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A hydrogen alliance? The potential for German-Russian cooperation in hydrogen energy

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Joint hydrogen energy projects are components of the comprehensive Russian-German energy cooperation which has been ongoing for more than five decades. Due to increasing demand for hydrogen resulting from Germany's energy transition (*Energiewende*) and to the potential of the hydrogen sector in Russia and its focus on export, the fundamental interests of the two states are well aligned. In 2020, Moscow and Berlin stepped up their political dialogue in this field, and companies from Germany and Russia went on to conclude their first agreements. The new aspect of this cooperation with Berlin is also important to Moscow in political terms.

However, the long-term strategic goals of the hydrogen energy policy pursued by the two states are divergent. From Germany's perspective, Russia is a potentially significant supplier of hydrogen, although it is one of many such prospective suppliers. Moreover, Berlin is prioritising the development of Europe's hydrogen production capacity. Moreover, while Germany views hydrogen energy (especially green hydrogen) as an important element of its *Energiewende* and a promising sector of the economy, Russia perceives its cooperation with Berlin in this area as an opportunity to derive economic benefits from hydrogen export and to boost the energy interdependence between the two states. There are no indications that the bilateral projects implemented by Russian and German companies could trigger a profound energy transition in Russia in the next few years. The two countries' fundamentally divergent approaches to hydrogen energy raise doubts about the prospects of a true 'hydrogen alliance' between Moscow and Berlin in the foreseeable future. There are many indications that for the time being the two sides will focus on smaller bilateral projects.

The context of energy cooperation

Germany and Russia are linked by extensive and long-standing contacts at both the political and business levels, as well as by comprehensive and multi-faceted energy cooperation. West Germany was among the first European recipients of Soviet gas, which it purchased on the basis of a contract signed back in 1970. Russia is Germany's main supplier of natural gas (51% in 2019), oil (32%) and anthracite (45%). Germany, for its part, is the biggest importer of Russian gas: according to 2019 figures, the volume of gas Russia exported to Germany was 57.1 bcm, which accounted for 28.6% of Gazprom's total exports

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to the countries of the so-called far abroad (in Gazprom's nomenclature this term refers to European states excluding the former Soviet republics, as well as Turkey and China).[1] In addition, Germany is a major importer of Russian oil: in 2019 the volume of Russian oil supplied to Germany was almost 24 million tons, which accounted for around 9.5% of Russia's total crude oil exports.[2]

Another field of energy cooperation involves investments in assets located in both Russia and Germany. Rosneft – Russia's largest oil producer and exporter – holds stakes in German refineries. Through the companies making up the Gazprom Germania GmbH holding company, Gazprom not only owns German assets but also supplies gas directly to German clients. Germany and German companies have been involved in joint infrastructure projects such as the Nord Stream 1 pipeline, which was handed over for use in 2011–2012, and Nord Stream 2 which has been under construction since September 2018. In addition, Gazprom has invested in the expansion of gas storage facilities in Germany.

> **Hydrogen cooperation is an element of long-standing energy cooperation between Moscow and Berlin.**

In addition, energy issues are regularly discussed during top-level political dialogue and at regular meetings between representatives of the Russian and German companies operating in this sector. Germany's energy cooperation with Russia is also facilitated by initiatives carried out by the local authorities of some German federal states and by Russian-German business groups, such as those affiliated with the Russian-German Chamber of Commerce.[3]

The interests of both sides

Just as in the energy cooperation they have carried out to date, regarding hydrogen energy the interests of Germany and Russia are characterised by a high degree of complementarity. Germany is strongly committed to hydrogen technology, which it views as one of the key instruments in its climate policy and as a potential development opportunity for its industry.[4] The importance of hydrogen technology in the decarbonisation of the economy has increased significantly following Germany's adoption in 2019 of its carbon neutrality goal to be achieved by 2050. Germany is focusing on green hydrogen, which it views as the only solution enabling it to meet its sustainable development needs. However, during the transition period other carbon-neutral options will also be permitted (see Appendix). The demand for hydrogen from such a large, highly industrialised and energy-intensive economy as the German economy will be very high. In its National Hydrogen Strategy (*Nationale Wasserstoffstrategie*), the German government assumes that this demand will rise from 55 TWh in 2019 to 90–110 TWh in 2030.[5] Depending on how technology advances and how much is invested, as well as how much hydrogen is used, the expected demand for hydrogen in 2050 will be between 250 and 800 TWh.[6] Germany estimates that it will only be able to cover around 15–30%[7] of this demand from its own sources, which – as with natural gas and oil – will equate to its permanent reliance on imports.

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1 'Динамика реализации газа в Европу', Газпром экспорт, www.gazpromexport.ru.

2 Calculations based on figures published by the European Commission and CDU TEK.

3 This group has repeatedly expressed its views on matters relating to Russian-German energy cooperation. Examples include its statements in defence of the planned construction of Nord Stream 2.

4 M. Kędzierski, 'Wodór – nadzieja niemieckiej polityki klimatycznej i przemysłowej', *Komentarze OSW*, no. 330, 6 May 2020, www.osw.waw.pl.

5 It should be noted that the grey hydrogen presently used is expected to be replaced with emission-free variants by 2030. For more see M. Kędzierski, 'The German hydrogen strategy: green hydrogen in the spotlight', OSW, 16 June 2020, www.osw.waw.pl.

6 *Eine Wasserstoff-Roadmap für Deutschland*, Fraunhofer Institute, October 2019, www.ise.fraunhofer.de.

7 Germany's production capacity relates to green hydrogen.

Efforts to provide the German economy with access to hydrogen have therefore become an important element of Germany's foreign policy. Russia, due to its potential for producing different variants of hydrogen, is viewed as an important source of hydrogen.

For Russia, cooperation with Germany in hydrogen energy is mainly an opportunity to gain a strong position on a potentially lucrative market which is only just emerging. Raw material exports continue to occupy a prominent place in Russia's foreign trade, and the government views each new field of cooperation in this area as an opportunity to boost the country's global standing. In addition, from Moscow's perspective, efforts to bring about closer energy cooperation with Germany are of major political significance. Russia views the implementation of such joint strategic projects with German partners as an instrument for normalising its relations with the West, and for neutralising the negative consequences of the sanction policy pursued by the US and the EU in the wake of Russia's aggression against Ukraine back in 2014.

" Alongside complementary interests, hydrogen cooperation between Germany and Russia is facilitated by the existing extensive infrastructure for transporting natural gas.

Alongside the two states' complementary interests, the already extensive natural gas infrastructure and their geographical proximity work in favour of German-Russian hydrogen cooperation. Transporting hydrogen through a pipeline is cheaper and more reliable than transporting it by sea from other continents. At the initial stage, hydrogen could be transmitted as an admixture to natural gas. However, once the pipes are properly adapted, it could replace natural gas in some pipelines. The EU will likely see an increasingly rapid decline in its demand for gas resulting from the implementation of its climate policy.

Initiating cooperation at the political level…

Attempts at assessing the prospects for German-Russian hydrogen cooperation had already been made when the two countries were devising the assumptions of their national hydrogen strategies.[8] Expanding bilateral energy cooperation by adding a hydrogen component to it was among the most important topics discussed during the 7th Conference of the Association of German Chambers of Industry and Commerce, held on 18 February 2020 in Berlin, and devoted to German-Russian economic relations. The meeting was attended by top-ranking government officials. For both Russia and Germany, the conference was an opportunity to express their intention to launch hydrogen cooperation and their willingness to work together to incorporate the construction of the controversial Nord Stream 2 gas pipeline into the EU's climate policy. They emphasised that this would enable natural gas with a 5–7% hydrogen admixture to be transmitted through this pipeline. The specific results of the conference included the decision to set up a bilateral task force on future energy policy. One of the main objectives of this policy will be to assess the potential for cooperation between the two states in hydrogen production, usage and trade, and to initiate bilateral pilot projects.

In addition, the development of a hydrogen partnership was the topic of the meeting of the German-Russian Raw Materials Forum held on 1 December 2020. Unlike in previous consultations, which primarily emphasised the potential for and mutual benefits of cooperation, this time both sides were

[8] So far, Russia has not adopted a hydrogen strategy for itself. On 12 October 2020, the Russian government adopted its Action Plan for the Development of Hydrogen Energy in the Russian Federation until 2024. It is a unique 'road map' which envisages the preparation of in-depth analyses in the next four years, drawing up the necessary legislation, the assumptions of pilot projects in hydrogen energy and the terms of bi- and multilateral international cooperation. План мероприятий («дорожная карта») по развитию водородной энергетики в Российской Федерации до 2024 года, Ministry of Energy of the Russian Federation, 12 October 2020, www.minenergo.gov.ru. For more on the significance of hydrogen energy in Russia's energy policy to date, see S. Kardaś, 'Russia's hydrogen strategy: a work in progress', *OSW Commentary*, no. 344, 22 July 2020, www.osw.waw.pl.

more open about their diverging approaches to this branch of their cooperation and their mutual expectations. Peter Altmaier, the German Federal Minister for Economic Affairs and Energy, pointed out that from Germany's perspective green hydrogen is the preferred solution, and that Berlin is mainly interested in establishing partnerships based on the application of green (domestic) technologies. From Berlin's point of view, hydrogen obtained from fossil fuels is an indispensable, albeit a temporary solution. Alongside this, Altmaier stressed that Russia has huge potential regarding renewable energy sources, and encouraged Moscow to launch an energy transition programme on the German model. Russia's participants in the meeting, deputy prime minister Alexander Novak and industry & trade minister Denis Manturov, emphasised the positive aspects of hydrogen obtained from natural gas & coal, and of hydrogen produced using nuclear energy (by way of electrolysis): from the Russian energy companies' point of view, this is a cheaper and economically more viable solution. Despite these differences, both Berlin and Moscow expressed their intention to boost cooperation: deputy energy minister Pavel Sorokin even proposed drawing up a bilateral 'road map' to identify specific measures and projects to expand the energy partnership by incorporating a hydrogen component into it.

…and at the corporate level

Russian and German companies are increasingly interested in launching cooperation in hydrogen energy. At a meeting of the Foreign Trade Chamber (*Auslandshandelskammer*, AHK) in Moscow held on 26 November 2020, representatives of the German economic and industrial elite expressed their interest in implementing hydrogen projects. Managers of companies such as ThyssenKrupp, Wintershall Dea and Siemens Energy, who attended the meeting, stressed the business potential of cooperation on implementing hydrogen projects in Russia. Recent months have seen more examples of bilateral business initiatives. One example of cooperation in this field involves the strategic partnership agreement between the Russian company Novatek and Siemens Energy; this envisages, for example, the joint development and implementation of new technologies for hydrogen production, as well as the replacement of natural gas with hydrogen in gas turbines used for electricity generation.[9] In addition, Novatek has launched cooperation with Uniper with the aim of securing hydrogen supplies to power plants owned by the German company and located in Russia,[10] and carrying out joint projects focused on development of hydrogen technologies.[11] Both Siemens and Uniper are examples of companies which have had a strong business presence in Russia for years, have ties with the political and economic elite, belong to the most ardent supporters of comprehensive hydrogen cooperation between Russia and Germany, and have actively lobbied in favour of this cooperation in Berlin.

" Germany is mainly interested in launching partnerships focused on green hydrogen and based on its domestic technologies.

Gazprom was among the companies which presented Germany with proposals for cooperation in the field of hydrogen energy. On 1 December 2020, at the German-Russian Raw Materials Forum, Gazprom's representative Alexander Ishkov announced a plan to establish the company Gazprom Hydrogen. Its main areas of activity would include the implementation of pilot projects, the development of technologies for low-emission storage and the transport of methane-hydrogen mixtures, as well as of pure hydrogen. One of the first cooperation proposals Gazprom has announced involves building a large plant in Germany to produce hydrogen from methane, located near the exit points of Nord Stream 1 and Nord Stream 2.

[9] 'Siemens Energy and Novatek to collaborate on more sustainable LNG production', Siemens Energy, 10 December 2020, www.siemens-energy.com.

[10] In the Russian Federation, Uniper operates five power plants with a total capacity of 11 GW, which are fired by hard coal, brown coal and natural gas.

[11] 'NOVATEK and Uniper Signed MOU on Hydrogen Production and Supply', NOVATEK, 29 January 2021, www.novatek.ru/en.

In addition, Gazprom has presented a plan for exporting hydrogen to Europe, combined with reverse supplies of carbon dioxide intended for utilisation or storage in Russia.[12]

" Unlike Germany, for the time being Russia does not view the development of its hydrogen energy sector as an element of its comprehensive energy transition.

Moreover, both states have pinned their hopes on the methane pyrolysis technology that could enable the emission-free production of turquoise hydrogen from natural gas. The German companies BASF and Wintershall Dea have invested in research focused on this technology, and the German Federal Ministry of Education and Research has pledged financial support to these initiatives. As regards the Russian side, Gazprom is among the companies which are involved in assessing the prospects of this method of producing hydrogen.[13] Germany has seen a revival of the debate on authorising the use of the carbon capture and storage technology (CCS), which has hitherto been considered controversial. The possible solutions include storing carbon dioxide under the seabed in German territorial waters and transferring it, for example, to Norway or to the Netherlands. Each of these solutions could pave the way for hydrogen to be produced from Russian natural gas on German soil.

Basic divergences in the German and Russian approach to hydrogen energy

From the German point of view, Russia's readiness to focus on green hydrogen may become an increasingly important factor in the long term. Any lack of progress in this area may adversely affect Berlin's assessment of cooperation prospects, because Germany will likely continue to focus on partnerships based on green technologies. German companies are among the world leaders in these technologies, and Germany's political and economic elite views them as potential export highlights and components of an attractive and promising business model. As a consequence, Germany has expressed its intention to become a global leader in the development, production and export of technologies enabling the production and utilisation of green hydrogen.

At this point, one major barrier involves the lack of clarity as to which approach to hydrogen energy will prevail in the context of this sector's development in Russia. The Russian domestic debate focuses around three different viewpoints: conservative, based on the conviction that the forecasts regarding the global hydrogen revolution will fail to materialise, which is why this sector should not be viewed as promising; adaptive, arguing that hydrogen energy should mainly be developed to serve export and that plans to replace fossil fuels with different energy sources, as announced by the main importers of Russian fuels, should be taken into account; and innovative, supporting the development of hydrogen energy in order to boost its share in the Russian economy.[14]

Russia's lack of readiness to carry out comprehensive reforms of the energy sector may be a serious systemic barrier to achieving the long-term goals of hydrogen cooperation. This is because the recommendations proposed by some experts envisage a profound energy transformation in the Russian Federation, involving in particular a major increase in the share of renewable energy sources in its energy mix within the next decade. This would help to create demand for green hydrogen, not

[12] '«Газпром» создаст спецкомпанию для водородных инициатив', Интерфакс, 1 December 2020, www.interfax.ru.

[13] Alongside Gazprom, Russian scientific institutes are involved in research into technologies for hydrogen production and use. On 1 December 2020, Russia's first consortium of entities involved in hydrogen projects was established. The Technological Hydrogen Valley includes selected scientific and research institutes: the Tomsk Polytechnic University, the Institute of Catalysis of the Siberian Branch of the Russian Academy of Sciences (RAN), the Institute of Problems of Chemical Physics of the RAN, the Institute of Petrochemical Synthesis of the RAN, the Samara State Technical University and Sakhalin University. In line with the initial assumption, the consortium's supervisory board is to include representatives of Russia's big companies.

[14] А. Механик, 'На водороде в будущее', *Эксперт*, no. 51, 14 December 2020, www.expert.ru.

only on the part of Russia's export partners, but also at home. However, this would require strategic political decisions that could undermine the interests of the largely conservative oil and gas lobby. Moreover, Russian political and business circles remain uncertain about the pace and the ultimate outcomes of the energy transition which the EU and its key member states are planning to carry out as part of the European Green Deal. This is accompanied by Russia's own ambivalent policy towards climate change.[15]

" One barrier to the development of hydrogen energy in Russia involves the absence of determination on the part of the major energy companies.

To facilitate its cooperation in hydrogen energy, Russia would also need to modify its standards regarding the investment conditions it offers to foreign entities. It is possible that the Russian government's policy will be affected not only by the positive experience of bilateral energy cooperation to date, but also by the fact that when establishing joint ventures to develop emission-free hydrogen energy, Russia would not be required to maintain ownership control. Unlike gas and oil fields, renewable energy sources that could potentially be used to produce so-called green hydrogen are not viewed as strategic resources. Cooperation with Germany could not only open up opportunities for Russia to acquire innovative technologies for joint hydrogen projects, but could also provide Russia with the prospect of developing its own hydrogen energy sector.[16] Berlin would welcome such cooperation because it views Russia as a prospective recipient of German hydrogen technologies, which could be widely applied both in hydrogen production and in the potential decarbonisation of the Russian industrial sector.

The ambiguity of Russia's approach to hydrogen energy and its long-term goals is also confirmed by Gazprom's position. On the one hand, Russia's biggest domestic gas producer is interested in developing joint projects with Germany using its raw material potential and the existing infrastructure. On the other hand, the company's executives have repeatedly expressed doubts regarding the profitability of initiatives aimed at producing so-called green hydrogen.[17] Russia's Energy Ministry has expressed a similar stance: in its view the development of hydrogen energy should not discriminate against the traditional sources of energy, which "can have an environmentally clean nature as well".[18]

Outlook

It seems that in the short- and medium term, the success of German-Russian hydrogen cooperation will depend, on the one hand, on how soon hydrogen production will be launched, on the production volume and on Russia's ability to supply hydrogen to Germany at a competitive price. On the other hand, it will depend on the demand from the German economy (and from other EU member states), and on the availability and attractiveness of alternative import options. Germany is mainly focused on developing the European hydrogen market, in which it could act as a hub, and is hoping to be able to import most of its hydrogen via pipelines, mainly from the Netherlands and Norway (due to its industrial demand, it prefers pure hydrogen rather than hydrogen as an admixture to natural gas).[19]

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[15] S. Kardaś, 'Climate ambivalence: Russia's climate change policy', *OSW Commentary*, no. 369, 15 December 2020, www.osw.waw.pl.

[16] В. Пермяков, 'Россия и Германия: новый энергодиалог', *Нефтегазовая вертикаль* 2020, no. 3–4, p. 55.

[17] '«Газпром» предупредил о риске нехватки воды при ставке на «зеленый» водород', Интерфакс, 1 February 2021, www.interfax.ru.

[18] О. Матвеева, 'Водородный триколор. Новое сырье может стать существенной частью энергобаланса', Коммерсантъ, 29 December 2020, www.kommersant.ru.

[19] The most promising solution involves using the gas infrastructure connecting Germany and the Netherlands. Most of this infrastructure will no longer be used following the end of natural gas extraction in the Netherlands. In addition, on 10 February 2021 the German government adopted a draft law to regulate the process of drawing up the foundations of the national hydrogen network. The law is expected to be passed by the Bundestag and the Bundesrat by the end of June 2021. See K. Stratmann, 'Bundesregierung ebnet Weg für Wasserstoffnetze', Handelsblatt, 10 February 2021, www.handelsblatt.com.

Other potential suppliers include France and Ukraine. Other methods of importing hydrogen and its derivatives include transporting it by sea from non-European locations; Berlin has already commenced such cooperation with countries in north and west Africa, as well as Australia and Chile. Germany views the attractiveness of green hydrogen as an important argument in favour of developing partnerships in this field with these countries, because domestic technologies (both electrolysers and RES installations) could be used in its production.

There are many indications that in the coming years, the development of Russian-German cooperation in hydrogen energy will be limited to Russian and German companies implementing joint small-scale projects, and to Germany using Russia's potential for producing emission-free variants of hydrogen. The hydrogen agenda will also serve political purposes; in particular, it will be used as an argument in favour of completing and putting Nord Stream 2 into service, and to obtain the right to use the pipeline on preferential terms. In the initial period, Russian hydrogen will most likely be shipped to Germany via the Baltic gas pipelines as an admixture to natural gas. Russian companies, particularly Novatek, will likely strive to use their cooperation with German partners to reduce the level of emissions from the production of LNG, which is becoming a strategically important export commodity in Russian energy policy (particularly in the context of plans to expand LNG export: the production volume is expected to increase up to 140 million tons by 2035).

One potential consequence of more advanced cooperation (a hydrogen alliance between Berlin and Moscow) would involve a new opportunity to extend the bilateral energy cooperation according to the models used thus far, in which Russia is the exporter and co-investor in infrastructure expansion, and Germany is the importer and supplier of technology. The gradual phase-out of fossil fuels by EU countries as part of their climate policy should be viewed as a factor reducing Russia's significance as a supplier of fuels to both Germany and other European importers. On the other hand, the potential successful development of cooperation in hydrogen energy could help to neutralise this trend, and as a consequence consolidate the existing economic and energy interdependence between Germany and Russia (albeit most likely on a more limited scale). However, there are no indications that Russia is currently ready to carry out comprehensive activities to launch an energy transition – one that would follow the German model or reflect the spirit of the assumptions of the European Green Deal.

APPENDIX

Hydrogen is not an energy source but a highly effective energy carrier. Although it practically never takes the form of pure hydrogen, it is very often found in chemical compounds such as CH_4 (methane) and H_2O (water). To enable the release of the energy it contains, hydrogen needs to be isolated from the molecules which contain it.

At present, in industrial applications **grey hydrogen** is used. This is obtained, for example, through natural gas steam reforming or through coal gasification, which generates CO_2 emissions. The application of carbon capture and storage technology (CCS) enables the capture of carbon dioxide from exhaust fumes in order to store it. **Blue hydrogen** obtained in this manner is viewed as a low-emission hydrogen variant. Another method for obtaining hydrogen involves methane pyrolysis, which results in the production of **turquoise hydrogen**. In this process, natural gas is heated to a high temperature to enable the separation of hydrogen from carbon, which results in the carbon becoming solidified. In this form it can be used as a raw material, for example in the steel industry. Electrolysis is an emission-free method of obtaining hydrogen from water using electrical energy. **Green hydrogen** is obtained when this method is applied using electricity produced from renewable sources; when nuclear energy is used, the result is **purple hydrogen**.

Hydrogen is viewed as an instrument which can be used in the decarbonisation of various sectors of the economy. In energy-intensive and high-emission **industries**, such as metallurgy and the chemical industry, hydrogen can replace fossil fuels (e.g. natural gas and coal) in the production processes. In the **transport** sector, it can be an alternative to the widely used petroleum-based fuels. In the **power sector** it can be used for storing energy and for balancing the electricity grid, and in the **heating sector** it can replace natural gas in heating installations in buildings.