

Green Hydrogen in Kazakhstan: **Barriers**

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Introduction

The Russian invasion created some unpredictable outcomes. In April 2022, consumer prices have advanced 8.1 percent¹ and the inflation rate for oil & gas in the European Union (the EU) has reached 38 percent², according to Europe's statistics agency. As a result, hydrogen became a hot topic. However, the unstable situation with Ukraine is not the only reason for corporations to look for alternative sources of energy. On July 14, 2021, the European Commission developed the EU Green Deal environmental plan, according to which it is planned to reduce carbon dioxide emissions by 55% by 2030³. Starting from 2023, additional taxes will be imposed on goods with a carbon footprint imported into the EU. On the other hand, the authorities of the EU will imply a transition to alternative energy sources to strive for hydrocarbon neutrality. Thus, large capacity batteries and green hydrogen are coming out onto the stage.

In our opinion, hydrogen will lead a new era of alternative energy while Kazakhstan will play a major role in decarbonisation and providing energy to the rest of the world. According to independent researchers, the country ranks among top 10 countries for green hydrogen export potential⁴. In the meantime, it will have to reach numerous milestones for the potential to be fulfilled and to change its core essence, since Kazakhstan is considered as a major producer of coal, crude oil, and natural gas, currently holding the 9th, 17th, and 24th places for the resources production in the world respectively⁵.

Net Zero

Today, about 70 million tons (Mt) of hydrogen is produced annually in the world for use in oil refining and production of ammonia for fertilisers⁶. Only 0.1 percent of those 70 million Mt is green. China maintains the 1st place in hydrogen production and consumption (more than 24 million Mt), followed by the EU, India, Japan, South Korea, and the United States. As a result of such production, the atmosphere suffers from about massive 830 Mt of CO₂ emitted per year.

To mitigate climate change, it is necessary to achieve zero carbon dioxide emissions through decarbonisation of the energy sector. This can be achieved - among everything else - through the transition to a green hydrogen economy. According to a 2021 report by the International Energy Agency, 17 governments have committed to the common cause, having published hydrogen strategies; more than 20 governments have publicly announced that they are working on strategies, and a number of companies

¹ https://ec.europa.eu/eurostat/databrowser/view/prc_hicp_manr/default/table?lang=en;

² <https://www.cnbc.com/2022/04/29/inflation-latest-eurozone-breaks-another-record-in-april-2022.html>;

³ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en;

⁴ <https://renewablesnow.com/news/traditional-energy-exporters-stand-to-lead-global-hydrogen-trade-woodmac-759504/>;

⁵ <https://www.iea.org/reports/kazakhstan-energy-profile>;

⁶ <https://www.iea.org/reports/the-future-of-hydrogen>;

are looking to take advantage of hydrogen-related business opportunities. Meanwhile, the Kazakhstan Republic Government and the SVEVIND Group met in Sweden on October 7th, 2021, to sign the roadmap for green hydrogen initiatives in Kazakhstan. SVEVIND is planning to produce 2 Mt of green hydrogen per year in Kazakhstan for domestic use and export to the EU. SVEVIND will build 30 Megawatts (MW) of renewable energy (RE) capacity, and Kazakhstan will become the largest green hydrogen producer in the world by 2030. Such projects will help the country to achieve carbon neutrality by 2060, just as planned by the President.

This article reviews potential obstacles for green hydrogen in Kazakhstan. We will additionally review the current legislation for hydrogen in Kazakhstan and analyse problems which arise during the implementation of green hydrogen projects. Would the potential investors be able to mitigate risks? What will it take to green hydrogen initiative to bring fruits?

Legislation for Hydrogen Development

The Kazakhstan Government takes the main role in the upcoming events. For the development of hydrogen energy, it is necessary to create a viable and clear hydrogen strategy. As of today, however, the legislation of Kazakhstan is in many ways insufficient for green hydrogen production.

According to the research by the International Renewable Energy Agency (IRENA)⁷, there are several pillars to base green hydrogen policy-making on:

- **National Hydrogen Strategy.** The Government needs to define the target amount of green hydrogen to be produced and to develop a particular strategy. It also needs to define the extent of support it will provide the investors with;
- **Setting Policy Priorities.** The Government needs to identify end-use industries in which hydrogen can be applied;
- **Guarantees of Origin.** The Government should require investors to prove that hydrogen, with all the emissions related to the production and transportation, is effective for decarbonisation purposes. Carbon emissions should be reflected over the whole hydrogen lifecycle. Thus, the Government will ensure that the exported green hydrogen will satisfy the needs and requirements of the EU and other countries;
- **Governance System and Enabling Policies.** The Government should ensure that hydrogen policy covers the social sphere by creating new jobs and numerous industries in order to maximise benefits to the national economy.

There are many steps ahead to develop working legislation for hydrogen itself. The Government needs to build a particular strategy which will not only resonate with the RE industry but also cover other industries which may benefit from green hydrogen.

In the meantime, Kazakhstan has a considerably advanced legislation for RES as a whole in the Central Asian region. Legislation for RES has seen significant improvements in recent years. Initiatives taken by the President, including a National Plan for Energy Sector Development 2025, have made the industry

⁷ <https://irena.org/publications/2020/Nov/Green-hydrogen#:~:text=National%20hydrogen%20strategy,for%20private%20investment%20and%20finance>.

attractive to investors, both foreign and domestic. Further prosperity of RES involves evolving legislation in Kazakhstan, fit to the phase of industry development, which is still an issue in Kazakhstan.

Due to the lack of a particular hydrogen regulation, the investors who aim to produce green hydrogen in Kazakhstan are based on the RE legislation. According to the concept for the transition to a green economy, the share of renewable energy sources by 2030 should reach 10 percent from the total produced energy and 50 percent towards the year 2050. In 2018, the Government introduced a concept of auctions for RES projects and all energy produced has been sold to the National grid ever since. However, such auctions and sale of energy to the National grid is not acceptable for green hydrogen enthusiasts. In order to ensure that energy produced by the RE facilities of the investors will be directed to the hydrogen production only, the concept of “island grid” should be established. Under such a concept, the Government should ensure that all the RES energy produced will exclusively be directed to hydrogen production, and under no circumstance the Government should take a watt of such energy for its needs.

Problems

Land

To obtain land plots, RES investors sign a bilateral Model Investment Agreement with the Government, which covers the basic principles and conditions. This Agreement will not adequately comply with the needs of investors. There is another way, a Non-Standard Investment Agreement, and here investors *may* include a detailed process for land plots allocation, further investment incentives and preferences, parties’ relations, specific project conditions, and the amount of government support and interference. Unfortunately, the Non-Standard one does not include investments into RES as one of prioritised investment activity types. Consequently, the investors struggle obtaining land plots under Non-standard Investment Agreement. In our opinion, the Government should amend the activity list and include RES.

High Costs of Green Hydrogen Production

The main barrier to the production of green hydrogen is cost. To be economically feasible, the cost of green hydrogen production should at least be equal to that of grey or blue hydrogen production. Modern technologies for production and transportation are still expensive. Local corporations will surely not be able to bear costs of green hydrogen production. Thus, it is required to attract foreign investment through mutually beneficial agreements, memorandums, and contracts. Enterprises and production facilities created as a result of such cooperation need modern infrastructure for their further functioning. Though RES generation costs have drastically fallen over the years, caused by development of technologies and competitive market, the investment threshold into the RES remains considerably high.

Doing Hydrogen Business

As of now, we consider many possible options for doing green hydrogen business but only three of them would be viable in Kazakhstan:

- investing into own RE facilities by using own funds;
- co-partnering with the Government (Public Private Partnership (PPP) or Production Sharing Agreement (PSA)); *or*
- purchasing RE from existing facilities.

In the first, the investor will bear a considerable amount of expenditures from the project outset. Financing construction of own RE facilities will not be available for all investors, and only huge corporations with huge plans can initiate such projects. However, such investors will be able to control produced energy and hydrogen at their own will in the framework of the local legislation. The main advantage for such investors is that they are free from currency risks as Kazakhstan suffers from sporadic currency devaluations and market fluctuations.

The second option would be the safest one, whereby investors and the Government will split the costs; however, the Government may request large amounts of electricity and hydrogen in return. The Government may also require that the ownership of RE facilities is transferred to Kazakhstan at the project end.

The final option is less desirable as investors will have to request the Government to amend the current RES legislation, so investors would be able to purchase energy from RE facilities. The cost of the produced RE is now high and RE facilities owners are not likely to cut the produced electricity cost. Thus, State incentives for hydrogen projects are required. Moreover, such investors bear the risk of terminated power supply by the Government in case of energy shortage in the region.

Even though the cost of RE production is still high, investors see the potential hidden. Their vision is based not only on the fact that the price of RE production is falling faster with introduction of new technologies but also on the increased production of electrolyzers. The cost for electrolyzers is also falling with lightspeed year by year and by 2030, it is expected to fall by half⁸. In our opinion, the Government should invest in the electrolyzers development to ensure the hydrogen projects feasibility.

Hydrogen Transportation and Storage

In Kazakhstan, for hydrogen projects to be feasible, the main condition would be the demand of foreign end-consumers for the green hydrogen. However, currently, Kazakhstan lacks hydrogen transportation and storage infrastructure. The cost of transporting is relatively high due to the hydrogen energy density. The transportation cost may be as high as the cost of production. Therefore, there is a risk that the production is likely to be limited to the regions with strong supply chains, large scale RE potential, and associated industrial demand.

On the other hand, hydrogen may be converted to liquid ammonia in order to reduce its volume, but liquid ammonia has a much lower energy density. In our opinion, the Government should form an available offtake for hydrogen production by allowing investors the transportation of hydrogen through the gas pipeline network available.

Another issue which investors will face is storage of hydrogen. Hydrogen is the lightest known element in the world, and under standard conditions, hydrogen is a gas. It is odourless and colourless, and it is hard to identify leakages. Although it is a non-toxic gas, hydrogen is still highly combustible. Fused with oxygen, it may produce a hefty explosion, so the storage proves to be highly dangerous.

⁸ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2014/IRENA_REmap_summary_findings_2014.pdf

Normally, hydrogen is stored in a liquid, gas, or absorbed forms. The major problems with storing hydrogen relate to costs and safety issues, which depend on chemical and physical characteristics of the element.

As to the storage in Kazakhstan, we identify only two possible options for hydrogen storage:

- tanks; *and*
- underground geologic formations;
- The storage of hydrogen is implemented by the companies which have obtained a respective licence in Kazakhstan.

Conclusion

The Kazakhstan President understands that green hydrogen can be of tremendous help on the way to carbon neutrality, and it can help boost the national economy⁹. However, the Government has to take a number of steps towards tapping into the hydrogen potential. Taking the world's political situation into account, the demand for green hydrogen will only grow annually. What we identified for now is that green hydrogen production comes not only with benefits but also with complications, such as high costs of production, underdeveloped legislation, issues with transportation and storage.

However, as it was shown, the barriers are passable. The Government together with investors should work out a certain strategy and apply efforts in order to spin off green hydrogen projects in Kazakhstan: the basis is present, and the people are ready - the only thing we need is constructive two-way communication. The success of hydrogen projects is achievable once the legislation is amended: the country has a great potential to be the hydrogen market leader.

⁹ <https://invest.gov.kz/media-center/press-releases/vodorodnaya-energetika-ctrategicheskij-vektor-razvitiya-ekonomiki/>