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Russia's hydrogen strategy: a work in progress

Szymon Kardaś

In recent years, numerous countries have adopted their national hydrogen strategies and begun to implement them. In July 2020, the European Union also adopted its strategic document in this field. Although the actions described in the document will impact the prospects of Russia exporting its fuels, Russia has only just begun to devise its position regarding this matter. To date, the first draft of the road map for the development of hydrogen energy in 2020–2024 has been compiled. Hydrogen energy is not among the priorities of Russia's energy policy. This is confirmed both by the content of Russian strategic documents and by the limited actions of the Russian leadership and energy companies carried out to date. These actions are currently limited to research and development initiatives and pilot projects. International cooperation in the field of hydrogen energy involving Russian companies is also rather limited. Russia has major potential for hydrogen production. The main obstacle to the development of the domestic hydrogen energy sector is posed by the absence of significant genuine interest from the central authorities in challenges related to global climate change; this translates into very limited regulatory and funding activity. It should not be expected that the development of this sector could be boosted by internal factors (the Kremlin views neither decarbonisation nor the need to increase the share of renewable energy sources in the energy mix as priorities). However, this development could be facilitated by changes happening in its export markets. It is highly likely that the implementation of hydrogen strategies in the EU (Germany in particular) could trigger increased interest from Gazprom in hydrogen energy. Due to the political support from the Russian leadership it receives, Gazprom is likely to boost its position in its strategic export market. In addition, Moscow can expect that its cooperation in the field of hydrogen energy could help it not only to tighten its economic relations with the EU, but to also win another instrument to lobby in favour of a normalisation of political relations between Russia and the EU. Alongside this, in the long term the "hydrogen revolution" may pose a major challenge for Russia – energy transition in the strategic export markets (the EU, Asian countries) may translate into a rapid decline in the export of Russian fossil fuels, which will likely have serious negative economic consequences for Moscow.

No hydrogen strategy

Although over the last year or so Russian central authorities have begun to show an interest in hydrogen energy, to date this industry has not been among the genuine priorities of the state's policy. The government's real actions continue to be introductory and preparatory; they have

OSW

Centre for Eastern Studies
ul. Koszykowa 6a, 00-564 Warsaw, Poland
tel.: (+48) 22 525 80 00, info@osw.waw.pl
www.osw.waw.pl

EDITORS: Adam Eberhardt, Marek Menkiszak, Katarzyna Kazimierska, Tomasz Strzelczyk
TRANSLATION: Magdalena Klimowicz
CO-OPERATION: Nick Furnival
DTP: Urszula Gumińska-Kurek

not translated into a change in Russia's strategy in this field thus far.[1] In August 2019, the Energy Ministry held Russia's first official consultations regarding the development of hydrogen energy. They were attended by representatives of other ministries, Russian energy companies (Gazprom, Rosatom, Rostech, Sibur) and experts. At a meeting held in October 2019, a decision was made to launch efforts to devise a national hydrogen energy strategy. Pursuant to a government decree of 18 November 2019, a working group for the development of hydrogen energy in the Russian Federation was established at the Energy Ministry. It includes representatives of Gazprom, Sberbank and Rosatom, members of academic communities, and experts. The working group's main task is to prepare a road map for the development of hydrogen energy in Russia. On 22 July 2020, the Russian "RBK" daily reported that the Russian Energy Ministry had compiled the first draft of the document which will now be forwarded to other bodies for further consultations. Once the consultation process is over, it will be adopted by the Russian government.[2] The road map envisages that the concept for the development of hydrogen energy in Russia will be adopted by the end of 2020. Russia's National Association of Hydrogen Energy, which has been in operation since 2003, has been involved in the standardisation of domestic hydrogen technologies.

In the most recent Energy Strategy of the Russian Federation until 2035 adopted by the Russian government, the hydrogen energy sector has only been listed as the seventh most important component of the energy sector as a whole after the oil, gas, petrochemical, coal, electricity and nuclear sectors. While the document states that Russia has the potential to enable it to become one of the global hydrogen leaders, the set of actions it proposes is very general. It covers the preparation and implementation of measures to support the development of infrastructure; the creation of a body of norms; increasing the production of hydrogen obtained from natural gas using renewable energy sources (RES) and nuclear energy; efforts to devise a low-emission hydrogen production technology; and measures to boost international cooperation in hydrogen energy and attempts to enter foreign markets. Similarly, the figures relating to the export of hydrogen, quoted in the energy strategy, are not particularly impressive – the estimated export volume is 0.2 million tons in 2024 and 2 million tons in 2035.

> **2019 saw the official launch of work on Russia's hydrogen strategy.**

Due to the general and preliminary nature of actions carried out to date, it is difficult to clearly define Russia's hydrogen strategy. On the one hand, the first version of the road map for the development of hydrogen energy in Russia, discussed by the "RBK" daily, emphasises the growing importance of the hydrogen energy sector globally, alongside Russia's readiness to expand its activity in this field. However, there is no clear information regarding the specific goals of Russia's hydrogen policy and its means of pursuing them. It remains to be seen what country's experience the Russian model of this sector's development will finally be based on. Several models are being considered in the country-wide debate, including the so-called Norwegian and Australian models. In the Norwegian model a monopoly (in Russia this could be Gazprom) develops specific hydrogen energy projects through its subsidiaries operating in this field. The potential obstacles to implementing this model in Russia would include Gazprom's current priorities (which involve developing traditional gas projects) and the fact that other companies also have certain aspirations in this field. The Australian model, in turn, envisages the establishment of a separate ministry dealing with hydrogen energy and the adoption of a strategy under which a support programme for all interested Russian companies would be carried out.

[1] Hydrogen energy was the subject of scientific and research initiatives back in the 1930s. The 1970s in the Soviet Union saw tests of hydrogen-powered cars. Hydrogen began to be used in the arms industry and in the space industry. These activities were continued following the break-up of the USSR. For more see 'Национальная Ассоциация Водородной Энергетики', www.h2org.ru.

[2] The document itself has not been published. The article published by "RBK" merely offers a synthetic discussion of its preliminary assumptions. А. Фадеева, '«Газпром» и «Росатом» начнут производить «чистый» водород в 2024 году', РБК, 22 July 2020, www.rbc.ru.

Limited results of hydrogen projects carried out to date

The activities Russian companies have carried out to date in the field of hydrogen energy are also limited. In most cases, they solely comprise research, conceptual work and pilot projects.

Gazprom and Rosatom are the main companies expressing an interest in developing hydrogen projects. Although Gazprom began to notice the trends present in the EU market and has recently become aware of the need to include hydrogen-related plans in its strategy, the results of its actions to date are negligible. The company has been involved in laboratory research performed in its centres in Samara, Tomsk and Ufa on obtaining so-called blue hydrogen through methane pyrolysis (this process involves splitting methane into gaseous hydrogen and solid carbon at a high temperature). However, even Gazprom representatives emphasise that using these technologies to produce hydrogen on an industrial scale will only be possible in the distant future. In addition, at present Gazprom's investments in so-called green energy projects are insignificant and are being carried out by several of its selected subsidiaries, such as Gazprom Gazomotornoye Toplivo, Gazprom Neft and Mosenergo. Gazprom's cooperation to date with foreign partners has also been limited. In September 2019, the company's representatives announced that consultations with the German company Uniper were underway.

Rosatom is another company to be working on its own hydrogen strategy. One of its subsidiaries, Rusatom Overseas, has experience in working with hydrogen and with the relevant technologies of hydrogen production and transport. It also has an experienced managerial team capable of implementing joint projects with foreign partners. Rosatom has produced a hydrogen-powered train in Sakhalin as a pilot initiative (it is partly based on a technology developed by Alstom). In September 2019, representatives of Rosatom signed an agreement with the Japanese Agency for Natural Resources and Energy on preparing a feasibility study of projects focused on Russia exporting hydrogen to Japan.

Besides Gazprom and Rosatom,[3] since 2013 RusHydro has been implementing its first hydrogen project (through its subsidiary Magadanenergo). The venture's foreign partner is the Japanese company Kawasaki Heavy Industries. Following a hiatus which lasted several years, in September 2017 the project was resumed – in Vladivostok the two companies and the Magadan Oblast authority signed an agreement on cooperation in the field of hydrogen energy. The agreement envisages the construction of a hydrogen production plant by 2024 to meet Japan's industrial demand. The power generation capacity of the Ust-Srednekanskaya hydropower plant controlled by RusHydro will be used in this undertaking.

At present, the use of hydrogen in the transportation sector is limited to pilot projects: in November 2019 the first hydrogen-powered tram was launched in Saint Petersburg and Russia's first hydrogen-powered bus was presented at the "Open Innovations" forum held in Moscow. Nor are the prospects for using hydrogen to generate electricity particularly promising. TAIF Group plans to launch two power plants built by Siemens by 2022, with a capacity of 495 and 270 MW respectively. They will be fired by a mixture of gas (75%) and hydrogen (25%), with the possibility of increasing the share of hydrogen up to 51%.

The activity of Russian companies in international bodies has also been limited. No Russian energy company has so far been included in the Hydrogen Council, which was established in 2017 in Davos and currently has 81 members.

The hydrogen revolution: an opportunity for Russia…

Due to Russia's potential and the geographical proximity of the most promising export markets, increased global interest in the development of hydrogen energy is an opportunity for the Russian fuel and energy sector.

[3] Rostech, Sibur and Interros also have some experience in using hydrogen and hydrogen technologies. To date, their activities have mainly been limited to research work.

Although at present Russia has relatively insignificant capabilities for hydrogen production (2–3.5 million tons annually), it is able to significantly boost its potential in this field – regardless of the method for obtaining hydrogen it will use.[4] Russia's power generation capacity is characterised by a relatively small carbon footprint. This sector is dominated by gas-fired heat and power stations (48%), nuclear power stations (18%) and hydroelectric power stations (17%). Russia has major water resources and is capable of generating power using RES (mainly wind energy), which enables it to produce large amounts of the so-called green hydrogen. In addition, Russian nuclear power stations have surplus power generation capacity. In the context of hydrogen production, the potential offered by the Kola Nuclear Power Plant and the Leningrad Nuclear Power Plant is particularly promising. Alongside this, Russia has the world's largest proven reserves of natural gas, which enables it to produce so-called blue hydrogen. It also has experience in using hydrogen in the space industry and defence industry.

According to preliminary forecasts by EnergyNet, in 2020–2025 Russia is capable of producing hydrogen at a competitive price (US$3.38 per one kilogram) and gaining a 10–15% share in the global hydrogen market. By 2025, the revenue earned by Russian companies from exporting hydrogen could amount to as much as US$ 1.7–3.1 billion annually.[5] According to the International Renewable Energy Agency (IRENA), the price of the so-called green hydrogen will stand at US$4–6 per one kilogram in 2025 and US$2 per one kilogram in 2040, which could enable Russia to gain a competitive advantage in the mid-term perspective. Alongside this, some experts argue that, due to the dynamic development of technology, the price may fall more rapidly to US$1.4–2 per one kilogram in 2030.

In addition, the development of hydrogen energy projects in Russia is facilitated by the proximity of the most promising export markets, i.e. the EU and Asian states (Japan, South Korea). Although the estimates provided by various analytical centres differ considerably, there are many indications that in the long-term perspective the global hydrogen market will continue to develop. Current global hydrogen consumption stands at around 70 million tons and is mainly concentrated in the refining industry (the production of petroleum products with low sulphur content) and the chemical industry (the production of ammonia). Depending on whether the ambitious assumptions of the climate policy adopted by the EU and by selected Asian states are reached, by 2050 the global hydrogen market may increase to 200 million tons or even – in the most optimistic scenario – to 1.5 billion tons. Its value may reach US$0.4–3 trillion;[6] for comparison in 2018 it was US$135 billion. Russian estimates are more cautious. The Energy Ministry estimates that in 2040 the hydrogen market may be worth US$32–164 billion (with the global trade volume standing at 15.8–82.2 million tons). Gazprom, for its part, estimates that in 2050 the market for blue hydrogen produced in Europe may be worth around 150 billion euros.

" Gazprom and Rosatom may become the leaders in the Russian hydrogen energy sector. However, to date the scope of their activities has been limited.

Optimistic prospects regarding the potential markets are mainly prompted by strategic decisions which the EU and the Asian states have made in connection with their hydrogen energy strategies. In July 2020, the European Union announced its hydrogen strategy. The document presents a number of actions planned under the EU's energy and climate policy which envisages climate neutrality being reached by 2050. According to the EU's hydrogen strategy, in the transitional period (by 2050) the production of not only so-called

[4] Depending on the production method and its impact on the level of greenhouse gas emissions, there are several types of hydrogen: 1) green hydrogen – produced by electrolysis using renewable energy sources (with no CO_2 emissions); 2) blue hydrogen – obtained from natural gas using carbon capture and storage technology (CCS); 3) grey hydrogen – obtained through natural gas steam reforming or through coal gasification.

[5] 'Перспективы России на глобальном рынке водородного топлива', EnergyNet, Moscow 2019, www.energynet.ru.

[6] Estimates presented by EnergyNet on the basis of data compiled by Navigant Research, Ecofys, IRENA, the Hydrogen Council and IAE.

green hydrogen (obtained using methods which do not pollute the environment by emitting CO_2), but also of so-called blue hydrogen and grey hydrogen will be allowed, and this will create an opportunity for Russia. At present, Russia is (and most probably, in the mid-term perspective, will continue to be) the main supplier of gas to the European market. In addition, in 2018–2020 numerous European countries and many non-European countries adopted their national hydrogen energy strategies. These include: Austria, France, the Netherlands, Germany, Japan, South Korea, Australia and Canada. It seems that China, India, Japan and South Korea may become the leaders as regards the increase in demand for hydrogen by 2024 – with China and India focusing on the petrochemical industry, and Japan and South Korea on the transportation sector.

…and a challenge for Russia

One of the main obstacles to the development of hydrogen energy in Russia is the relatively insignificant interest which the central authorities have in the challenges of global climate change. The most recent Energy Strategy of the Russian Federation until 2035 devotes little attention to the problems of global energy transition and the trends associated with it. While both the EU and the Asian states have decided to eliminate or considerably reduce the use of fossil fuels in their energy mix in the long-term perspective, Russia is jeopardising its status in the European markets and in Asia. Both the strategic documents and the actions carried out to date by the Russian central authorities and Russian energy companies indicate that Moscow is not fully convinced by the suggestions of other states and international organisations that the need to implement low-emission and energy efficient technologies globally is a permanent and irreversible trend (in particular, the use of RES, non-standard fossil fuels such as gas hydrates, hydrogen energy and thermonuclear energy). In addition, another weak point of the actions carried out by the Russian authorities in the fuel and energy sector is the fact that these actions are frequently tactical rather than strategic. Decisions tend to focus on specific problems or sometimes result from lobbying activities carried out by individual interest groups. To a smaller degree they reflect the genuine challenges relating to the development of specific components of the fuel and energy sector.[7]

> **Negligible interest on the part of the central authorities in the challenges posed by climate change is one major obstacle to the development of hydrogen energy in Russia.**

Another major obstacle to hydrogen energy is the absence of sufficient support from the state both when it comes to the required regulatory framework (regulations relating to safety standards) and financial outlays. According to a report compiled by EnergyNet, the creation of an efficient hydrogen energy industry in Russia would require funds of around US$2.2–3.9 billion annually. Investments are necessary not only in the field of research into the relevant technologies to reduce the cost of hydrogen production (zero-emission and low-emission production in particular) but also to fund the expansion of infrastructure. Although the planned expansion of the gas network in Europe could be used for hydrogen transmission and storage, it would also require the relevant modernisation of transmission networks connecting Russia and the rest of Europe. At present, the safe upper limit of the share of hydrogen in the gas mix is 20–30%; a higher content of hydrogen could cause permanent damage to infrastructure. In addition, due to the fact that hydrogen is more volatile than natural gas, it is more flammable. According to Russian estimates, the modernisation of the transmission infrastructure could trigger the need to increase the funds earmarked for network expansion by around 10%. Moreover, if plans for the wider use of hydrogen in the Russian transportation sector are adopted,

[7] Systemic problems hampering the development of the domestic fuel and energy sector are frequently emphasised by numerous reports compiled by prestigious analytical centres in Russia including the Energy Centre at the Moscow School of Management "Skolkovo", EnergyNet, the Analytical Centre at the Government of the Russian Federation, the Energoinnovatsiya association and Vygon Consulting. See М. Смирнов, 'Новая формула для российской энергетики', *Нефтегазовая вертикаль*, no. 17, 2019, p. 20.

funds for the construction of refuelling stations for hydrogen-powered cars would be required.[8]

Outlook

Any further development of the Russian hydrogen energy sector will most likely be stimulated not so much by increased emphasis on the national climate policy, as by the dynamic implementation of hydrogen strategies in the potential export markets. Most of the factors which provide an impetus to the development of hydrogen energy and which are present in other countries, are non-existent in Russia. These factors include: decarbonisation, increasing the share of RES in the energy mix, and striving to achieve energy independence. To date, the Russian government has not viewed climate-related challenges as a priority. Therefore, it is unlikely that the role of hydrogen in the Russian energy mix will grow in the coming years. The environmental policy pursued by selected cities is likely to be an exception, one example of this is the federal "Clean Air" programme. Under this programme, plans have been made to reduce toxic emissions by 22% by 2024 in cities such as: Bratsk, Chelyabinsk, Chita, Krasnoyarsk, Lipetsk, Magnitogorsk, Novokuznetsk and Omsk.[9]

The prospects for Russia increasing its presence on export markets look more promising. In the coming years, Gazprom is likely to increase its activity in this field, mainly hoping to boost the volume of gas it is exporting to Europe for the purpose of producing so-called blue hydrogen. Interest expressed by Germany is one major factor increasing Gazprom's prospects for gaining a strong presence on the European hydrogen market. German politicians and representatives of business circles alike (mainly those grouped in the Russian-German Chamber of Commerce) have called on Moscow and Berlin to develop cooperation in the field of hydrogen energy. It should be expected that the cooperation carried out to date, in particular in the gas sector, may increase the likelihood of the Russian central authorities offering political and financial support to hydrogen projects. This mainly concerns President Vladimir Putin because he continues to be the key decision maker in matters relating to Russia's energy policy. This scenario seems all the more likely because the Russian side views the new field of cooperation between Moscow and Berlin not only as an instrument for tightening economic relations, but also as a tool for amplifying its demands regarding a normalisation of political relations between Russia and the EU.

> **Russia has major potential for developing hydrogen energy.**

The revealed preliminary assumptions of the road map for the development of hydrogen energy in Russia confirm that in the coming years Gazprom and Rosatom will take the leading role in this sector. These companies are involved in pilot projects focused on producing hydrogen using the potential offered by nuclear power stations and infrastructure used in gas extraction and processing. In addition, until 2024 Gazprom will continue its research on using hydrogen in devices such as engines and gas boilers, as well as on using it as fuel in various means of transport. Rosatom, for its part, is expected to build a testing ground for hydrogen-powered rail transport.

However, in the long term the "hydrogen revolution" will pose an increasing challenge for Russia. Due to the shape of the Russian energy sector, which mainly relies on exporting crude oil, petroleum products and natural gas, any possible increase in Russia's share in hydrogen markets will not be able to balance out the decline in revenue from exporting fossil fuels. As a consequence, this may trigger serious economic problems which will cast a shadow on the stability of the Russian state.

[8] July 2020 saw the opening of Russia's first hydrogen refuelling station. С. Ильин, 'В России открылась первая водородная автозаправочная станция', 12 July 2020, motor.ru.

[9] Ю. Мельников, 'России не хватает стимулов для развития водородной экономики', Независимая газета, 13 April 2020, www.ng.ru.