THE CURRENT SITUATION AND DEVELOPMENT PROSPECTS OF THE HYDROGEN ENERGETICS ABROAD AND IN RUSSIA: PROBLEMS AND TASKS OF THE LEGAL REGULATION

DOI 10.18572/2410-4396-2021-1-96-101

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This article is dedicated to the analysis of the current situation and possible prospects of the development of hydrogen energetics in the world, including the Russian Federation. The author reviews in detail the main aims, tasks and areas of the approved specialized state strategies and roadmaps of the countries of the Asia-Pacific region, the countries of the European Union, Canada and Russia that may act as drivers of the development of hydrogen energetics and its future growth in a relatively large market. The article contains proposals regarding the areas of the legal regulation of the use of hydrogen energetics. The following main vectors may be included in terms of statutory regulation for the encouragement of the development of hydrogen energetics in Russia: the boosting of the national demand; the creation of the regulatory framework in the technical regulation sphere; the introduction of amendments and additions to the trade and customs regulation system; the development of a statutory act regulating classification of tradable hydrogen by its origin from the standpoint of the production technology and the used energy sources; the improvement of tax laws in terms of support of the development of hydrogen energetics; financing and investment attraction events; the promotion of international cooperation in the sphere of hydrogen energetics.

Keywords: *energy law, hydrogen energetics, strategic tasks in the sphere of energetics.*

The provisions of the Paris Agreement within the United Nations Framework Convention on Climate Change supported by 196 world countries including the Russian Federation determined the regulatory actions aimed at decreasing the content of carbon dioxide in the atmosphere from 2020. [1] The fulfillment of climatic tasks related to the reduction of carbon dioxide emissions, and the use of hydrogen as an energy source are a promising area.

The three factors acting as drivers of the global development of the world hydrogen energetics have been singled out in the course of the research:

— Hydrogen energetics as a means of decarbonization of the world economy;

— Hydrogen energetics as an economic recovery driver, while the launch of the hydrogen technology market will also facilitate overcoming the negative consequences of the COVID-19 pandemic and ensure sustainable development of the world economy;

— Hydrogen energetics as an energy accumulation means required in view of the extensive use of RES and the increasing share of this energy type in the power balance of countries all over the world.

The development of the hydrogen vector draws more and more attention on the international stage, and hydrogen energetics is increasingly supported both on the corporate and state levels. The following countries can be singled out:

— The Asia-Pacific Region: China and Japan;

— The European Union: Germany and Norway;

— The North America: Canada.

Many of the above listed countries have been the first to set the aims of decarbonization of the economy branches by transfer to hydrogen energetics and to acknowledge the potential of hydrogen as an energy source. [2]

In the beginning of our study, the main hydrogen types pursuant to its production means and its carbon footprint in increasing order should be reviewed:

— The "green" hydrogen: for the purposes of discussion, carbon neutral, obtained through electrolysis or other means using electrical energy from RES, without any non-renewable energy resources use;

— The "turquoise" hydrogen: for the purposes of discussion, carbon neutral or having a low carbon footprint, obtained through methane (natural gas) pyrolysis;

— The "yellow" hydrogen: for the purposes of discussion, carbon neutral or having a low carbon footprint, obtained through electrolysis using electrical energy generated by atomic power stations;

— The "blue" hydrogen: for the purposes of discussion, carbon neutral or having a low carbon footprint, obtained through steam reformation of methane or another mineral hydrocarbon fuel using the CO_2 capture, storage and use technology;

— The "grey" and "brown" hydrogen: those having a high carbon footprint, obtained through steam reformation of methane or coal gasification products. [3]

The "blue" and "green" hydrogen production technology is viewed in the world as the priority one as it ensures the minimum level of direct CO2 emissions in the course of production.

Let us start the study with the **People's Republic of China**. China is the world's leader by the volume of hydrogen production. The Chinese share of the total volume of hydrogen produced in the whole world in 2018 accounted for approximately a quarter. [4] As opposed to the majority of other countries where natural gas is the primary raw material for hydrogen production, approximately 70% of hydrogen in China is obtained by gasification. Almost a half of all hydrogen is used in the PRC to produce ammonia, almost 30% is used to produce methanol, and the remaining volume is used in the petrochemical and chemical industries.

Today, there is no program document in China aimed at the development of hydrogen energetics. At the same time, much attention is paid to the use of hydrogen as automobile fuel. Thus, in 2015, China adopted a state technological and innovative development program named *Made in China 2025*, in which one of the priorities is the development of the technology of production of automobile transport using hydrogen fuel. [5] In 2019, the Chinese government resolved to re-allocate state subsidies from electric automobile transport to hydrogen transport to stimulate the development of hydrogen application in transport.

The regional government is also actively stimulating the development of automobile transport using hydrogen fuel. Thus, programs of subsidizing the manufacture of hydrogen automobile transport and construction of hydrogen fuel filling stations are adopted in 11 regions. In June 2019, the Chinese government called upon the creation of a "hydrogen society", an "ecosystem" with hydrogen production factories, storage capacities, transport and sale infrastructure, and the conditions for hydrogen use in the transport and energy sectors. The Chinese Hydrogen Alliance has become the state policy proponent. It acts as a link between the state structures responsible for the elaboration of

the regulatory framework of hydrogen energetics and stimulation of its development (the Ministry of Science and Technology of the PRC, the Ministry of Commerce of the PRC, the Ministry of Industry and Information Technology of the PRC, etc.) and companies operating in the hydrogen technology market.

Let us have a look at **Japan** next. Japan is annually producing approximately 1.3 million tons of hydrogen. [6] Unlike China, the largest part of hydrogen is consumed by the petrochemical industry. The remaining volumes are used to produce ammonia and methanol. Japan is one of the world's leaders in technological developments in hydrogen energetics. The country has the Basic Hydrogen Strategy for the development of hydrogen energetics adopted on December 26, 2017, by the Ministry of Economy, Trade and Industry of Japan [7] and the 5th Strategic Energy Plan 2018 adopted in July 2018. The main aims of the strategy are the raising of competitiveness of hydrogen as compared to traditional fuel types and the use of hydrogen for large-scale decarbonization of the economy branches (industry, transport, energetics, etc.).

The strategy includes plans of the development of the "green" hydrogen production technology, creation of infrastructure for import and sale of hydrogen within the country and widespread introduction and development of technologies of production of electrical energy and heat from hydrogen. The Japanese hydrogen energetics development strategy was supplemented with the 10-10-10 principle in 2019. This principle means the aim of creation of 10 million hydrogen systems and 10 thousand fuel filling stations for transport vehicles using hydrogen fuel elements in 10 years.

Let us move on to review the current situation and prospects of the development of hydrogen energetics in the **European Union (EU)** and some of its member states.

In July 2020, the European Commission published a hydrogen strategy called *Building a Hydrogen Economy for a Climate-Neutral Europe*. [9] On the same day, the beginning of the operation of the Clean Hydrogen Alliance was announced. [10]

The strategy gives the first-ever detailed classification of various hydrogen types depending on the source of origin and production means as in the very beginning of our article. The decided preference is given renewable hydrogen, i.e., produced by means of electrolysis based on renewable energy sources, the "green" hydrogen.

The largest part of investments is planned to be attracted through the Clean Hydrogen Alliance that should develop a well-managed flow of projects aimed at solution of the named tasks of hydrogen energetics creation stages.

The main markets that are expected to be gradually adapted to use hydrogen fuel are industrial installations and transport. The main present-day barriers for switching to hydrogen fuel in the mentioned segments are the high cost and the need for investments in the corresponding infrastructure and storage.

It is noted that the European Commission plans to submit standards and quotas or minimum volumes of renewable hydrogen use in separate end use sectors to provide conditions of certainty for investors and thus motivate the development of hydrogen energetics.

Hydrogen may be transported in a gaseous or liquid form. This fuel type may withstand cyclic and seasonal storage, *inter alia*, be stored in salt caverns and provide electrical energy during peak load periods. It is expected that on the initial stage industrial clusters with intentionally intertwined demand and supply points will appear, and in the course of development of these local networks, they will also be able to cover additional demand in the industrial sector triggering the need for transportation of the hydrogen fuel over larger distances. By this time, it will be required to ensure operational compatibility of networks and develop unified hydrogen fuel quality standards and operational rules for transborder projects. The applicable statutory acts in this sphere will have to be reviewed, including the directives governing the transeuropean energy and transport networks.

The elements of the European gas infrastructure can be converted to suit the hydrogen fuel transportation need in the event of reduction of the demand for natural gas, ensuring a low-cost energy transition.

The European Commission has some doubts regarding pumping hydrogen mixtures in the gas infrastructure, which are, *inter alia*, connected with the risks for the existing natural gas facilities. With that in mind, it is suggested to study more

carefully the opportunities for hydrogen supply in the form of mixtures, which will also require revision of the national and European gas quality standards.

The market regulation requires to give all manufacturers access to the hydrogen infrastructure on a non-discriminatory basis. In particular, it will be necessary to develop the rules for access of third parties, network connection conditions and parameters, administrative process approval procedure.

Germany is one of the first EU countries to declare the approval of the National Hydrogen Strategy designed to ensure the future world leadership of the country in hydrogen technologies on the national level. [11] According to the strategy, the main focus over a long-term perspective will be on "green" hydrogen produced using renewable energy sources. Germany plans to invest approximately 7 billion euro in "green" hydrogen production by 2030 and also plans to allocate 1.4 billion euro as subsidies to the transport sector to promote the hydrogen energy carrier.

The German National Hydrogen Strategy also suggests that the launch of the national hydrogen technology market and the creation of the global hydrogen market are possible only in accordance with the principles and norms of the common EU market and the development of European laws in the sphere of low hydrogen energetics level is the most important prerequisite for the establishment of the internal European hydrogen market.

Germany approved an Action Plan within the National Hydrogen Strategy (V. Action Plan: Necessary Steps for the Success of the National Hydrogen Strategy). The Action Plan consists of 38 events representing steps to be made on the way towards the successful implementation of the National Hydrogen Strategy reviewing approaches to solution of not only economic, engineering, technological and social issues but also legal regulation issues that need to be improved for the effective use of energy from renewable sources and setting of a fair price on the state level according to the climatic policy principles and the energy transition for the purposes of broadening of opportunities for "green" hydrogen production. The events also include the study of the need for introduction of amendments to the energy market regulation rules.

Norway is also pursuing an ambitious climatic and ecological policy with measures to reduce greenhouse gas emissions by adopting its national strategy on June 3, 2020, which laid the basis for further work on hydrogen. [12]

The strategy consists of three parts (in addition to the introductory part):

1) Safe use and production of hydrogen with a low emission level;

2) Hydrogen in Norway;

3) Norway and hydrogen on the international level.

The strategy includes a claim, that the Norwegian government will continue to support the necessary technological development using the existing instruments, review hydrogen development and use support measures in view of the 2030 Climate Target Plan, [13] continue to support research, development and demonstration of hydrogen technologies through the corresponding programs focusing on the high scientific quality and business development potential projects, the develop an action plan to raise the share of state procurements favorable for the climate, environment and green innovations, continue its efforts to develop national provisions and standards, etc.

The **Canadian** government presented its state hydrogen strategy for 2020 through 2050 in December 2020. [14] The implementation of this strategy in the five coming years will require substantial investments of 5 to 7 billion dollars by estimates. The strategy contains a detailed plan on how Canada can get access to significant hydrogen production and reach the main aim: the zero emissions by 2050. The opportunity for decarbonization of the energy system by using hydrogen as an energy carrier is the primary driver for Canada. Hydrogen projects reducing the greenhouse gas level proclaimed by the strategy can reach up to 30% of the whole Canadian energy system by 2050.

The implementation of the strategy is divided into three phases giving a general understanding of the time period when various regulation and stimulation measures will take effect:

— Short-term (2020 to 2025) events will be focused on building a hydrogen industry including the development of new hydrogen

supplies and the infrastructure, improvement of regulatory provisions including the development of clean fuel standards to stimulate short-term investment and presentation of a new policy and regulatory measures to achieve the zero emissions by 2050;

— Middle-term (2025 to 2030) events will be aimed at the growth and diversification of the hydrogen sector including broadening of hydrogen application areas, as well as the large-scale hydrogen production by mixing with natural gas, etc.;

— Long-term (2030 to 2050) events stipulate creation of the necessary hydrogen supply and sale infrastructure, this strategy phase includes the review of the opportunity for increasing the number of hydrogen transportation pipelines as compared to the current pipeline system.

However, hydrogen integration strategies in Canada differ prom province to province, thus, the corresponding regulatory provisions and incentives will be different. For example, the province of Alberta prioritized the "blue" hydrogen production while the province of Quebec is focused on the production of the "green" hydrogen. [15]

Let us now review the current situation and prospects of the development of hydrogen energetics in Russia. The Russian Federation has an enormous potential in the traditional mineral energy carrier sphere, as well as in the renewable energy source sphere, is able to get a positive synergetic effect on the economy of the country due to the development of export hydrogen energy carriers and broadening of hydrogen application spheres in the national market.

The government of the Russian Federation attempts at supporting the world trend aimed at decarbonization of energetics. On October 12, 2020, the government of the Russian Federation adopted Decree No. 2634-p and approved the Action Plan called *The Development of Hydrogen Energetics in the Russian Federation until 2024* (the "Plan") setting aims of organization of the first-priority works designed to establish a high-performance export-oriented hydrogen energetics sphere by improvement of the regulatory framework, development and implementation of measures of state support of hydrogen production, storage, transportation and use projects, consolidation of the positions of national companies in the ready-made product sale markets and carrying out of research and development works in critical science, engineering and technology development areas. [16]

According to section one (out of eight) of the adopted Plan dedicated to the strategic planning and monitoring of the development of hydrogen energetics, in the first quarter of 2021, a concept of hydrogen energetics development in the Russian Federation meant to become a program document for the development of hydrogen economy in the country should be elaborated and approved, a project office for the implementation of the hydrogen energetics development concept should be set up, and, at the same time, an inter-departmental work group for the development of hydrogen energetics should be created.

Apart from the above, section one of the Plan contains the following:

— The events aimed at the encouragement and state support of the development of hydrogen energetics;

— The production potential forming;

— The implementation of high-priority pilot projects in the hydrogen energetics sphere;

— The research and technology advancement and development of high-tech solutions;

— The improvement of the regulatory framework and the national standardization system;

— The human resource development;

— The development of international cooperation. [17]

The following main areas may be included in terms of the statutory regulation for the encouragement of the development of hydrogen energetics in Russia: — boosting of the national demand; — the creation of the regulatory framework in the technical regulation sphere; — the introduction of amendments and supplements to the trade and customs regulation system; — the development of a statutory act regulating classification of tradable hydrogen by its origin from the standpoint of the production technology and the used energy sources; — the improvement of tax laws in terms of support of the development of hydrogen energetics; — financing and investment attraction events; — the promotion of international cooperation in the sphere of hydrogen energetics.

Thus, summing up the research results, we may single out the following existing barriers, the

overcoming of which is one of the main hydrogen energetics development priorities in Russia as well as in the world:

1. The high cost of "low carbon" hydrogen production ("blue", "turquoise", "green" and others) resulting in the low competitive ability of hydrogen as compared to traditional mineral energy carriers;

2. The insufficient readiness of "low carbon" hydrogen production technologies for industrial use as well as hydrogen storage and transportation technologies;

3. The absence of a hydrogen storage and transportation infrastructure;

4. The limited nature of the regulatory framework in the hydrogen energetics sphere, that requires a separate approach and solution of problems, *inter alia*, in the sphere of industrial security on hydrogen energetics facilities, environmental safety and healthcare.

An additional barrier for Russia is a small number of programs of state encouragement of the development of hydrogen energetics and insufficient incentives in terms of the climatic agenda for the development of a national market hydrogen as an ecologically clean energy carrier in the Russian Federation, as well as the absence of any decarbonization incentives. ■

References

1. Paris Agreement within the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/resource/docs/2015/cop21/rus/l09r.pdf.
2. Faris J. Which Countries Are Backing the Hydrogen Economy? / J. Faris // H2 Bulleti. 2020. December 29.
3. Deryushkin D. Top Three Promising Hydrogen Production Technologies for Russia / D. Deryushkin // Gas Business. 2020. No. 4. P. 12-17.
4. Data and Statistics. Explore Energy Data by Category, Indicator, Country or Region // IEA. URL: https://www.iea.org/data-and-statistics/data-tables?country=WORLD&energy=Balances&year=2018.
5. Tse A. Why «Made in China 2025» Triggered the Wrath of President Trump / A. Tse, J. Wu // South China Morning Post. 2018 September 11.
6. Data and Statistics. Explore Energy Data by Category, Indicator, Country or Region // IEA. URL: https://www.iea.org/data-and-statistics/data-tables?country=JAPAN&energy=Balances&year=2019
7. Basic Hydrogen Strategy. December 26, 2017. Ministerial Council on Renewable Energy, Hydrogen and Related Issues. Provisional Translation. URL: https://www.meti.go.jp/english/press/2017/pdf/1226_003b.pdf.
8. Strategic Energy Plan. July, 2018. Provisional Translation URL: https://www.enecho.meti.go.jp/en/category/others/basic_plan/5th/pdf/strategic_energy_plan.pdf.
9. A Hydrogen Strategy for a Climate-neutral Europe // European Commission. URL: https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf.
10. The European Clean Hydrogen Alliance // European Commission. URL: https://ec.europa.eu/growth/industry/policy/european-clean-hydrogen-alliance_en.
11. The National Hydrogen Strategy (Germany). Federal Ministry for Economic Affairs and Energy, 2020. 32 p. URL: https://www.bmbf.de/files/bmwi_Nationale%20Wasserstoffstrategie_Eng_s01.pdf.
12. The Norwegian Government's Hydrogen Strategy. Towards a Low Emission Society. URL: https://www.regjeringen.no/contentassets/8ffd54808d7e42e8bce81340b13b6b7d/hydrogenstrategien-engelsk.pdf.
13. 2030 Climate Target Plan // European Commission. URL: https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en.
14. Hydrogen Strategy for Canada: Seizing the Opportunities for Hydrogen. A Call to Action. December, 2020. 141 p. URL: https://www.nrcan.gc.ca/sites/nrcan/files/environment/hydrogen/NRCan_Hydrogen%20Strategy%20for%20Canada%20Dec%2015%202200%20clean_low_accessible.pdf.
15. Collett M. A Federal Hydrogen Strategy for Canada / M. Collett, A. Harvie, M. Devost, G. Smeijers // Norton Rose Fulbright logo. 2021. January 15.
16. The Government of the Russian Federation Has Approved an Action Plan for the Development of Hydrogen Energetics // Ministry of Energy of the Russian Federation. 2020. October 22.
17. Decree No. 2634-p of October 12, 2020. URL: http://static.government.ru/media/files/7b9bstNfV640nCkkAzCRJ9N8k7uhW8mY.pdf (date of access November 1, 2020).