen is about 75 million tons, of which only 0.7% is low-carbon hydrogen. It is mainly used in the chemical industry to produce ammonia and methanol. However, it can also be used in steel production, replacing natural gas or coal, or in vehicles, as a fuel. It is worth mentioning that today, the efficiency of hydrogen-fueled cars is much lower than the efficiency of electric vehicles. Moreover, hydrogen is very explosive and its widespread use as a fuel for vehicles requires the introduction of appropriate safety measures. However, notably the fuel parameters of hydrogen, allow us to consider it as a contender

for the title of "fuel of the future". Hydrogen itself is not a primary element and does not exist in nature in a pure form, it must be produced by chemical reactions - by steam reforming of methane or by electrolysis of water with the help of special installations called electrolyzers. The most promising hydrogen producing technologies are alkaline (CAPEX per unit varies in a range of €750-1400/kW) and proton exchange membrane (PEM) (CAPEX per unit varies in a range of €900-1800/kW). Each of these technologies has its pros and cons, but both are energy intensive.

European countries plan to use electricity from offshore wind farms in the North and Baltic Seas to produce hydrogen. An ambitious program has been adopted to implement this plan - with installed capacity of 440 GW by 2030 and 1,300 GW by 2050. That is, about 30 GW per year. The produced hydrogen is planned to be pumped into underground storage facilities, for further use in industrial processes, and as fuel for deep-sea vessels, and, in rare cases, for incineration on gas turbines during the hours of maximum electricity demand and lesser wind and solar energy production. At the same time, there is a clear understanding, both in the expert community as well as among ordinary Europeans, that this is not the most efficient use of resources. So far, only Germany has announced plans to build new gas-fired power plants that will run on hydrogen. In addition, it is necessary to consider the consumption of specially prepared water to produce hydrogen by PEM electrolysis (about 15 liters of deionized water per 1 kg of hydrogen), as well as operation and maintenance cost of wind and gas turbines. However, European society is willing to pay that high price to prevent climate change and to prevent the solution of the problem to the future generations of Europeans.

What is the role of Azerbaijan, Kazakhstan, and Uzbekistan? Considering the existing natural gas reserves, the hydrogen economy in the context of these countries, in the short- and mid-term has an exclusively export meaning. Even with the present significant volumes of natural gas production and export, the resource availability of Azerbaijan and Kazakhstan is more than 70 years. Uzbekistan is in a somewhat different situation, in which it makes sense to pay attention to Turkmenistan, given its current volume of production, its availability, according to the most modest estimates, is more than 170 years. Moreover, water availability is an issue in the region. The water scarcity index calculated by the World Resources Institute shows the level of competition among water users (municipal, industrial, agricultural) for water use and surface water depletion. Hydrogen production will add another water-user, which means more competition and water shortages for third industries.

Conclusion

In conclusion, it should be noted that Azerbaijan and Kazakhstan had a unique opportunity, given the interest shown by large investors and the impressive volumes of renewable energy for development: (i) to increase its scientific, technological and industrial potential, (ii) localize certain equipment and components, taking into account resources available in the countries, and (iii) lay the foundation for the reindustrialization and sustainable development of the new generations, in harmony with the environment.

The countries of the region need to consolidate their human and logistical resources, industry, establish a joint supply chain for the timely implementation of these projects, i.e., be suitable for regional development. Otherwise, Europe will buy hydrogen from African countries that have already announced plans to develop hydrogen projects with a total capacity of 144 GW, and from Saudi Arabia, which has started the physical implementation of a giant project to produce "green" hydrogen called NEOM.

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