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FOREWORD FROM THE EDITORS

Dear Readers,

The 2020–2021 year of home-office work, video conferences and online learning has undoubtedly been difficult for us all. However, while this unprecedented situation has presented numerous constraints, it has also shown us just how interconnected our world is and the possibilities that exist. New formats of academic and business exchange have exploded into the online sphere, entangling our perceptions of the world even further. This new situation has also provided many of us — especially at the ENERPO Journal — an opportunity to reconsider, revise and improve our projects.

It is with this reflection that the editorial board of the ENERPO Journal is extremely excited to share with our readers that we have begun to redesign our journal and have taken steps to have the journal indexed internationally. Not only have we expanded upon the types of articles to be found in the journal, but we have also instituted a double-blind peer review editing process with experts from around the globe. We look forward to seeing what further opportunities await the journal in the near future.

Beyond the journal itself, the ENERPO Research Center has remained incredibly busy and productive over the last year. The Center remains engaged in research on Russian coal sector challenges and transition opportunities. One of our current projects at ENERPO is to assess the current and future status of coal industry in Russia. We focus on macroeconomic and social stability of coal regions in the context of global energy transition.

Furthermore, between September 2020 and March 2021, we undertook a comprehensive research project regarding the climate risks for oil and gas, power utilities, mining, agriculture, pulp and paper, and banking sectors in Russia. We have presented our findings at different webinars organised by the Moscow stock exchange and rating agency RAEX Europe and released industry guides for these sectors.

Lastly, since our report on responsible banking practices released together with WWF Russia in 2019, we have acquired many requests from banks and large Russian companies to explain to them the ESG risks involved in their practices. This January we launched a series of vocational trainings for the energy, mining and banking sectors to raise awareness about ESG and help companies build internal capacity. Thanks to our training seminars, more than 300 people from different industries have had the chance to improve their knowledge on ESG risk management, ESG reporting and green financial products.

We at the ENERPO editorial board would like to take this opportunity to thank you for your continued readership; for your enduring interest in the field of energy politics; and for your ongoing support and contributions to our journal, to our research center and to the European University.

Yours truly,
Joshua R. Kroeker and **Dana Rice**

Editors

INTERVIEW WITH **DR MIKHAIL KRUTIKHIN**

Abstract

Reflecting on the major events of 2020 and the outlook for 2021, ENERPO Journal sat down with Dr Mikhail Krutikhin (co-founder and partner of RusEnergy) to discuss the 2020 Russian-Saudi oil price war, the Russian Federation's newly published Energy Strategy 2035, the Power of Siberia pipeline and the possibilities of Russia's transition to a knowledge-based economy.

Keywords: clean energy, Energy Strategy of the Russian Federation (ES-2035), oil price shock, global pandemic, Power of Siberia

Интервью с Михаилом Крутихиным

Аннотация: Размышляя об основных событиях 2020 года и перспективах на 2021 год, журнал ENERPO встретился Михаилом Крутихиным (соучредителем и партнером RusEnergy), чтобы обсудить войну цен на нефть между Россией и Саудовской Аравией в 2020 году, недавно опубликованную Энергетическую стратегию Российской Федерации на 2035 год, трубопровод «Сила Сибири» и возможности перехода России к экономике, основанной на знаниях.

Ключевые слова: чистая энергия, Энергетическая стратегия РФ (ЭС-2035), нефтяной шок, пандемия, Сила Сибири

In 2020, Russia experienced the double shock of an oil price collapse and a global pandemic. In your view, how has the Russian energy sector weathered these events, and what is the outlook for 2021?

When I saw the official figures of oil and gas production in Russia for the previous year, I was not surprised because, well, the figures as usual do not fit simple arithmetic. If you just add all the figures month by month as they are published in Russia, you will get chaotic answers that have absolutely nothing in common with the reality. According to our calculations [by RusEnergy], oil production in Russia fell about 11% and revenues from oil and gas fell about 16% during the year. That's a very big downslide. And it affected the status of the Russian oil industry first of all, not gas, because Russia has plenty of gas, much more than it can sell, and the markets are still there. Oil is more difficult. Under the pressure of the OPEC+ agreement, Russian companies had to start deceasing production, and the cutdowns affected the least profitable wells. We see that the number of idle wells in Russia decreased by half during the second part of the year. And it will be very, very difficult to rejuvenate production from those wells. You see, those older wells produce not oil but a substance which mostly consists of water — sometimes it is 94–96% water and then oil. To extract obsolete equipment from the oil wells and to use new equipment to produce the new amount of oil from those old wells is not commercial at all. And so, the companies believe they will not be able to bring oil production in Russia to the level of 2019 — which seems to be the record year, the peak year — and after 2019, oil production in Russia is going to decline, maybe slowly (because Russian companies are using all the technologies they possess to increase oil production from brownfields — the fields that have brought onstream long ago and are still operational — it means that Russian companies are sucking out the last remaining cheap oil they have and they do not want to go into new territories and start new projects because they are not sure of the future). According to the official figures, about 60% or maybe even 70% of remaining oil reserves in Russia are hard to recover and they need the price of a barrel in the vicinity of maybe 80 dollars. 80 per barrel is impossible right now. And so, the oil companies just do not want to invest because if you start a new oil production project, you have about between seven and 15 years of negative cash flow. For a substantial return, you need a lot of time. Nobody is sure of the future, and the horizon of planning for Russian oil companies does not exceed one or maybe three years. If we look further in the future, we see that maybe as global oil demand is decreasing it will be the realm of such countries as Saudi Arabia, which has plenty of cheap oil, to manipulate and control the market. Maybe there will be enough oil to satisfy domestic demand, but in some 15 years, Russia will disappear as an oil exporter from the global market. So, this is the situation now, and I do not think it is going to improve even though the government says 'okay, if the price of oil is 40–45 dollars, we will be able to get back to the production level of 2019'. I do not believe that.

In 2020, Russia published a new energy strategy, covering the next fifteen years (ES–2035). Are there any major changes in this new document compared to Russia's previous strategy written in 2000?

Forget about such documents. It's the fourth energy strategy they've adopted as far as I remember, and each of those documents was obsolete before it was signed into effect. It's not a real document because it is not mandatory for oil companies to follow that strategy. We see other documents such as the Doctrine of Energy Security of the Russian Federation, which was signed a year and a half ago by the Russian President, and it says that Russia is going to base its energy strategy on fossil fuels, on carbon. Meanwhile, it views energy efficiency, energy safety, alternative energy and so on as either risks or challenges for the traditional Russian energy industry. It shows that Russia is not ready to switch to the new strategy of the developed state, which is decarbonisation and some sort of a transition to a cleaner, more sustainable energy. And it's not just developed countries. I've seen that even in Africa they've adopted plans for switching to a new, greener energy strategy. Russia is lagging behind or doing absolutely nothing at all.

Regarding decarbonisation and the transition to a cleaner, more sustainable future, I know that the ES–2035 document does mention further investments in hydrogen and helium. Hydrogen fuel is certainly receiving a lot of attention right now. In fact, several of our articles in this issue of ENERPO examine hydrogen strategies across Europe, Asia and Australia — this is a big development from previous issues where we received no hydrogen-related submissions. What role do you see hydrogen playing in the future of Russia's energy sector, both in the short and long term?

Yes, from time to time we hear Russian government officials mentioning hydrogen. It's a fashionable word now. Two years ago, I attended expert talks in Berlin. Nobody talked about hydrogen. It was mentioned only once. Last year, when I attended another expert meeting in Berlin, everybody was speaking about hydrogen.

But the problem is whether Russia can fit its hydrogen production into the global market. Russia is basing its assumptions on its possibility to produce hydrogen using methane, which is also a carbon fuel. The market for hydrogen is in Europe, and Europeans prefer green hydrogen, which is produced with the assistance of alternative energy — wind, solar and so forth. Russia is not ready to switch to alternative sources for producing hydrogen. And so, when Russia might offer Germany, for example, to transport a supply of hydrogen to Germany, the Germans would say 'no, we have our own means of producing hydrogen and we do not want to import it'. I doubt very much that Russia will find the market for its allegedly 'dirty' hydrogen in the future.

The ES–2035 also envisions the continued modernisation and development of Russia's fuel and energy complex infrastructure, including the gasification of Eastern Siberia and the Far East. On this note, I'd like to briefly discuss the Power of Siberia pipeline, which began operating in December 2019. In an article earlier last year, you spoke about how Russia is selling this gas to China for less than the cost of producing and that the [Kovykta and Chayandinskoye] deposits feeding the pipelines are overestimated. Do you believe that the strategic and political benefits of the pipeline outweigh the economic inviability?

Well, that's a big topic. First of all, there were two purposes for the project. The first one was geopolitical. President Putin said on multiple occasions that he wanted the eastern and western networks of gas transportation to become connected and then Russia will be able to switch the flows from Europe to China, from China to Europe, wherever the market is better. And it failed. If you look at a map of the pipelines, you will see that the capacity of the pipelines going west is over 200 bcm a year whereas the Chinese have not agreed to receive more than 38 bcm a year. You cannot operate the switch in this way and blackmail Europe or blackmail China. It's an absolutely impossible dream of the Russian President as usual with its geopolitical purposes for pipelines. For example, establish new streams in the Baltic and Black Seas around Ukraine — it failed. Right now, the Chinese geopolitical idea is also failing.

But the other purpose of the pipeline was to make his friends richer, some of the people who provide the services for the construction of the pipeline. It's okay for them — they got the money they wanted from the investment program of Gazprom. But the problem right now is that Gazprom cannot carry out its promises to China. I spoke to the Chinese. They say 'okay, if by the year 2025, Russia cannot deliver 38 bcm a year by this pipeline, we will charge Gazprom for penalties and Gazprom is going to pay for the inability to carry out its contractual obligations'. Now when Gazprom understood that they cannot do that with the reserves they have in Yakutia, they made a proposal to Putin to build another pipeline. So, the new pipeline is going to start at the Yamal Peninsula, which is the main source of gas deliveries to Europe and then go all the way across Eastern Siberia to connect to the Power of Siberia to carry out the dream of Mr Putin and to satisfy the Chinese. It will be a very expensive project. When we compare the length of the project and the problems along the way with the usual costs per kilometre of Gazprom pipelines, we can easily calculate that the final price tag is going to be over 100 billion dollars. So, for Gazprom, that's a huge burden because the company cannot get the money it hoped from gas sales in Europe, demand is not increasing, prices are decreasing, and Gazprom is in the red already. Of course, the government will help Gazprom with loans and credits and fiscal benefits and so on. However, the profits of selling gas to China are not going to be huge. It's just satisfying the false geopolitical ideas of Mr Putin and nothing else — and along the way some cronies of the president are going to get some money from these crazy ideas.

The ES–2035 states that Russia's fuel and energy complex will become a 'central pillar' for Russia in the next decade, transitioning from a 'donor' to the 'locomotive of the Russian economy'. Isn't the fuel and energy complex already the locomotive of the Russian economy? Shouldn't Russia be

trying to diversify away from this dependency on the energy industry?

Basically, Russia is still dependent on oil and gas and coal and raw materials production. 85% of Russian exports by cost are energy and raw materials. From diamonds to coal. Two years ago, I participated in a conference in Doha, and the conference was devoted to the problem of a new economy, an economy based on knowledge, not on exploitation of resources. It was strange to listen to the Qataris arguing that even their country, which is dependent on gas and oil, is going to switch to a new paradigm and that the future of humanity is a knowledge-based economy. And when I was speaking at the conference, I was ashamed because everything that I could quote from the Russian government showed Russia serving as a bad example. Russia's going in the opposite direction. It's still determined to base its development on exploitation of resources, raw materials, and when we look at scientific research, education and knowledge, we see that the politics of Russia is aimed at decreasing this sector of the economy. We see deterioration of school education and scientific work. Underpaid scientists want to go abroad to some other country, and if you ask young students in Russia, half of them want to leave Russia and to work somewhere else. They don't want to be underpaid and without any opportunity to expand their talents. One of the main slogans of the Russian government is 'import substitution'. We do not want any foreign technologies. The Russian president said, 'let them develop their technologies and we'll come and grab them — or "snatch" them'. We see that the Russian government is adopting a law which makes it legal to steal knowledge from other countries without paying any attention to international law, to anything. If you steal patented technology or some sample of equipment, it's okay with the Russian law right now. I don't think this is a healthy approach to the future of the country.

CHALLENGES FOR A KNOWLEDGE-BASED ECONOMY IN RUSSIA

Dr Mikhail Krutikhin

Abstract

Building a knowledge-based economy can only be achieved through a combination of international and domestic factors. For Russia, unfortunately, both international and domestic conditions present significant obstacles. Moscow's inability to overcome these challenges means that the nation's transition from a raw materials exporter to a pioneering modern economy will remain a dream rather than a reality.

Keywords: brain drain, import replacement, sanctions

Вызовы перед экономикой знаний в России

Аннотация: *Построение экономики знаний может быть достигнуто только за счет сочетания международных и внутренних факторов. В случае России, к сожалению, как международные, так и внутренние условия являются источниками значительных трудностей. Неспособность Москвы преодолеть эти вызовы означает, что переход страны от экспортера сырья к новаторской современной экономике останется мечтой, а не реальностью.*

Ключевые слова: утечка мозгов, импортозамещение, санкции

Production and export of raw materials is the backbone of Russia's economy. This fact gives the Russian government cause for concern, as other developed nations seem to be moving towards economies based on human development and knowledge rather than on primitive exploitation of natural reserves.[1] When President Vladimir Putin was re-elected in May 2018, he announced a plan of 13 national projects, dubbed 'May Decrees', to place his country among the world's top five economies. The overall cost of the plan is estimated to total 25.7 trillion rubles ($391 billion) by 2024. However, education and science are not priorities in the plan. Non-energy infrastructure will be the most expensive project, at a cost of 6.4 trillion rubles, followed by roads at 4.8 trillion, ecology at 4 trillion and demography at 3.1 trillion.[2]

In the Russian budget, the development of human capital remains in disregard. Ongoing structural and demographic changes in Russian society, along with underfinancing, have resulted in the deterioration of education on all levels and the decline of scientific research.

Between 2001 and 2019, the number of rural schools in Russia decreased from 46,000 to 24,000 and the number of urban schools declined from 26,000 to 18,000. The number of universities and other higher education institutions has fallen from 965 to 818.[3] According to HSE University Rector Yaroslav Kuzminov, only some 15% of Russia's adult population are now engaged in various continuing learning and development tracks, while in Sweden this figure is 62% and 42% in Germany (the average among leading countries is about 40–50%). Educational spending in Russia accounts for just 3.5% of the federal budget.[4] Since 2013, the sum allocated to education in the annual federal budget has shrunk from 506.2 billion rubles to 432.5 billion rubles. a schoolteacher's monthly salary averages $610 throughout Russia, falling to as low as $362 in the Ivanovo Region northeast of Moscow.[5]

The quality of university education and academic work in Russia is, to put it mildly, questionable. A 2018–2019 report produced by Dissernet, an independent NGO, revealed that

[1] *Higher School of Economics, 2018. Russia's Economy Has Almost Exhausted Its Opportunities for Catch-Up Growth. [online] Available at: https://www.hse.ru/en/news/research/218041407.html*

[2] *The Moscow Times, 2019. Putin's Ambitious Plan to Overhaul Russia's Economy. [online] Available at: https://www.themoscowtimes.com/2019/02/11/putins-ambitious-plan-to-overhaul-russias-economy-will-cost-390bln-government-estimates-a64464*

[3] *RBC Group, 2019. Счетная палата о сообщила о резком сокращении числа школ в России. [online, in Russian] Available at: https://www.rbc.ru/society/28/06/2019/5d16366a9a7947d218d79f3a*

[4] *Higher School of Economics, 2018. The Digital Revolution Is the Key Trend in Education. [online] Available at: https://ioe.hse.ru/en/news/214157165.html*

[5] *News.ru, 2019. Опрос показал, где в России живут самые высокооплачиваемые учителя. [online, in Russian] Available at: https://news.ru/society/opros-pokazal-gde-v-rossii-zhivut-samye-vysokooplachivaemye-uchitelya/*

among 676 university rectors, 64 of them had plagiarized dissertations, 32 helped degree contenders produce plagiarized dissertations, 31 published academic articles with falsified data and 112 had a record of 'unethical' scientific behaviour. The findings of the report indicate that about one-fifth of rectors of Russian universities can hardly be trusted as academic researchers.[6] Another Dissernet investigation from 2016 showed that fabricated academic degrees are discovered in Russia almost daily.[7]

The deterioration of educational and academic work in Russian universities has resulted in their poor reputation worldwide. The largest and most famous institution of higher education in Russia, Lomonosov Moscow State University, ranked 189th in the World University Rankings in 2019.[8]

Attempts have been made to improve the situation. In April 2018, the Higher School of Economics (HSE) and the Alexei Kudrin Center for Strategic Research presented a draft reform of Russian education with a potential cost of up to 8 trillion rubles. They proposed creating a system for supporting early development for all children from birth to three years, introducing educational complexes[9] in schools based on artificial intelligence, and building 40 new training centres. Full implementation of these initiatives would have resulted in increasing total education spending in the state budget to 4.8% of GDP by 2024, as compared with 3.5% of GDP in 2017. The authors claimed this would bring Russian education spending to roughly the same proportion of GDP as an average OECD country. The full implementation of the proposals of the HSE and the CSR would require additional budgetary financing at the level of 4.6 trillion rubles for six years. If extra-budgetary funding were added (e.g., public-private partnerships in the construction of schools), the amount might increase to 8.3 trillion rubles.[10]

The proposals are hardly realistic when considered from the angle of Russia's strategy of budgetary spending. The emphasis of the current government in the 2019 federal budget is on such highly prioritized items as 'social policies' (24.5%), with pensions to retired workers at the top of the list), military spending (14.6%), and law enforcement (11.3%). Education and science have been allocated 4.1% of the funds.[11]

The poor quality of education affects professional training and R&D work even in Russia's vitally important oil and gas industry. In 2014, according to official records of the Russian Ministry of Industry and Ministry of Energy, imports accounted for 85% of equipment and technologies for hydraulic fracturing, 80% of high-pressure pumps, 77% of wellhead installations and 67% of drilling services. Oil and gas software were almost 100% supplied by foreign companies. The ministries claim that the overall dependence of the oil and gas industry on imports fell from 60% in 2014 to just 51% in 2019, and in 2020, the figure is expected to reach 43%.[12]

'Import replacement' is one of the Russian government's main slogans, invented after the introduction of international sanctions in 2014 in response to Russia's aggression towards Ukraine, Moscow's alleged interference in the 2016 U.S. presidential elections and the poisoning of Russian fugitives and political opponents abroad. In many cases, however, there is no such replacement taking place. Many supposedly domestically produced goods are foreign-made and then supplied with 'Made in Russia' labels or assembled from foreign-made parts with minimal assembly performed by workers in Russia. Moreover, Russia is still entirely dependent on foreign imports for sophisticated equipment, such as subsea units for underwater oil and gas production.

Another problem that prevents Russia's movement toward a knowledge-based economy is the phenomenon of 'brain drain'. In the Global Talent Competitiveness Index of INSEAD Russia ranks 107th out of 118.[13] Poor (and worsening) educational standards, ridiculously low wages, underfinancing of R&D institutions plus the general lack of social freedoms and insufficient legal protection in Russian society are all driving the younger generations out of the country, and talented youth is spearheading this exodus. Each year, an estimated 100,000 Russians emigrate to developed countries, around 40% of these emigrants have higher education[14]. Between 1990 and 2018, the number of researchers in Russia decreased by 2.7 time. The share of holders of doctorate degrees among researchers dropped from 13.8% to 13% (from 2013 to 2016), and candidates of sciences (PhD) — from 31.7% to 30%. The average age of a Russian researcher exceeds 50 years while one-third have already reached retirement age. Russian academia is losing its young specialists and older academics are about to retire, but there are too few academics to take their place and push research forward.[15]

A recent opinion poll showed that 41% of Russians aged 18–24 would like to leave their native country and establish

[6] *Dissernet, 2019. Rectors of Russia. [online] Available at: https://www.dissernet.org/publications/rectory.htm*

[7] *Dissernet, 2016. Fake Academic Degrees in Russia. [online] Available at: https://www.dissernet.org/publications/c_sh_p.htm*

[8] *Times Higher Education, 2020. World University Rankings 2020. [online] Available at: https://www.timeshighereducation.com/world-university-rankings/2020/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats*

[9] *Editor's Footnote: образовательный комплекс in Russian. According to Ardabatskaya, '[t]he heart of the modernization of the modern education system is based on the idea of continuity, integrity and biodiversity ... Recently they have been revived throughout school systems, which today are called educational complexes or education centres. They are based on the integration of several levels of education and to create a single and continuous educational space with a wide range of services.' See Ardabatskaya, I.A., 2016. Creating of Educational Complexes: Tradition and Innovation. Ярославский педагогический вестник.*

[10] *Higher School of Economics, 2018. Russia's Economy Has Almost Exhausted Its Opportunities for Catch-Up Growth.*

[11] *FinCan.ru, Russia's Budget in Figures. [online, in Russian] Available at: http://fincan.ru/articles/45_byudzhet-rossii-na-2019-god-v-cifrah/*

[12] *Kommersant, 2018. Oil and Gas Companies Have Tasted Import Replacement. [online, in Russian] Available at: https://www.kommersant.ru/doc/3743355*

[13] *INSEAD, 2017. 2017 Global Talent Competitiveness Index focuses on talent and technology. [online] Available at: https://www.insead.edu/news/2017-global-talent-competitiveness-index-davos*

[14] *The Moscow Times, 2018. Russia's Brain Drain on the Rise. [online] Available at: https://www.themoscowtimes.com/2018/01/24/russias-brain-drain-on-the-rise-over-economic-woes-report-a60263*

[15] *RBC Group, 2018. В РАН заявили о возросшей в два раза за три года «утечка мозгов». [online, in Russian] Available at: https://www.rbc.ru/society/29/03/2018/5abcc9f59a7947e576977387*

permanent residence status elsewhere.[16] This is hardly a good environment for a knowledge-based economy.

CONCLUSIONS

The development of human capital and the formation of a knowledge-based economy are impossible without integration into the global exchange of ideas, technologies, know-how and cash flows. In this respect, 'import replacement' must be regarded as a 'patriotic' publicity stunt, aimed at a domestic audience. It cannot substitute international cooperation and leads to backwardness instead of real progress. Russia, with its meagre contribution to global GDP and economic stagnation,[17] has no other choice but to resort to international experience, capital, technologies and equipment to become an integral part of the worldwide movement for progress. Unfortunately, international sanctions and the Russian government's increasing political isolation in the global arena, followed by the proclaimed strategy of dependence on domestic resources, are impeding the development of a knowledge-based economy.

Russia's integration into the group of nations that see their future in the values of human capital and access to knowledge can only be possible if two conditions are met. Domestically, the government must create a political and economic environment that stimulates education and science. Internationally, Russia's foreign policy, including its treatment of the former Soviet republics, ought to be based on peaceful principles rather than military aggression and coercion.

Mikhail Krutikhin

Partner, RusEnergy, Russia

[16] *Novaya Gazeta, 2019. «Левада-Центр»: о желании эмигрировать из России заявили 41% молодежи. [online, in Russian] Available at: https://www.novayagazeta.ru/news/2019/02/04/148936-levada-tsentr-o-zhelanii-emigrirovat-iz-rossii-zayavil-41-molodezhi*

[17] *The Moscow Times, 2019. The Russian Economy is Stagnating. [online] Available at: https://www.themoscowtimes.com/2019/05/27/the-russian-economy-is-stagnating-a65760*

THE RUSSIAN COAL INDUSTRY IN THE CONTEXT OF DECARBONIZING THE GLOBAL ENERGY SECTOR

Dr Nikita A. Lomagin, Maxim A. Titov, Mikhail A. Oshchepkov

Abstract

This paper considers the current state of the Russian coal industry. A scenario analysis of its development in the context of emerging trends in the decarbonization of the world energy sector is presented.

Keywords: coal industry, power engineering, decarbonization, heat and electricity generation

Российская угольная промышленность в контексте декарбонизации мирового энергетического сектора

Аннотация: *В данной статье рассматривается современное состояние угольной промышленности России. Представлен анализ сценариев развития в контексте формирующихся тенденций декарбонизации мирового энергетического сектора.*

Ключевые слова: угольная промышленность, энергетика, декарбонизация, производство тепловой и электрической энергии

INTRODUCTION

Until recently, the coal industry was perceived as one of the most important components of the energy security system of most countries and was a key supplier of heat and electricity for the needs of the population around the world. Coal's use in the global energy sector was due to its low cost in comparison with natural gas, and in the case of Russia, the historically developed infrastructure features of the country's energy complex. At the same time, the process of burning coal fuel is accompanied by negative consequences for the environment, which leads to a decrease in the value of coal for the economies of a number of developed countries. As a result, many of these countries have transitioned to alternative energy sources.

Russia, as one of the world's leading coal producers, is heavily dependent on the changing structure of the global energy market. As Russia's main energy consumers transition towards more environmentally friendly alternatives, Russia's domestic coal mining companies face increasingly serious challenges. However, modern technologies in the field of processing and use of coal fuel are becoming a new opportunity for this traditional industry. The introduction of so-called "clean" coal will make this fuel source more acceptable for the low-carbon future of the energy system.

KEY TRENDS IN GLOBAL ENERGY

The starting point in determining the possible development trajectories of the coal industry is an ongoing global trend associated with the constant growth of global energy consumption. The increase in the world's population and the desire of people to improve their living conditions are becoming powerful drivers of the development of global energy. At the same time, the role of hydrocarbon resources in global energy consumption continues to prevail.

As mentioned earlier, the main problem in the observed trend is not the direct increase in energy consumption itself but the negative impact of derived products on the environment generated by the combustion of traditional carbon-containing fuels. Therefore, to understand the prospects of the Russian coal industry, it is important to consider a number of other trends in the global energy sector.

Thus, it is worth noting that the active development of renewable energy sources (RES) has led to parity between the share of RES (27%) and coal generation (26%) in the global energy balance as of the end of 2019.[1] However, if we compare the energy resources used as fuel for production of thermal energy, then RES accounts for no significant portion of production of thermal energy, and for coal, gas and oil-more than 40% because in difficult weather conditions,

[1] *Power generation in 2019 in the world, Statistical Yearbook of World Energy 2020. [online] Available at: https://yearbook.enerdata.ru/renewables/renewable-in-electricity-production-share.html*

the efficiency of using solar and wind power plants (SES and WPP) is extremely low.[2] Despite the current trend associated with the continuing annual increase in the global average air temperature, the prospects for the use of renewable energy for heat generation remain weak.

The second significant problem is that in the conditions of the unified energy system operating in Russia, significantly less energy is consumed at night than in the morning or in the afternoon. At the same time, the greatest jumps in electricity consumption are observed in the morning. Such a consumption format is extremely difficult to change, so the voltage peaks at certain time intervals during the day can be taken as a constant value.

A system operator responsible for the operation of the power grid has to make certain efforts aimed at the constant distribution of available capacity for the local needs of the population. As controlling weather patterns is impossible, the widespread use of renewable energy creates new difficulties. The production of energy at wind and solar farms significantly depends on the weather, and not on human needs. "Good" weather is a prerequisite for the solar panels to work and the wind turbine blades to rotate.

Global Electricity Consumption

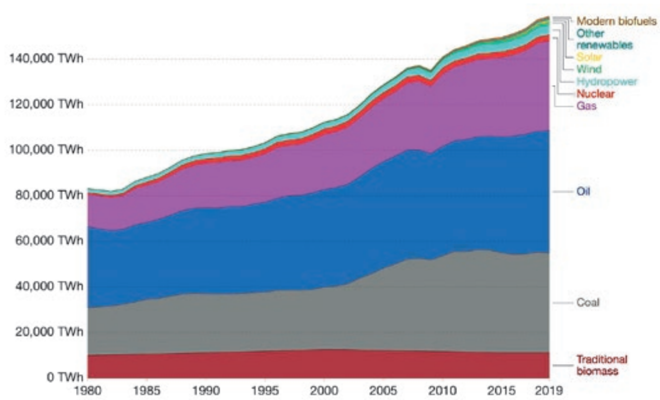

Figure 1 Global consumption of electricity by source, TWh
Source: Our World in Data[3]

According to the UN baseline scenario, the global population will reach 9.2 billion people by 2040, and the main increase will be provided by the least developed countries of Asia and Africa, where the issue of energy availability prevails over the sources of its production.[4] Therefore, natural population growth combined with an increase in GDP in these regions creates additional needs for electricity and an increase in the consumption of traditional types of energy resources. At the same time, the main contribution to the global growth of generated electricity is being made by China and India.

Electricity Generation by Region

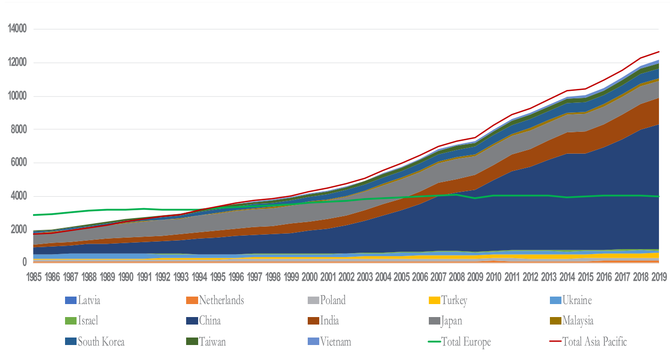

Figure 2. Electricity production by region, TWh
Source: BP Statistical Review of World Energy 2020[5]

Based on data from BP presented in its annual energy reports, at the end of 2019 the Asia-Pacific region contributed 47.9% to the growth of global electricity generation (a +5.4% increase since the prior year, 2018). At the same time, the total generation of EU countries is significantly lower than Asia and is at 14.8% (–0.1% by 2018).[6]

The high growth rate of electricity production in the Asian region confirms the fact that there is a significant amount of additional electricity needs for its population. However, in some Asian countries, there are still people who do not have any access to electricity. Consequently, as the economies of these countries develop, the need for additional generation will grow. Which energy sources will meet the growing demand remains an open question.

In developed countries, increasing electrical demand is less of a challenge. We can even trace a downward trend in electricity consumption per capita in Germany, France and Japan. Conversely, in India and China, the growth of industry and the quality of life of the population leads to the opposite results. A number of analysts consider that certain countries will drive that increased demand for power, most notably India, where population growth and economic development could make that country responsible for about 11% of total global energy consumption in 2040, according to a recent BP report.[7]

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[2] *What is heat and power engineering?, Official website of the Far Eastern Federal University (FEFU). [online] Available at: https://www.dvfu.ru/schools/engineering/structure/departments/the_department_of_heat_power_engineering_and_heat_engineering/*

[3] *Global direct primary energy consumption, Our World In Data is a project of the Global Change Data Lab. [online] Available at: https://ourworldindata.org/grapher/global-primary-energy?time=earliest..latest*

[4] *World Population Prospect 2019, the Highlights, the official United Nations population. [online] Available at: https://www.un.org/development/desa/pd/ru/news/world-population-prospect-2019*

[5] *BP Statistical Review of World Energy 2020. Electricity generation. [online] Available at: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/xlsx/energy-economics/statistical-review/bp-stats-review–2020-all-data.xlsx*

[6] *Idem.*

[7] *Proctor, D., 2020. India Expects to Double Power Consumption, POWER magazine. [online] Available at: https://www.powermag.com/india-expects-to-double-power-consumption/*

Electricity Consumption Per Capita

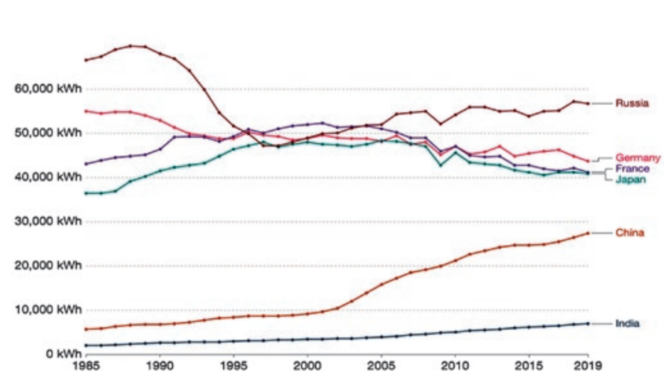

Figure 3. The pattern of electricity Consumption per person, KWh
Source: Our World in Data[8]

Another trend is the continued global growth in electricity generated directly from the burning of coal fuel in 2019. Despite the apparent fluctuations in the general values of the chart downward in 2019 associated with the reduction in coal countries of the EU, the trend continued to increase for coal generation in the Asia-Pacific region, which actually levelled out the efforts of Europe.

Coal-fired Power Generation by Region

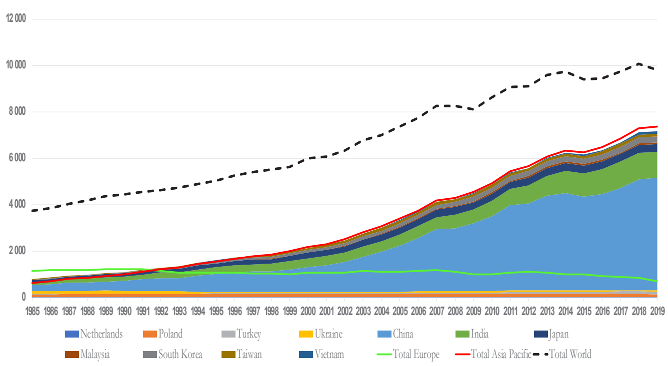

Figure 4. Electricity generation from coal by region, TWh
Source: BP Statistical Review of World Energy 2020[9]

Even if all EU countries were to completely abandon coal in 2019, its total consumption for electricity generation would fall by only 7.1%. So, if electricity consumption only grows in the future, coal will continue to occupy a significant share in the global energy balance for some time to come. The most difficult thing for economists in this case is to determine the tipping points when each individual country will begin to reduce the production and consumption of coal fuel in favour of cleaner energy resources.

INFLUENCE OF THE GLOBAL ENERGY TRENDS ON RUSSIA'S COAL SECTOR

Turning to the influence of the described trends in the global energy sector on the Russian coal industry, it is worth noting that the graphs in Fig. 2 and Fig. 4 were built on the basis of data from individual countries and entire regions that are the largest importers of Russian coal. These include China, Republic of Korea, Germany, Japan, Netherlands, Poland, Turkey, Taiwan, Ukraine, India, Vietnam, Latvia, Malaysia, Israel and Finland.

The Russian Federation supplies energy coal in two main directions – to Europe (to the West) and to Asia (to the East). Even now, with a high degree of probability, it is possible to fix the trend of reducing coal generation in Europe, where at the end of 2019, 18.4% less electricity was obtained from coal than in 2018. At the same time, we see an increase in coal generation in Asia by 1.2% over the same period. The main problem in this case is that in the Asia-Pacific region, several times more coal is burned annually than in Europe. Therefore, assuming that the current growth rate continues, even if Europe completely abandons coal, an increase in Asian coal-fired electricity generation will fully account for the elimination of coal in Europe by 2027.

Forecast of Electricity Production from Coal for 2020–2040

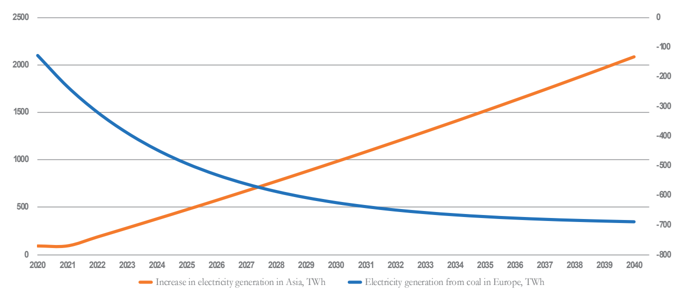

Figure 5. Forecast of electricity production from coal for 2020–2040, Twh
Source: calculated based on data from BP Statistical Review of World Energy 2020[10]

Among the main importers of Russian coal, only five countries – India, Vietnam, Malaysia, Turkey and Ukraine – have failed to reach a consensus on achieving carbon neutrality (Table 1).

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[8] *Global Change Data Lab. Energy use per person, Our World In Data. [online] Available at: https://ourworldindata.org/grapher/per-capita-energy-use*

[9] *BP Statistical Review of World Energy 2020. Electricity generation from coal. [online] Available at: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/xlsx/energy-economics/statistical-review/bp-stats-review-2020-all-data.xlsx*

[10] *Idem.*

Dynamics of Coal Imports in Key Regions of the Russian Federation

Asia	Import in 2019, Mt	2019 to 2018	Carbon "zero" consensus
China	32,8	119%	by 2060
South Korea	28,3	97%	by 2050
Japan	20,2	111%	by 2050
Taiwan	8,5	92%	(officially no, by 2060 with China)
India	8,0	178%	officially no
Vietnam	6,1	230%	15% reduction by 2030
Malaysia	3,3	106%	officially no
Europe			
Germany	21,3	154%	by 2050
Netherlands	13,8	115%	by 2050
Poland	10,9	82%	officially no, but consensus has been achieved
Turkey	9,4	79%	officially no
Ukraine	8,1	74%	officially no
Latvia	4,7	110%	by 2050

Table 1. The trajectory of the main importers of Russian coal towards carbon neutrality
Source: prepared based on CDU TEK data (2018–2019) and media publications[11]

The current picture does not bode well for the Russian coal industry, but until 2050 we can predict the relevance of this type of fuel for the Asia-Pacific region with an increase in consumption in the next 5–10 years.

The Energy Strategy of the Russian Federation until 2035, prepared by the Government of the Russian Federation, has become a new phase for the Russian coal industry. Although its main focus is on the oil and gas sectors, the Russian government is nevertheless optimistic about the further development of the domestic coal industry. At the same time, it believes that in order to ensure the competitiveness of coal in both the domestic and foreign markets, it is necessary to curb the growth of natural gas prices and continue programs of preferential tariff formation for its rail transportation. By 2035, the Russian government plans to create new coal mining centers in the Republics of Sakha and Tyva, the Trans-Baikal Territory, and other regions of Siberia and the Far East, which can ensure a 1.5-fold increase in coal exports under favourable conditions. In a conservative scenario, coal production will stabilize at the current levels (375 million tons per year), and in an optimistic scenario it will grow by 1.3 times (up to 490 million tons). Under the conservative scenario, coal exports will remain at 160 million tons per year, while under the optimistic scenario, they will grow to 250 million tons.[12]

The global trend aimed at decarbonization, in general, does not affect the government's strategy and the plans of Russian coal miners. Signed by the President of the Russian Federation, V. Putin's Decree No. 666 implies a reduction in emissions by 2030 to 70 percent of the 1990 level, taking into account the maximum possible absorption capacity of forests, that is, minus 30 percent from 1990 by 2030.[13] Russia is currently at an emission level of about minus 50 percent of its 1990 level, including forest uptake, and about minus 30 percent without it. Consequently, according to the new goal, the Russian government has little to grapple with in the area of climate action.

If one looks at the structure of energy consumption in Russia, then two regions have a significant impact on climate change — the Siberian Federal District and the Far Eastern Federal District. In these districts, the share of coal consumption is 84.6% and 54.2%, respectively. Otherwise, the internal balance of the Russian energy sector looks quite stable.

In this regard, the decarbonization processes currently taking place in the world have a greater impact on the export potential of Russian coal products. If the European partners' interest in coal continues to decline, in 10 years all coal cargo flows from Russia to the west will probably be redirected to the east. The volume of coal shipments will then be determined by three main factors: the capacity of railways, the demand of Asian economies for coal and the price and competitiveness of Russian coal fuel in comparison with other world exporters.

Currently, metallurgical coal does not have full-fledged substitutes to meet the needs of the global steel industry. The share of its exports in the absolute volume of coal supplied from Russia is about 10%, but its scope of application relates to metallurgy, not energy.

[11] Tarazanov I. and Gubanov D., 2020. The results of the Russian coal industry in January-December 2020. Coal, (3), pp. 54–69.

[12] About the approval of the Energy Strategy of the Russian Federation for the period up to 2035, Order of the Government of the Russian Federation of 09.06.2020 N 1523-p. [online] Available at: http://www.consultant.ru/document/cons_doc_LAW_354840/

[13] On reducing greenhouse gas emissions, Decree of the President of the Russian Federation of 04.11.2020 N 666. [online] Available at: http://www.consultant.ru/document/cons_doc_LAW_366760/

Fuel and Energy Balances of the Regions of the Russian Federation

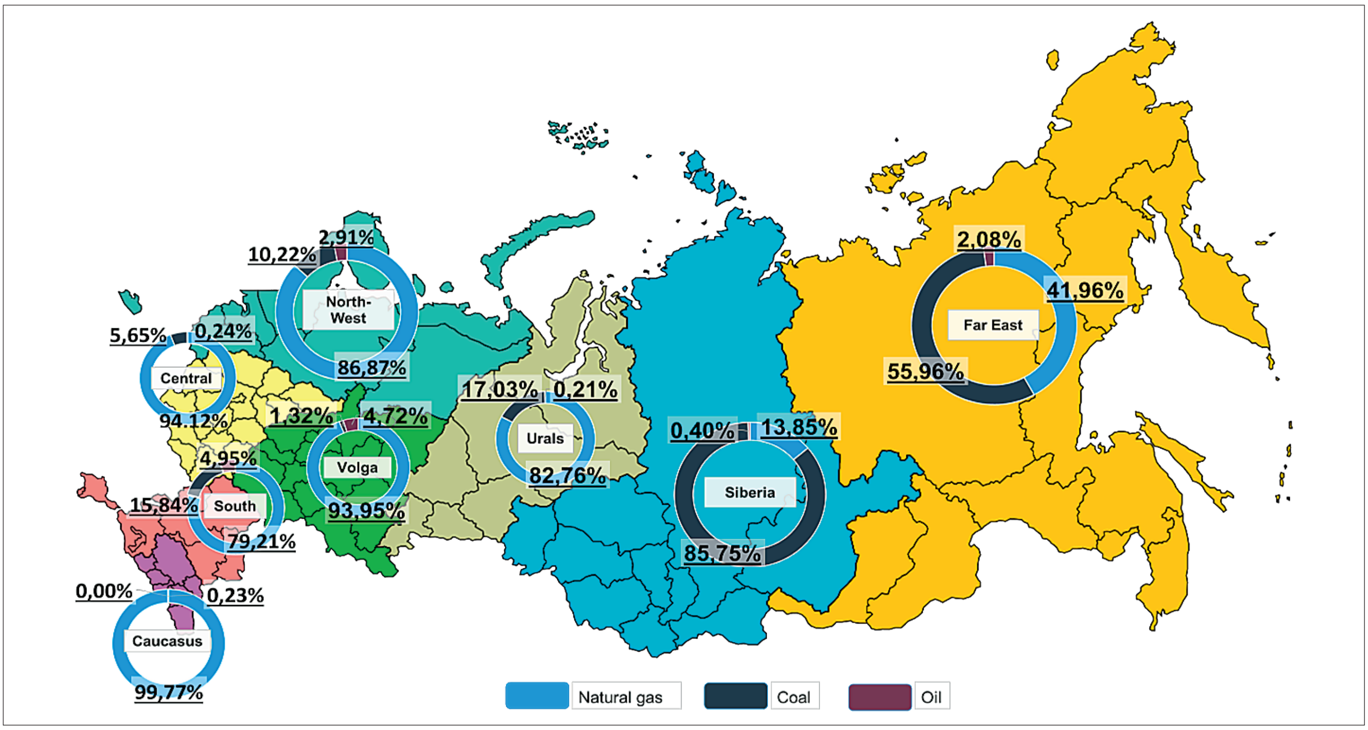

Figure 6. Fuel and energy balances of Russian regions by 3 energy sources at the beginning of 2019, %
Source: prepared on the basis of Rosstat data (EMISS)[14]

CONCLUSION: THE FUTURE OF RUSSIAN COAL

The complexity of forecasting scenarios for the further development of the Russian coal industry is also due to the fact that all its enterprises are concentrated in private hands. While the Russian gas, oil and nuclear markets are represented by large state-owned companies such as Gazprom, Rosneft and Rosatom, there are several coal companies, all of which are left to their own devices and are very sensitive to market conditions and regulatory changes.

In regard to clean coal technologies, at first glance, electric power stations operating on ultra-supercritical steam parameters seem promising, which allows stations to reduce coal consumption from 800 grams to 380 per 1 kWh. The result of such savings is also a reduction in emissions and ash waste, which significantly improves the environmental performance of coal generation. The use of modern electronic filters can further reduce the negative impact of coal burning at thermal power plants, leading to reductions in greenhouse gas emissions up to the level of natural gas-fired thermal power plants. To date, the described technologies are widely used in China and Japan. In Russia, this technology has not been widely used due to its high cost.

The decarbonization of the world economy forms the conditions for the trajectory of further development of the Russian coal industry. In particular, if Europe continues to reduce the volume of coal purchases, then Russia will have an excess supply of this type of fuel for Asia-Pacific countries. This, in turn, may lead to a drop in the price of Russian coal in the long term. There is a risk that eventually coal will be sold at cost, and all profits will be eaten up by the railway operator's tariffs.

As the demand for coal decreases, mining companies may start to face the risk of closing them, and the burden on infrastructure will fall entirely on the shoulders of the state. In the current conditions, representatives of the coal business and the Russian government need to step up their efforts to support the industry, introduce new technologies and create opportunities for redirecting coal export flows from the west to the east. These efforts need to begin immediately. So far, the support of the industry from the state is invisible, and private producers build their future plans solely based on the physical export of the extracted coal.

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[14] *Unified Interdepartmental Information and Statistical System (EMISS). Electricity consumption in the Russian Federation. [online] Available at: https://fedstat.ru*

CAN HYDROGEN SAVE RUSSIA'S ENERGY EXPORTS TO THE EU?

Jon Amilibia Piqué

Abstract

In recent years, hydrogen has been gaining more attention due to several countries' commitment to the global energy transition. The role of hydrogen in the future is yet to be determined; however, it could replace fossil fuels in several areas. As a leading exporter of fossil fuels, declining demand for fossil fuels could put Russia at economic risk. Although hydrogen could be the answer to Russian vulnerability, the current rents coming from fossil fuel exports make Russian leadership complacent. To overcome this stagnation and embrace hydrogen technology, Russia should focus on developing a national hydrogen plan that would allow the country to have a comprehensive approach and readiness towards hydrogen export.

Keywords: exports, hydrogen, natural gas, Russia

Может ли водород спасти российский экспорт энергоносителей в ЕС?

Аннотация: *В последние годы водороду уделяется все больше внимания в связи с приверженностью ряда стран глобальному энергетическому переходу. Роль водорода в будущем еще предстоит определить; однако он может заменить ископаемое топливо в нескольких областях. Снижение спроса может подвергнуть Россию, ведущего экспортера ископаемого топлива, экономическому риску. Водород может стать ответом на уязвимость России, хотя рента, получаемая от экспорта ископаемого топлива, делает российское руководство беззаботным. Чтобы преодолеть эту стагнацию и внедрить водородные технологии, Россия должна сосредоточиться на разработке национального водородного плана, который позволил бы стране иметь комплексный подход и готовность к экспорту водорода.*

Ключевые слова: экспорт, водород, природный газ, Россия

The role of Russia as an energy and resources exporter is unquestionable. Still, times are changing. With more awareness around anthropogenic climate change, fossil fuels are increasingly targeted by the EU as a risk for humanity and the planet. The implications of a transition to a green economy or decarbonisation of different sectors could have devastating consequences for Russia. As previously stated, the Russian economy is highly dependent on energy exports, and "from 2015 to 2017, the oil and natural gas industry in Russia generated up to 40% of federal budget revenues, peaking in 2018 at more than 46%."[1] Excessive reliance on energy rents creates a vulnerability if the primary customer of energy products goes decarbonised. Russia's main exports and sources of revenue could shrink and drive the country to economic stagnation or crisis. Still, there is hope in such a dark future.

In the last several years, there has been a steady push for hydrogen technology. This technology is appealing as it can replace most of the liquid fossil fuels, minimise the impact of greenhouse gas (GHG) emissions and allow a steady continuation of economic activity. Hydrogen technology, although in a very early stage, could amount to a revolution for the Russian energy sector. Several countries have already established their strategies and goals for a transition to the hydrogen economy.[2] These countries, mainly developed and many of them European (for instance, Germany, France, Japan and South Korea), are setting ambitious goals to decarbonise the economy. The problem for Russia is that these European countries planning a transition to hydrogen are currently the leading markets for Russian energy exports.[3]

Yet, Russia does not appear to be paying sufficient attention to the development of hydrogen technology. As Mitrova, Melnikov and Chugunov note, "up until now Russia has, with the exception of a few standalone projects, stood apart from the international communities and partnerships which de-

[1] *Ministry of Finance of the Russian Federation, 2019. Federal Budget of the Russian Federation. [online] Available at: https://minfin.gov.ru/en/statistics/fedbud/ [Accessed 1 December 2020].*

[2] *Hydrogen Council, 2017. How hydrogen empowers the energy transition. [pdf] Available at: https://hydrogencouncil.com/wp-content/uploads/2017/06/Hydrogen-Council-Vision-Document.pdf [Accessed 10 December 2020].*

[3] *Germany, Austria, Czech Republic, Slovakia, Slovenia, Lithuania, Estonia, Latvia, Finland, Poland, Hungary, Bulgaria among others.*

velop hydrogen technologies."[4] Myopia for new technology could lead to severe vulnerability for the Russian state in the future. In this article, I will analyse the steps necessary for Russia to catch up with other "pro-hydrogen" countries, the prospects for Russian hydrogen generation and export and the challenges Moscow could face if Russian leadership decides to develop a strong hydrogen economy.

THE ROLE OF RUSSIAN ENERGY EXPORTS IN THE EUROPEAN MARKET

Russia is one of the biggest energy suppliers in the EU. The relationship between the EU and Russia has been somewhat problematic in the last eight years. Still, energy trade flows have not been altered. This is a clear signal that depicts how relevant Russia is for European energy. Yet, in the last twenty years, many European states and the EU itself have tried to diversify their energy imports in order to limit reliance on Russian natural gas. From Moscow's perspective, Russia has been able to modernise and revitalise the economy thanks to the significant and steady rents of oil and gas exports. Although diversification for Russian gas is a topic on the agenda for Russian leaders,[5] we observe an interdependence between the EU and Russia regarding energy.

In 2019, Russia exported 149,7 bcm[6] of natural gas to the EU, roughly 39%[7] of all-natural gas imports in the EU. The revenues for Russia from these exports represented 110 billion USD.[8] According to Mitrova, Melnikova and Chugunov, "[t]he emerging hydrogen market will likely compete with hydrocarbon markets, where Russia's position now seems unshakable — and in this sense, a strategy of ignoring or even opposing the new technology may seem attractive in the short term".[9] But in the longer term, the picture could radically change. According to the EU's green deal, by 2030 the EU aims to reduce 40% of its GHG emissions, have a 32% of renewables in the primary energy mix and improve the energy efficiency by 32,5%.[10] All these measures would reduce energy imports of the EU by one third. The goals are even more ambitious for the year 2050, by which time, in accordance with the Paris Climate Accord, the EU plans to be a net-zero GHG emitter. All these measures mean that oil and coal in the EU could be phased out by the year 2030[11] and natural gas could be phased out by 2040.[12]

Although these are long term goals, the truth is that a decrease in the relevance of fossil fuels is expected for the European energy mix. This is bad news for Russia, as diversifying energy exports away from Europe could be costly and inefficient. Still, hydrogen could help mitigate the adverse effects of European green transition on Russian rents. Gazprom, the largest gas company in the world, projected last year that "the hydrogen market in the EU is estimated at 153 Billion euros for the year 2050".[13] This means that for the year 2050, Russia could be providing hydrogen instead of natural gas to the European Union. The value of the market in thirty years from now would surpass the current value of the European natural gas market at 110 billion euros.[14]

RUSSIAN POSSIBILITIES FOR HYDROGEN EXPORTS TO EUROPE

The possibilities for hydrogen in Russia are immense. Indeed, Russia, due to particular circumstances elaborated below, could become a production hub for blue[15] and yellow[16] hydrogen.

As we can see from Figure 1, Russia has a relatively low carbon content per kWh of electricity.[17] This is due to the specific mix for electricity generation. Russia relies on natural gas-powered thermal power plants (48%), nuclear power plants (18%), hydroelectric power plants (17%) and coal-fired thermal power plants (16%).[18] This electricity generation mix could prove to be a perfect source of "low" polluting energy sources for the generation of hydrogen. Although the European Union mentions green hydrogen on the 2020–2050 energy strategy,[19] the production of this type of hydrogen could not meet the required demand, as renewable energy sources are still scarce. Therefore, yellow and blue hydrogen could significantly gain relevance in the European market.

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[4] *Mitrova, T., Melnikov, Y. and Chugunov, D., 2019. The Hydrogen Economy — a path towards low carbon development. Moscow: SKOLKOVO Moscow School of Management.*

[5] *See the construction of natural gas pipelines in Russian Far East to China.*

[6] *BP, 2019. Statistical review of world energy 2019. [pdf] Available at: https://www.bp.com/en/global:/corporate/energy-economics/statistical-review-of-world-energy.html [Accessed 30 November 2020].*

[7] *Dickel, R. et al., 2014. Reducing European Dependence on Russian Gas: distinguishing natural Gas from geopolitics. Oxford Institute for Energy Studies, 92, pp. 3–42.*

[8] *International Renewable Energy Agency, 2017. REMAP 2030, Renewable Energy Prospects for the Russian Federation. [pdf] Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Apr/IRENA_REmap_Russia_paper_2017.pdf [Accessed 26 November 2020].*

[9] *Mitrova, T., Melnikov, Y. & Chugunov, D., 2019. The Hydrogen Economy - a path towards low carbon development.*

[10] *European Commission, 2020. Climate Strategies & Targets. [pdf] Available at: https://ec.europa.eu/clima/policies/strategies/2030_en [Accessed 25 November 2020].*

[11] *Caspar, O., 2020. The Climate Crisis - a Russia-EU Cooperation Opportunity. EUREN Brief, 11.*

[12] *Caspar, O., 2020. The Climate Crisis - a Russia-EU Cooperation Opportunity.*

[13] *Shiryaevskaya, A., 2018. Russia looks to Hydrogen as a way to make gas greener for Europe, Bloomberg. [online] Available at: https://www.bloomberg.com/news/articles/2018–11–08/russia-looks-to-hydrogen-as-way-to-make-gas-greener-for-europe [Accessed 1 December 2020].*

[14] *International Sustainable Energy Centre, 2019. [online] Available at: http://www.isedc-u.com/en/press-center/news/3333-russia-looks-to-hydrogen-as-way-to-make-gas-greener-for-europe.html [Accessed 4 December 2020].*

[15] *"Blue hydrogen" refers to hydrogen produced with electrical energy from natural gas.*

[16] *"Yellow hydrogen" refers to hydrogen produced with electrical energy from nuclear power plants.*

[17] *Imperial College London Consultants; E4tech; Drax, 2018. Energy Revolution: a Global Outlook, s.l.: s.n.*

[18] *Mitrova, T., Melnikov, Y. & Chugunov, D., 2019.*

[19] *"Green hydrogen" is hydrogen produced with electrical energy from renewable sources (wind, solar, etc.)*

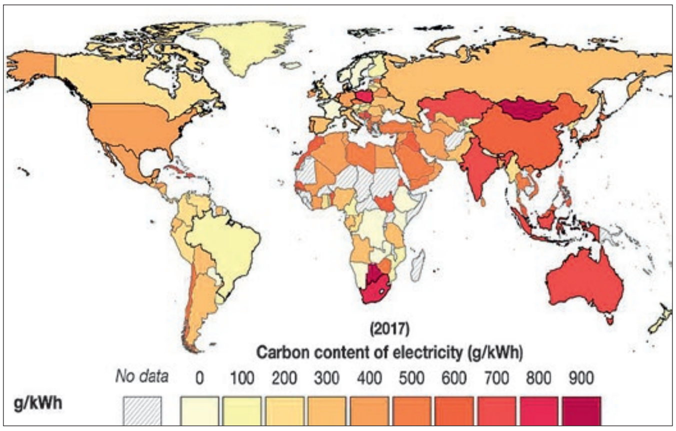

Figure 1. Carbon content of Electricity (g/kWh), 2017
Source: Energy Revolution: a Global Outlook, 2018.[20]

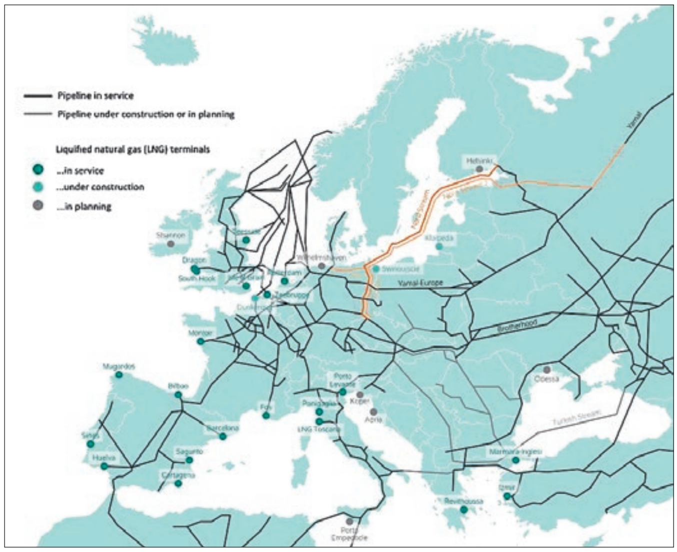

Figure 2. Main European Natural Gas Pipelines & LNG Terminals
Source: Wettengel, 2020.[22]

Another advantage regarding the possible export of hydrogen to the European market is the availability of already constructed infrastructure. As Figure 2 shows, the pipelines crossing Europe were laid decades ago, and others are still being built (see the examples of NordStream 1 & 2). These pipelines could be used for the export of hydrogen from Russia to European countries. The existing infrastructure is a significant incentive for possible Russian hydrogen exports to Europe as relatively few investments would be required to export this gas.

Although existing infrastructure is a significant advantage for Russia and it is already possible to export hydrogen mixed with ammonia,[21] several technical difficulties would have to be addressed. First, the pressure at which hydrogen must be pumped in the pipelines is significantly high, as hydrogen requires higher pressure than natural gas for its transportation. Therefore, the pumping stations must be adapted to the new requirements. Second, both Russia (upstream) and the hydrogen importers (downstream) would be required to invest in storage units. One metric tonne of hydrogen takes seven times the space of one metric tonne of natural gas. Therefore, the existing storage capacity must be increased. This should be addressed primarily downstream as the consumers need to have enough capacity to store the required amounts of hydrogen. As the EU has large LNG regasification capacity, these facilities could also be used for importing hydrogen. However, the liquefaction temperature for hydrogen is significantly lower than for natural gas, which requires more energy, and this process could therefore make liquefied hydrogen not cost-effective for its export.

Apart from the opportunities mentioned above for hydrogen export, Russia has proven to be a relatively stable and reliable natural gas supplier for European countries. Hydrogen could mean a next step in energy relations between the EU and Russia. Still, some steps are necessary before Russia is ready to export hydrogen to Europe.

CHALLENGES FOR HYDROGEN TECHNOLOGY IN RUSSIA

Russia, as a fossil fuel-rich country, has not been very active in the transition to green energy, although this transition by other countries could have profound implications for the Russian economy. The abundance of fossil fuels is likely the reason behind this low interest for decarbonisation of the economy in Russia. Many scholars have analysed the effects of the so-called "resource curse". One of the main results of this curse is that the rents of energy exports create myopia among ruling elites that is difficult to evade. This myopia drives rulers to act with a short-term mindset. Ross, an expert in the field of economics, explains that resource rents make state officials both myopic and risk-averse: upon receiving large windfalls, he suggests, governments grow irrationally optimistic about future revenues and "devote the greater part of their resources to jealously guarding the status quo instead of promoting development".[23] This is a possible answer to why Russia is slow to adopt new technologies such as hydrogen technology and embrace renewables.

For hydrogen to prosper in Russia, three conditions must first be met. These are the three prerequisites that Frontier

[20] *Imperial College London Consultants; E4tech; Drax, 2018. Energy Revolution: a Global Outlook.*

[21] *Editor's Footnote: Using ammonia as a carrier for hydrogen has gained traction in recent years due to the fact ammonia is easier to liquify, and therefore easier to store, than hydrogen.*

[22] *Wettengel, J., 2020. Gas pipeline Nord Stream 2 links Germany to Russia, but splits Europe. Clean Energy Wire, 7 September.*

[23] *Ross, M. L., 1999. The Political Economy of the Resource Curse. World Politics, 51(2), pp. 297–322.*

Economics outlines for the development of the hydrogen industry in any given country.[24]

First, there must be a market for the desired good. If there is no market, there is no incentive to develop a product. As mentioned before, the projections of Gazprom for the hydrogen market in the EU for the year 2050 are of 153 billion euros.[25] Exploiting this market could be extremely beneficial for the Russian economy, especially considering a possible natural gas phase-out in the mid-term.

Second, there should be technological development of the hydrogen industry. Russia should start preparing plans for the possible production of hydrogen. In particular, Russia could start developing pilot projects in hydrogen export. To create an influential industry, Russia could form sectoral clusters or hydrogen clusters in the national market. The creation of clusters could be critical to the future development of the industry and the capabilities for export. Russia should also invest in developing a national hydrogen plan and connecting different research centres in order to attract experts on hydrogen energy. The lack of a hydrogen plan in Russia is one of the most significant obstacles for the development of the technology. According to Mitrova, Melnikov and Chugunov, experts on the Russian energy sector, "in Russia, not only is there no national hydrogen programme, but there is not even any apparent coordination of various research groups and interested parties".[26]

Third, Russia should try to attract international investors to the hydrogen industry. This could bring technological development together with the capital needed to develop the necessary infrastructure (production sites, storage capacity, etc.).

CONCLUSIONS

If the EU continues to pursue its ambitious climatic objectives, the future of Russian energy exports to the EU in the medium term could shift from predominantly exporting fossil fuels to exporting renewable fuels such as hydrogen. The decarbonisation of the economy is becoming a hot topic increasingly relevant in the European Union, and the consequences could be translated to Russia. The possible phase-out of coal, oil and natural gas by the biggest market for Russian energy exports could force Russia to consider exporting hydrogen. Indeed, if the prospects for hydrogen are confirmed, Russia could remain as a leading energy provider of the European Union. Still, there are several issues to face on the Russian side. The abundance of resources could exert a negative effect on the long-term strategy of Russian leadership. Action must be taken, such as the development of a national hydrogen plan. If plans and actions are delayed, Russia could lag behind in a new world and lose a share of its much-needed energy rents.

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[24] *World Energy Council & Frontier Economics, 2018. International Aspects of a Power to X Roadmap, Weltenergierat - Deutschland. International Sustainable Energy Centre, 2019. [online] Available at: http://www.isedc-u.com/en/press-center/news/3333-russia-looks-to-hydrogen-as-way-to-make-gas-greener-for-europe.html [Accessed 4 December 2020].*

[25] *Shiryaevskaya, A., 2018. Russia looks to Hydrogen as a way to make gas greener for Europe.*

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LOW CARBON HYDROGEN FROM FOSSIL FUELS AND GREEN HYDROGEN PRODUCTION IN AUSTRALIA'S ENERGY STRATEGY

Anatolii Nikolaev

Abstract

In outlining Australia's current hydrogen production plans and arguing for the best strategy moving forward based on the goals set by the Australian government, this paper analyses key hydrogen-related documents by the government. The paper highlights two hydrogen production pathways: fossil fuel-derived hydrogen from natural gas and coal with carbon capture and green hydrogen produced with renewable energy. The study finds that in long-term sustainable development scenarios production of hydrogen from renewables in Australia will not be able to supply all of the hydrogen in global export scenarios due to the high projected costs of renewable electricity and the scale of renewable installations required. To accomplish its hydrogen export ambitions, Australia should plan for hydrogen production from fossil fuels in the period until 2040 and, potentially, for a long-term scenario (after 2040).

Keywords: Australia, green hydrogen, hydrogen strategy, low carbon hydrogen, renewables

Чистый водород из ископаемого топлива и производство зеленого водорода в энергетической стратегии Австралии

Аннотация: *В данном документе излагаются текущие планы по производству водорода в Австралии и ведутся споры касательно наилучшей стратегии развития в данной сфере, соответствующей целям, поставленным государством, а также анализируются ключевые документы австралийского правительства, регулирующие производство водорода. В статье выделяются два способа производства водорода: из ископаемого топлива (природного газа и угля с улавливанием углерода), а также зеленый водород, полученный с использованием возобновляемых источников энергии. Исследование показывает, что в долгосрочной перспективе при устойчивом развитии производства водорода, водород из возобновляемых источников энергии не сможет обеспечить весь в потенциальный экспорт водорода из Австралии в связи с высокими прогнозируемыми затратами на производство возобновляемой электроэнергии и масштабами необходимых работ. Чтобы реализовать свои амбиции по экспорту водорода, Австралия должна планировать производство водорода из ископаемых видов топлива в период до 2040 года и, возможно, в более долгосрочной перспективе (после 2040 года).*

Ключевые слова: Австралия, зеленый водород, водородная стратегия, низкоуглеродистый водород, возобновляемые источники энергии

INTRODUCTION

The world is at the start of the energy transition to "green" economies. Australia too has its energy transition plans. Progress in Australia's power sector has been impressive: renewables had a 20% share in electricity generation (up to 40% in some regions) in 2019. The country is the global leader in renewable energy capacity deployment per capita.[1] However, the share in the total energy mix is much lower at merely 6%.[2] Australia has set a target for CO2 emission reduction in the blueprint of the country's energy policy.[3] The goal for Australia's carbon emissions reduction is 26–28% (868–934 MtCO2) below the 2005 level by 2030, which requires certain measures for industry and mining as well as transportation sectors.[4] The country needs other less carbon-intensive technologies to expand its "green" portfolio to lower emissions sources and chief among them is hydrogen. In 2019, Australia drafted its hydrogen plan, titled "Australia's National Hydrogen Strategy" (2019) that describes the

[1] *Stocks, M., Blakers, A. and Baldwin, K., 2019. Australia is the runaway global leader in building new renewable energy, ANU College of Science. [online] Available at: https://science.anu.edu.au/news-events/news/australia-runaway-global-leader-building-new-renewable-energy [Accessed 15 December 2020].*

[2] *DISER, 2020. Australian Energy Update 2020. [pdf] Available at: https://www.energy.gov.au/sites/default/files/Australian%20Energy%20Statistics%202020%20Energy%20Update%20Report_0.pdf [Accessed 15 December 2020].*

[3] *Department of the Environment and Energy, 2019. a fair deal on energy. [pdf] Available at: https://www.energy.gov.au/publications/fair-deal-energy [Accessed 15 December 2020].*

[4] *Department of the Environment and Energy, 2017. Australia's emissions projections 2017. [pdf] Available at: https://www.environment.gov.au/system/files/resources/eb62f30f-3e0f-4bfa-bb7a-c87818160fcf/files/australia-emissions-projections-2017.pdf [Accessed 18 March 2021].*

road to hydrogen economy for the country.[5] The global demand for hydrogen will rise in the next few decades including in key markets for Australian energy exports.[6] With the aim of capturing this future market, Australia also plans to become a major hydrogen export player.

This article analyses several key hydrogen-related documents in Australia including non-government reports and various energy outlooks to provide a consolidated picture of how Australia should deploy hydrogen with regard to its domestic and export context. The article considers both hydrogen from fossil fuels and renewable energy.

HYDROGEN STRATEGY IN AUSTRALIA

The Australian government's National Hydrogen Strategy places emphasis on hydrogen production for gas networks (initially blending hydrogen with natural gas leading to eventual replacement with hydrogen), industries, transportation, heating, and exports. The document builds on the National Hydrogen Roadmap (2018) framework and all states have adopted this strategy.[7] Additionally, there are local regional documents such as the Western Australian Renewable Hydrogen Strategy (2021),[8] South Australia's Hydrogen Action Plan (2019),[9] the Queensland Hydrogen Industrial Strategy 2019–2024 (2019)[10] and the Tasmanian Renewable Hydrogen Action Plan (2020)[11] which consider regional specifics, such as extensive hydropower potential in Tasmania. Other notable hydrogen-related documents are the First Low Emissions Technology Statement (2020) and the Technology Investment Roadmap (2020) by the Department of Industry, Science, Energy and Resources (DISER).

The National Hydrogen Strategy aims to review existing regulation on industrial hydrogen to adapt hydrogen as an energy carrier and adjust energy market planning for hydrogen.[12] According to the document, the actions required to stimulate hydrogen industry growth include promoting development of hydrogen hubs, establishing international supply chains, investments in research of mature and emerging technologies and incentives for hydrogen demand locally. Various state initiatives and financial institutions including Clean Energy Finance Corporation and the Northern Australia Infrastructure Fund can provide financial support for hydrogen development.[13]

The hydrogen production projections presented in the National Hydrogen Strategy are based on a report published by Deloitte titled "Australian and Global Hydrogen Demand Growth Scenario Analysis". The report contains four scenarios: Hydrogen: Energy of the Future (HEF), Hydrogen Targeted Deployment (HTD), Business as Usual, Electric Breakthrough (Table 1). [14] In the HEF scenario, all aspects of industry development are favourable for hydrogen. HTD assumes that countries aim to maximize economic benefits for the deployment of hydrogen. "Business as Usual" means little change from historical patterns in Australia with some changes in the global market allowing for limited hydrogen deployment. Electric breakthrough describes rapid technological advances in electrification, while hydrogen technologies fall behind. In this scenario, electrified technologies outcompete hydrogen technologies, and hydrogen is limited to minor applications. The scenarios place 2050 hydrogen production in Australia in the range of anywhere from 1 to 20 Mt H2 up from 0.5 Mt H2 today.

	Hydrogen Production (Mt H2)		
	2030	2040	2050
Hydrogen: Energy of the Future	1	7	20
Hydrogen Targeted Deployment	< 1	2	8
Business as Usual	< 1	< 1	2
Electric Breakthrough	< 1	< 1	1

Table 1: Australian Hydrogen Production by Scenarios
Source: Deloitte, 2019. Australian and Global Hydrogen Demand Growth Scenario Analysis.

Australia's National Hydrogen Strategy focuses on low-emission hydrogen. While the document considers the use of renewables for hydrogen production, it focuses instead on clean hydrogen in general. Clean hydrogen includes not only green hydrogen from renewables but hydrogen from fossil fuels as well SMR (steam methane reforming, the most common way to produce hydrogen now)[15] and coal gasification, as long as sufficient carbon capture is in place (90% for SMR, 95% for coal gasification).[16]

[5] *COAG Energy Council, 2019. Australia's National Hydrogen Strategy. [pdf] Available at: https://www.industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf [Accessed 15 December 2020].*

[6] *PwC, 2020. Embracing clean hydrogen for Australia. How the journey towards decarbonisation can be fuelled by Hydrogen. [pdf] Available at: https://www.pwc.com.au/infrastructure/embracing-clean-hydrogen-for-australia-270320.pdf [Accessed 15 December 2020].*

[7] *Longden, T., 2020. Analysis of the Australian Hydrogen Strategy. [pdf] Available at: https://www.kas.de/documents/274425/8492225/Analysis+of+the+Australian+Hydrogen+Strategy.pdf/ae45d460-115e-d618-27d4-49959d047d11?version=1.0&t=1597804885621 [Accessed 15 December 2020].*

[8] *Government of Western Australia DJTSI, 2021. Western Australian Renewas ble Hydrogen Strategy. [pdf] Available at: https://www.wa.gov.au/sites/default/files/2021-01/WA_Renewable_Hydrogen_Strategy_2021_Update.pdf [Accessed 18 March 2021].*

[9] *Government of South Australia, 2019. South Australia's Hydrogen Action Plan. [pdf] Available at: http://www.renewablessa.sa.gov.au/content/uploads/2019/09/south-australias-hydrogen-action-plan.pdf [Accessed 18 March 2021].*

[10] *Queensland Government, 2019. Queensland Hydrogen Industrial Strategy 2019–2024. [pdf] Available at: https://www.dsdmip.qld.gov.au/__data/assets/pdf_file/0018/12195/queensland-hydrogen-strategy.pdf [Accessed 18 March 2021].*

[11] *Tasmanian Government DSG, 2020. Tasmanian Renewable Hydrogen Action Plan. [pdf] Available at: https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0003/207705/Draft_Tasmanian_Hydrogen_Action_Plan_-_November_2019.pdf [Accessed 18 March 2021].*

[12] *COAG Energy Council, 2019. Australia's National Hydrogen Strategy.*

[13] *Idem.*

[14] *Deloitte, 2019. Australian and Global Hydrogen Demand Growth Scenario Analysis. [pdf] Available at: https://www2.deloitte.com/content/dam/Deloitte/au/Documents/future-of-cities/deloitte-au-australian-global-hydrogen-demand-growth-scenario-analysis-091219.pdf [Accessed 15 December 2020].*

[15] *IEA, 2020. Energy Technology Perspectives 2020. [pdf] Available at: https://webstore.iea.org/download/direct/4165 [Accessed 15 December 2020].*

[16] *Longden, T., 2020. Analysis of the Australian Hydrogen Strategy.*

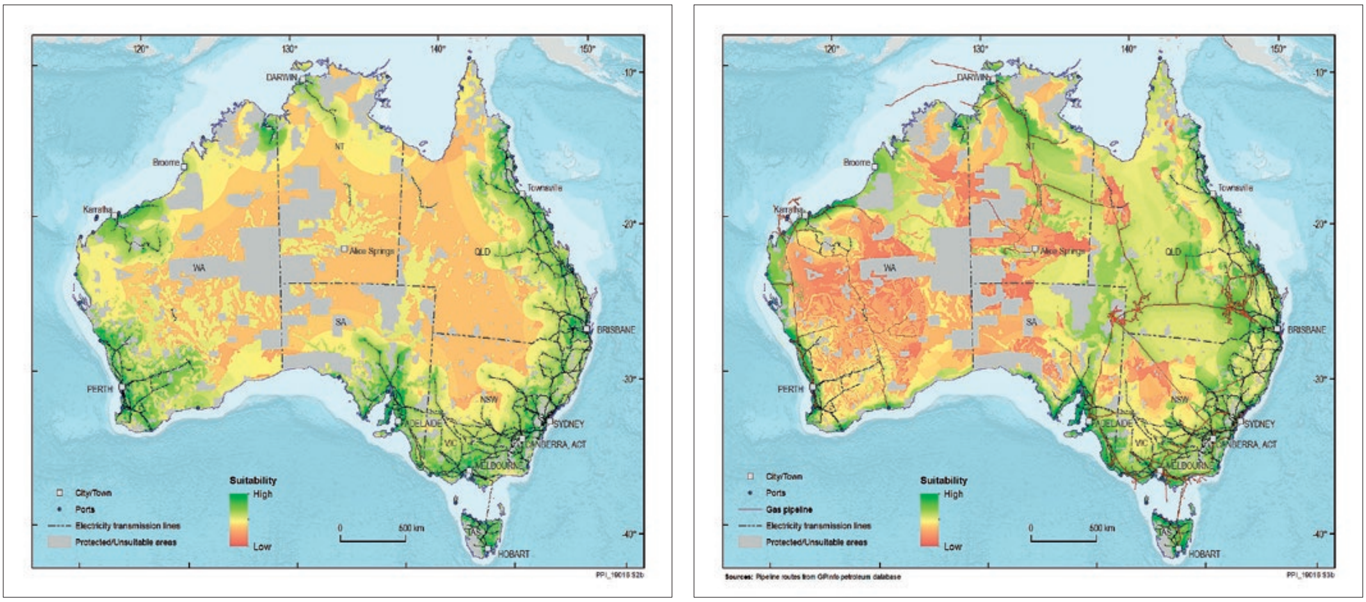

Figure 1. Renewable hydrogen potential with infrastructure (left) and with pipelines (right) in consideration
Source: Feitz, A.J., Tenthorey, E. and Coghlan, R.A., 2019. Prospective hydrogen production regions of Australia

The National Hydrogen Strategy is comprehensive as it considers hydrogen transition from various angles. The question remains whether the country can meet its hydrogen targets, and to address this subject this article will now move to consider the resources and the infrastructure Australia has at its disposal.

HYDROGEN PRODUCTION POTENTIAL

The potential for green hydrogen from renewables in Australia is exceptional. Electrolysis for hydrogen generation requires renewable energy capacities and Australia has suitable sites for onshore wind farms, hydropower plants and vast territories that receive enough sunlight for solar energy.[17] In Figure 1 below, darker shades of green point to higher suitability. Grey areas indicate national parks and otherwise unavailable lands.

According to the Australian Energy Resources Assessment (AERA), by 2019 renewable installation stood at 21.1 GW (14.1 GW without residential PV), including 8 GW of hydropower, 4.9 GW of wind and 310 MW utility solar.[18] By September 2020, solar PV alone had a reported 18.5 GW capacity.[19] The country reached its Renewable Energy Target of 33,000 GWh ahead of the schedule in 2019.[20] These achievements and the global tilt towards clean energy assure a strong future for renewable energy in Australia. The prospect of cheap renewable energy for electrolysis paves the way to widespread green hydrogen production in the future.

Additionally, hydrogen production requires freshwater resources. In the initial stages of hydrogen production development, the increase in water consumption will be marginal. HEF scenario suggests much higher demand. However, this is not a serious problem, as the mining industry in Australia already consumes much more fresh water today than any hydrogen scenario.[21] In addition, desalination of seawater is cheap and only adds a few cents per kg H2 to the hydrogen production cost.[22]

Nevertheless, when infrastructure is taken into account, it becomes apparent that transmission infrastructure can slow down the development of renewable energy, in turn delaying hydrogen deployment (Figure 2).[23] The situation becomes even more drastic for inland hydrogen production if the use of existing pipelines is considered for transportation.

[17] Feitz, A.J., Tenthorey, E. and Coghlan, R.A., 2019. Prospective hydrogen production regions of Australia. [pdf] Available at: https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/130930 [Accessed 15 December 2020].

[18] Geoscience Australia, 2019. Australian Energy Resources Assessment. [pdf] Available at: https://aera.ga.gov.au/ [Accessed 15 December 2020].

[19] APVI, 2020. Australian PV market since April 2001. [online] Available at: https://pv-map.apvi.org.au/analyses [Accessed 15 December 2020].

[20] Clean Energy Council, 2019. Renewable Energy Target. [online] Available at: https://www.cleanenergycouncil.org.au/advocacy-initiatives/renewable-energy-target [Accessed 15 December 2020].

[21] Deloitte, 2019. Australian and Global Hydrogen Demand Growth Scenario Analysis.

[22] COAG Energy Council, 2019.

[23] Feitz, A.J., Tenthorey, E. and Coghlan, R.A., 2019. Prospective hydrogen production regions of Australia.

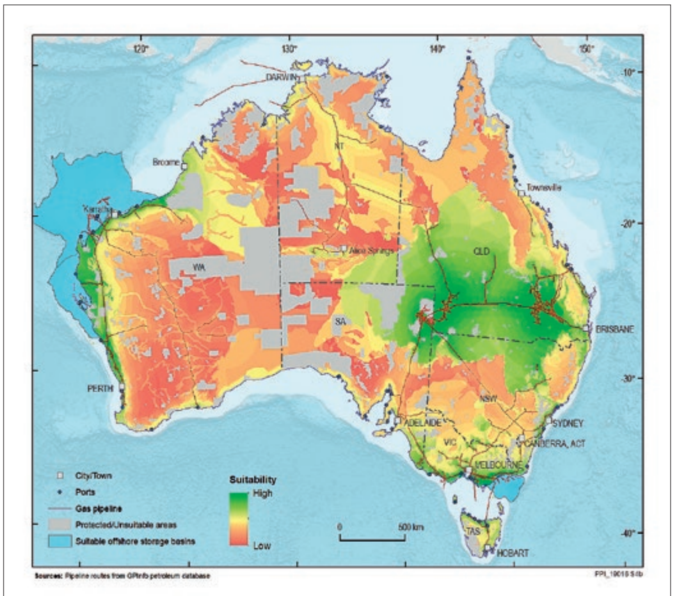

Figure 2. Hydrogen potential of SMR and Coal gasification with CCS
Source: Feitz, A.J., Tenthorey, E., Coghlan, R.A., 2019

Production of hydrogen from fossil fuels requires the use of coal and natural gas as well as advanced CCS (Carbon Capture and Sequestration) facilities. Australia is abundant in both resources and is one of the global leaders in natural gas and coal exports. Experience in these industries and transportation infrastructure provides a nurturing climate for fossil fuel-derived hydrogen production (liquefied natural gas [LNG] experience is applicable to hydrogen liquefaction).

The location of advanced CCS facilities places the limit on hydrogen production which requires the presence of natural resources, coal and gas, subsurface carbon storage, water, and pipeline access (Figure 3).[24] Red areas indicate low suitability.

Australian hydrogen potential is vast for all hydrogen production pathways, but the lack of infrastructure places a limit to this potential, as the figures above show. This is particularly important in light of Australia's plans for hydrogen exports.

HYDROGEN EXPORTS

Australia is a net energy exporter.[25] It is one of the global leaders of coal and LNG exports, focused on the Asian market.[26] This includes shipments of coal to South Korea and Japan who both pledged to achieve carbon-neutrality by 2050 as well as to China (2060 target).[27] Hydrogen is one of the ways to phase out coal in the energy sector of these economies. Australia is well poised to capture this market, given the established trade links between the countries and the production potential Australia has.

One additional issue to address is the international transportation of hydrogen. Australia does not share any land borders with other countries, and its energy export destinations are too far away to construct pipelines (distance further adds to the already high hydrogen costs). The two main ways to handle hydrogen transportation by sea considered in the case of Australia are liquefied hydrogen and transporting hydrogen in ammonia form. The former then goes through a regasification process at the target location, while the ammonia can be burned as a fuel itself. The Australian Government regards ammonia as the favourable way to transport hydrogen.[28] Ammonia has an advantage over liquefied hydrogen since it has a high energy density, and its transportation system is mature, whereas liquefied hydrogen shipment is far from developed. In addition, hydrogen liquefaction requires much lower temperatures than LNG, further raising costs.[29]

Australia's National Hydrogen Strategy sets the ambitious target of becoming one of the top three exporters of hydrogen to Asia by 2030.[30] Current hydrogen exports account for about 1% of global at 0.5 Mt; ammonia is less than 1% at 1 million tons.[31]

To meet that target, the HEF scenario sees 1 Mt H2 produced in 2030, with only 0.5 Mt H2 by electrolysis, leaving 50% to hydrogen from fossil fuels. For the 2050 target of 18 Mt H2 with a 100% share of green hydrogen, the amount of additional electricity from renewable sources required stands at 912 TWh. This translates into roughly 2,337 typical 106MW wind farms or 4,764 typical 78MW solar power plants, above today's capacity. For the HTD scenario, the equivalent is lower at 482 106MW wind farms (10 times more than today's total wind capacity in Australia) or 983 78MW solar power plants.[32] Realistically that means that in the HEF and HTD scenarios export targets will require hydrogen from fossil fuels at least partially. The IEA in its 'Sustainable Development' scenario indicates 40% of fossil-derived hydrogen with CCS in 2070 with a bigger share in earlier years.[33]

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[24] *Idem.*

[25] *Department of the Environment and Energy, 2019. a fair deal on energy.*

[26] *Zaretskaya, V. (2019) Australia is on track to become world's largest LNG exporter, EIA. [online] Available at: https://www.eia.gov/todayinenergy/detail.php?id=40853 [Accessed 15 December 2020].*

[27] *Cunningham, M., Van Uffelen, L. and Chambers, M., 2019. Changing Global Market for Australian Coal, Reserve Bank of Australia. [online] Available at: https://www.rba.gov.au/publications/bulletin/2019/sep/the-changing-global-market-for-australian-coal.html [Accessed 15 December 2020].*

[28] *DISER, 2020. Technology Investment Roadmap: First Low Emissions Technology Statement – 2020. [pdf] Available at: https://www.industry.gov.au/sites/default/files/September%202020/document/first-low-emissions-technology-statement–2020.pdf [Accessed 15 December 2020].*

[29] *CSIRO, 2018. National Hydrogen Roadmap. [pdf] Available at: https://www.csiro.au/en/Do-business/Futures/Reports/Energy-and-Resources/Hydrogen-Roadmap [Accessed 15 December 2020].*

[30] *COAG Energy Council, 2019.*

[31] *Deloitte, 2019. Australian and Global Hydrogen Demand Growth Scenario Analysis.*

[32] *Idem.*

[33] *IEA, 2020. Energy Technology Perspectives 2020. [pdf] Available at: https://webstore.iea.org/download/direct/4165 [Accessed 15 December 2020].*

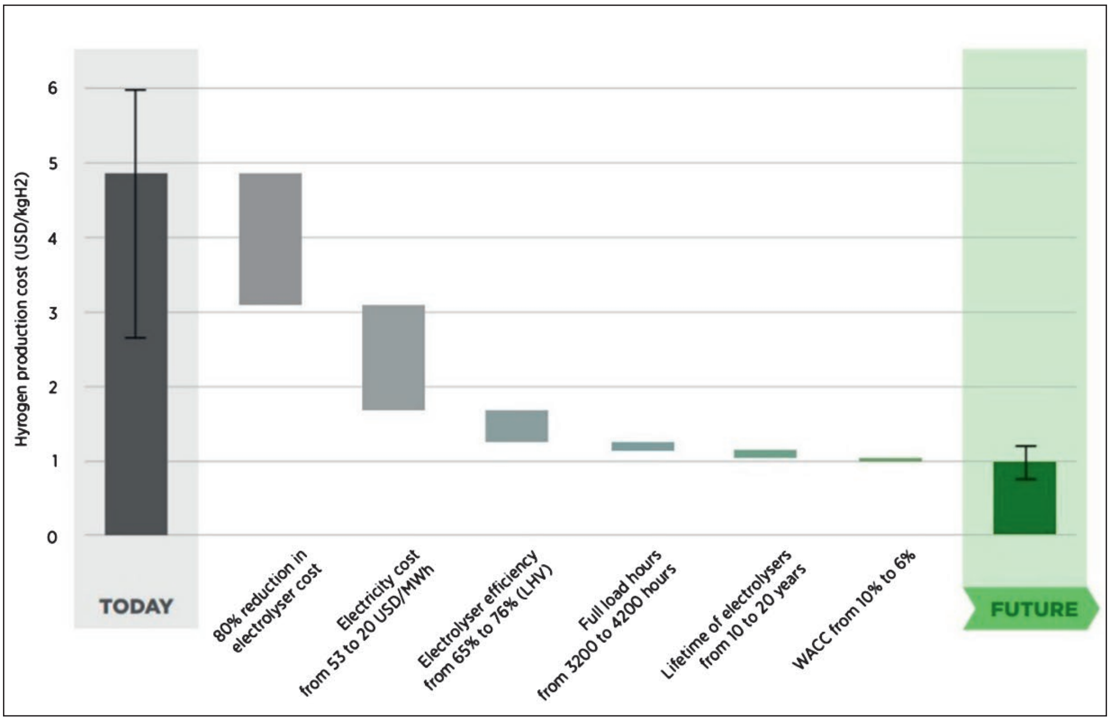

Figure 3. Step changes for achieving green hydrogen competitiveness
Source: IRENA, 2020. Green Hydrogen Cost Reduction

Allocation of emissions is one important point to consider in the case of low emission fossil-derived hydrogen and green hydrogen. The importing country has less incentive to care about hydrogen production emissions: after all, the hydrogen it receives will not pollute at the consumption point regardless of the production technology. Countries with carbon-emission targets will receive equal environmental benefits from imported green hydrogen or hydrogen from fossil fuels. Unless there are measures addressing this issue in place, what will matter most for the countries mentioned above is the cost of the hydrogen.

COST ANALYSIS OF HYDROGEN PRODUCTION

The First Low Emissions Technology Statement by the Australian government specifically mentions the target of low emission hydrogen below 2 AUD (1.5 USD), the price at which hydrogen becomes competitive in many of its applications.[34] Globally, SMR hydrogen costs USD 0.7–1.6 kgH2 or USD 1.2–2.0/kgH2 with CCS. Renewables-based electricity hydrogen (green) costs around USD 3.2–7.7/kgH2[35] The cost-competitiveness of green hydrogen depends on the cost of electricity from renewables.

Capital expenditure (commonly abbreviated as CapEx) takes a lion share in the cost of renewables, and capital cost reduction is the main driver behind the cost of green electricity. The scale up of technology that is relatively simple (such as utility solar) lowers CapEx significantly. If cost of electrolysis decreases, hydrogen production CapEx may reduce significantly. However, even in that scenario, renewable electricity costs impact on hydrogen cost matters as operational expenditure (OpEx) reductions still account for up to 30% of potential hydrogen cost, according to International Renewable Energy Agency.[36] The steps to make hydrogen cost-competitive (Figure 3) taken from the IRENA report mentions a 20 USD/MWh threshold for green hydrogen as a requirement to hit the 1.5 USD/kg target.

Today, some renewable energy contracts in Australia offer under 50 USD/MWh.[37] At the same time, the average utility solar PV (photovoltaics) in Asia has a levelized cost of electricity (LCOE) of 60 USD/MWh and onshore wind around 80 USD/MWh).[38] Even though on average Australia has cheaper on average renewable electricity in the region, the projected figures for 2030–2040 are not low enough: to reduce the cost from 3.2–7.7 USD to below 1.5 USD, more than a two-fold decrease in the cost of renewable electricity is required (considering that electricity takes a lion share of the OpEx for electrolysis). The target of 2 AUD/kg (1.5 USD/kg) would require much lower renewables-based electricity costs.

[34] *DISER, 2020. Technology Investment Roadmap: First Low Emissions Technology Statement – 2020.*

[35] *IEA, 2020. Energy Technology Perspectives 2020.*

[36] *IRENA, 2020. Green Hydrogen Cost Reduction. [pdf] Available at: https://irena.org/-/media/Files/IRENA/Agency/Publication/2020/Dec/IRENA_Green_hydrogen_cost_2020.pdf [Accessed 15 December 2020].*

[37] *Stocks, M., Blakers, A. and Baldwin, K., 2019, Australia is the runaway global leader in building new renewable energy.*

[38] *Wood Mackenzie, 2020. Battle for the future 2020: Asia Pacific power and renewables competitiveness report. [pdf] Available at: https://www.woodmac.com/our-expertise/focus/Power--Renewables/new-research-battle-for-the-future-2020---asia-pacific-power-and-renewables-competitiveness/ [Accessed 15 December 2020].*

Renewable electricity costs have been decreasing in the last decade, and the trend will continue as installations ramp up. According to one report, 2050 LCOE from utility PV will be down to 38 USD/MWh and 66 USD/MWh for onshore wind.[39] Other reports give a more optimistic view of down to 17 AUD/MWh (13 USD/MWh) from solar PV in 2050 with a mean cost projection of 22 USD/MWh in 2050.[40] The same mean cost projection for 2040 is 26 USD/MWh. However, other cost factors, such as electrolysis technology are likely to only partially contribute to hydrogen cost reduction at that point compared to the 2050 level, implying the cost will be still a distance away from the 1.5 USD/kg (Figure 3). The mean cost projection for 2030 is well above required.

Carbon market action is another issue that can slow down hydrogen growth — one important cost variable is the cost of carbon, which makes green hydrogen more cost-competitive eventually. Additionally, the high global demand for hydrogen in the future (and subsequently, higher price) would potentially allow for higher hydrogen costs in the strategy implementation than the 1.5 USD/kg mentioned in the document.

Green hydrogen production is expensive. For example, while the EU Hydrogen Strategy gives priority to renewable hydrogen (with 30–60 times more investment in green hydrogen in 2020–2050 than in fossil fuel hydrogen), this will require as much as 382 billion EUR (455 billion USD) investment for just 10 Mt of green hydrogen a year by 2030. The Oxford Institute for Energy Studies points to unrealistically high electrolysis load assumed by the EU Hydrogen Strategy and to insufficient investments in low carbon hydrogen (3–18 billion in the next 30 years).[41]

While some reports keenly focus on green hydrogen production and even exports of green hydrogen in a 10-year time frame, when the cost of renewables is low enough, Australia's National Hydrogen Strategy describes scaling up hydrogen production using different approaches including low-emission hydrogen from coal and gas. The future cost of hydrogen will be one of the main indicators of progress in Australia's National Hydrogen Strategy implementation.

Early hydrogen production (2030–2040) at the commercial scale can only realistically come from SMR and coal gasification with CCS due to cost-competitiveness, particularly in the case of exports. Further, a large share of hydrogen production in the long-term will have to come from fossil fuels in the event hydrogen gains momentum globally.

CURRENT PROJECTS AND INVESTMENTS

The investments and actual projects are other real indicators of progress. The Australian government committed 500 million USD to hydrogen projects at the release of Australia's National Hydrogen Strategy in 2019. The latest government support package in new energy technologies includes 1.6 billion USD for Australian Renewable Energy Agency (ARENA), 74.5 million USD in Future Fuels Collaborative Research Centre and 70.2 million USD to stimulate local hydrogen export hubs.[42]

Current hydrogen projects include various electrolysis, infrastructure, ammonia and transportation projects, and research labs. Among them, only a few are hydrogen from fossil fuels projects (Figure 4).[43] Asian Renewable Energy Hub (AREH) is one noteworthy project, approved recently, that will become the largest renewable installation in the world with plans to use some of the electricity for hydrogen production.[44]

The development of hydrogen production from fossil fuels in Australia includes HESC (Hydrogen Energy Supply Chain) — a pilot brown coal gasification plant for hydrogen export to Japan in liquefied form; Hazer Group — methane cracking to produce hydrogen and graphite; and Woodside — hydrogen from natural gas for export.

From this point, it is apparent that the current trend is to gather expertise in green hydrogen production and various uses domestically. Hydrogen from fossil fuels projects tend to focus on exports. Investors tend to be more selective during times of uncertainty, so only the most well-developed low-emission projects are likely to receive support.[45] With exports in mind, hydrogen from fossil fuels may get more investment than it receives today once the demand for low carbon fuels (at the point of consumption) rises as China, South Korea and Japan start implementing their short-term goals for carbon-emission pledges.

CONCLUSION

Australia's carbon emissions reduction target requires various green technologies, including hydrogen, and Australia has a robust strategy for hydrogen deployment. Future hydrogen exports look very promising for Australia considering its resources and established trade links with large countries that have set carbon-neutral targets, such as to China, Japan and South Korea.

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[39] *Wood Mackenzie, 2020. Battle for the future 2020: Asia Pacific power and renewables competitiveness report.*

[40] *Longden et al., 2020. Green hydrogen production costs in Australia: implications of renewable energy and electrolyser costs. [pdf] Available at: https://energy.anu.edu.au/files/2020%2009%2001%20-%20ZCEAP%20-%20CCEP%20Working%20Paper%20-%20Green%20hydrogen%20production%20costs.pdf [Accessed 18 March 2020].*

[41] *OIES, 2020. EU Hydrogen Vision: regulatory opportunities and challenges. [pdf] Available at: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/09/Insight–73-EU-Hydrogen-Vision-regulatory-opportunities-and-challenges.pdf [Accessed 18 March 2020].*

[42] *DISER, 2020. Technology Investment Roadmap: First Low Emissions Technology Statement – 2020.*

[43] *Palmer, G., 2018. Australia's Hydrogen Future. [pdf] Melbourne: Energy Transition Hub. Available at: https://www.energy-transition-hub.org/files/resource/attachment/energy_hub_h2_20181214.pdf [Accessed 15 December 2020].*

[44] *Mathews J. et al., 2020. Super-charged: How Australia's biggest renewables project will change the energy game, Eco-Business. [online] Available at: https://www.eco-business.com/opinion/super-charged-how-australias-biggest-renewables-project-will-change-the-energy-game [Accessed 15 December 2020].*

[45] *IEA, 2020. World Energy Investment [pdf]. Available at: https://webstore.iea.org/download/direct/3003 [Accessed 15 December 2020].*

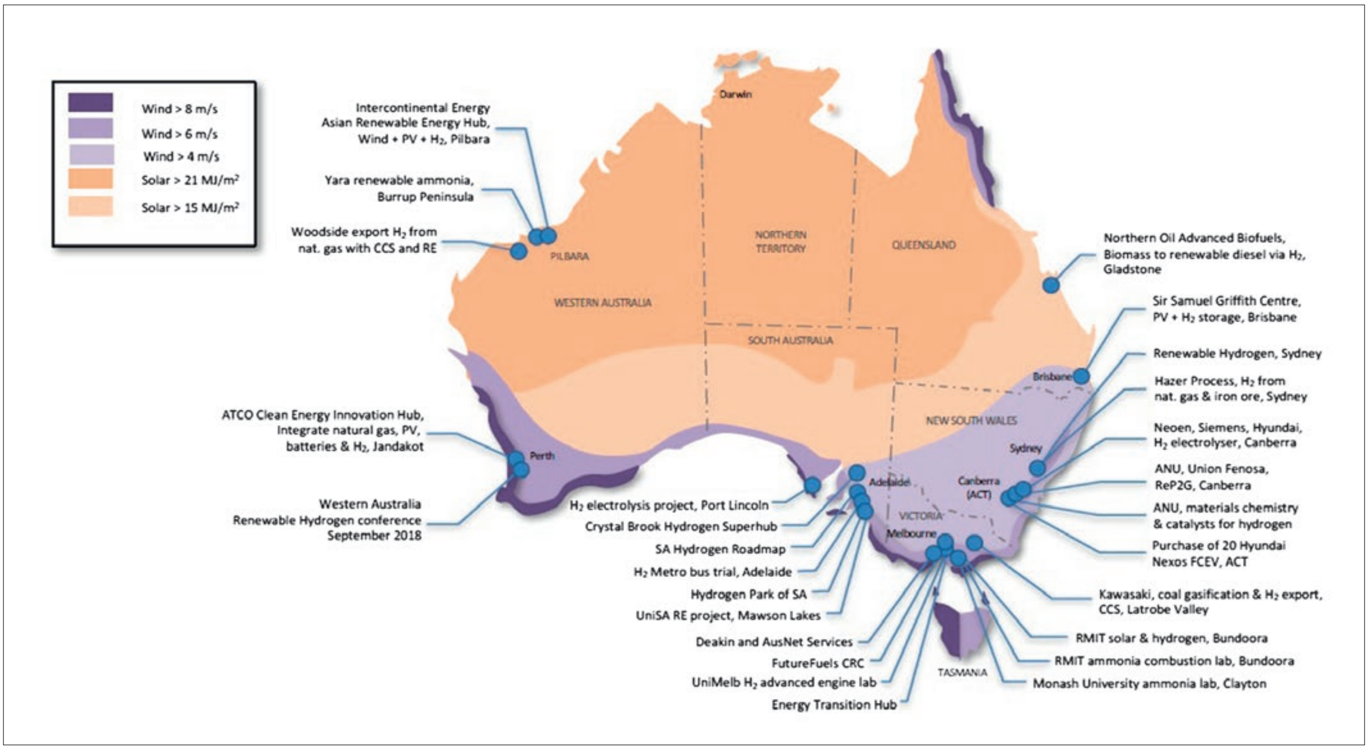

Figure 4. Australian Hydrogen Projects and Initiatives
Source: Palmer, G., 2018. Australia's Hydrogen Future

This paper considered two main hydrogen production pathways in Australia's hydrogen strategy: green hydrogen from renewables and hydrogen from fossil fuels (SMR and coal gasification with CCS). For hydrogen from renewables, the positives include regulatory and investment environment, as well as significant progress in renewable energy deployment — the share of renewables in power generation is significant and Australia has the potential and past experience of increasing that number considerably every year. Weak transmission infrastructure is one serious issue that can slow down the development of renewable energy, in turn delaying green hydrogen production. Additionally, the 2 AUD/kg (1.5 USD/kg) green hydrogen cost target requires much lower renewable energy costs compared to today's. Further, electrolysis of such scale requires extensive renewable capacity. The capacity of renewables that will be needed to meet the country's emission reduction targets in the electricity sector alone is already extremely high. Full commitment to green hydrogen production requires even more renewable capacity on top of this. Whether the country will have such capacities in time depends on future policies, investments, technologies and timely implementation.

Potentially, hydrogen from fossil fuels is the fastest and easiest way to start commercially viable hydrogen production. Production of hydrogen from fossil fuels will be an important initial contribution to the growth of the hydrogen economy and for transportation and infrastructure development in particular. For that purpose, to start the hydrogen revolution early, it matters less whether Australia produces hydrogen from renewables or from fossil fuels. Undoubtedly, hydrogen from fossil fuels with today's costs and effectiveness of CCS will result in increase in Australia's CO2 emissions. However, a developed hydrogen economy will likely have less net carbon emissions even using hydrogen from fossil fuels alone (with CCS). As for exports, importing countries will care more about the costs in the bid to reduce domestic emissions than about overall global emission from the hydrogen they consumed, unless additional carbon measures are introduced. The "Hydrogen as the Fuel of the Future" scenario requires a global interest in hydrogen and investments, including investments from private sector. Additionally, even in this most optimistic scenario, a large share of hydrogen will have to come from steam methane reforming and coal gasification to produce enough hydrogen for Australia's hydrogen export leadership.

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FROM MOSCOW TO BEIJING: HOW CHINA IS REPLACING RUSSIA IN CENTRAL ASIA'S GAS SECTOR

Ethan Woolley

Abstract

While Russia has maintained strong political influence in the Central Asian republics following the USSR's collapse, China has increasingly encroached into Russia's backyard through economic activity. China's appetite for energy has manifested itself in this trend, particularly in the gas sector. Turkmenistan, for example, which has the fourth-largest gas reserves in the world, has gone from primarily exporting its gas to Russia in 2010 to China very nearly being its sole customer by 2018. With much discussion over the nature of Sino-Russian relations, China's encroachment into such a sensitive and critical region on Russia's border must be examined as a potential sore spot in the relationship. This article explores the motivation behind China's interest in increasing its consumption of gas and how, as a result of Chinese involvement in upstream gas exploration, China is replacing Russia as key energy partner in Turkmenistan, Uzbekistan and Kazakhstan.

Keywords: Central Asia, China, gas, Russia

От Москвы до Пекина: Как Китай заменяет Россию на газовом рынке Центральной Азии

Аннотация: *В то время как Россия сохранила сильное политическое влияние в республиках Центральной Азии после распада СССР, Китай все чаще вторгается на задний двор России посредством экономики. Прослеживается тенденция увеличения заинтересованности Китая энергоносителями, особенно природным газом. Например, Туркменистан, обладающий четвертым по величине запасом газа в мире, перешел от экспорта своего газа в Россию в 2010 году к тому, что в 2018 году Китай стал практически единственным импортером туркменского газа. При обсуждении характера китайско-российских отношений вторжение Китая в такой чувствительный и важный регион на границе с Россией должно рассматриваться как потенциальное уязвимое место в отношениях двух стран. В этой статье исследуется мотивация, лежащая в основе китайской заинтересованности в увеличении потребления газа, а также, как в результате участия Китая в разведке газовых месторождений Китай постепенно заменяет Россию в качестве ключевого энергетического партнера Туркменистана, Узбекистана и Казахстана.*

Ключевые слова: Центральная Азия, Китай, газ, Россия

INTRODUCTION: PLACING CENTRAL ASIA IN CONTEXT

In the last ten years, a debate has persisted in think tanks, foreign ministries, and academia surrounding the trajectory of the Sino-Russian relationship. Is the relationship heading towards a formal alliance, or is it condemned to remain a partnership of convenience? The answer is not clear; in the span of three months, articles with contradictory headlines like "China and Russia don't need a military alliance, says Moscow's ambassador" and "Putin: Russia-China military alliance can't be ruled out" were published by The South China Morning Post and The Associated Press, respectively.[1] The lopsided nature of the relationship is noteworthy. In 2018, total bilateral trade reached $100 billion; China represented 15.5% of Russia's trade portfolio, while Russia was only 0.8% of China's trade.[2]

This question over the nature of the Sino-Russian relationship is important — a combination of Russian energy and weapons technology with the size of China's economy and population would have significant consequences on the geopolitical balance of the world. This article will focus on one specific topic in one region: growing Chinese involvement in Central Asia's gas sector. Central Asia has been a key part of Russia's national security strategy since the Russian Empire's conquest of the region in the 19th century. Keeping the region's countries securely in Russia's orbit protects Russia's southern flank and, as a result, its European core. Any loss of influence, whether it be political, economic,

[1] *Zhou, L., 2020. China and Russia don't need a military alliance, says Moscow's ambassador, South China Morning Post. [online] Available at: https://www.scmp.com/news/china/diplomacy/article/3115737/china-and-russia-dont-need-military-alliance-says-moscows; Isachenkov, V., 2020. Putin: Russia-China military alliance can't be ruled out, Associated Press [online] Available at: https://apnews.com/article/beijing-moscow-foreign-policy-russia-vladimir-putin-1d4b112d2fe8cb66192c5225f4d614c4*

[2] *Hillman, J., 2020. China and Russia: Economic Unequals. Center for Strategic and International Studies. [online] Available at: https://www.csis.org/analysis/china-and-russia-economic-unequals*

military or cultural, could impact the region's historical role as a buffer between Russia and the outside world. The goal of this article is not to argue that a second "Great Game", like the 19th century competition between Imperial Russia and Great Britain, is afoot between modern-day Russia and China. Rather, its intent is to document an important shift in one of the region's most important assets—energy—from Moscow to Beijing.

THE ROLE OF GAS IN CHINESE ENERGY CONSUMPTION

For the last 30 years, Chinese energy demand has been a dominant theme in world energy markets. China became a net energy importer in the late 1990s, the world's largest energy consumer in 2009 and the world's largest crude oil importer in 2017.[3] In addition, China is second only to Japan in terms of liquified natural gas (LNG) imports.[4] Chinese energy demand has consistently outstripped domestic production in every category, fostering extraordinary import dependence; in 2019, 44% of Chinese gas[5] and 69% of Chinese oil consumption came from imports.[6]

Despite China's massive imports of oil and gas, coal remains the single largest energy source for the world's second-largest economy. In 2019, coal accounted for 57% of Chinese primary energy consumption and 65% of electricity generation. While coal is a strategic asset for China (in 2019 China consumed 81.67 exajoules of coal and produced 79.82, making its import dependency relatively low), there are costs. Coal is significantly more pollutive than oil or gas, and Chinese President Xi Jinping has publicly stated that his goal is to move away from coal and towards natural gas[7], both to meet China's international climate change pledges as well as respond to domestic concerns over air pollution.

Unfortunately for the Chinese government's goals, domestic gas production has been disappointing. In brief, 50% of China's shale wells, which are located in the Sichuan Basin, are over 3,500 km deep and thus too expensive to extract; ConocoPhillips exited Chinese shale development in 2015 and Royal Dutch Shell stopped development in Sichuan in 2016.[8] BP, the final international oil company still operating in the Chinese shale sector, exited in 2019.[9] In the Fuling gas field, producers needed a subsidy of $1.59/MMBtu to break even in 2014, and as recently as 2019–20, shale production only received a $0.79/MMBtu subsidy from the Chinese government.[10] Synthetic natural gas (SNG) has fared just as poorly, since all projects (which are expensive) are located in Xinjiang or Inner Mongolia, the provinces with the lowest gas prices. The 12th Five-Year Plan called for 15–18 bcm/year of SNG capacity by 2015 and 60 bcm/year by 2020; however, by 2015 only 3.1 bcm had been built and the 13th Five-Year Plan revised the 2020 target to 17 bcm.[11] Thus, in 2019, out of the 305 bcm of gas China consumed, only 178 bcm of gas could be supplied domestically from its various projects; the rest come from a combination of LNG and pipeline imports.[12] China's appetite for natural gas has led it to turn to Central Asia as its primary source for pipeline gas. While Central Asia has historically been in the Russian sphere of influence, Chinese energy companies have assumed significant roles in the Central Asian energy sector, particularly in the upstream activities in gas-rich Turkmenistan.

In 2019, natural gas only accounted for 7.8% of Chinese primary energy consumption. As part of the government's climate change and pollution strategy, President Xi has set a goal of doubling this figure to 15% and has pledged that China's emissions will peak by 2030 and that the country will be carbon-neutral by 2060.[13] Given that domestic production simply cannot achieve this target, let alone meet current demand, foreign imports are required. In 2019, China imported 84.4 bcm of LNG and 47.7 bcm of pipeline gas.[14] From a purely economic perspective, increasing LNG and pipeline imports is the natural decision; however, strategic concerns must be taken into consideration. With the exception of Russia, China does not share a physical border with any of its LNG partners. In times of war, seaborne imports of any kind are vulnerable to disruption. China does not even necessarily have to be involved in a conflict—13.4% of China's LNG comes from Qatar and has to pass through the Strait of Hormuz. Furthermore, in the event of a conflict involving China and the United States, it should be noted that 47% of China's LNG comes from Australia, a staunch American ally and member of the Five Eyes intelligence group. Securing supplies that can be maintained and defended in the event of war or international disruption are critical, and pipeline supplies are key to achieving this end.[15]

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3 *EIA, 2018. China Surpassed the United States as the World's Largest Crude Oil Importer in 2017. [online] Available at: https://www.eia.gov/todayinenergy/detail.php?id=34812*

4 *Jaganathan, J., 2018. China Overtakes Japan as World's Top Natural Gas Importt er, Reuters. [online] Available at: https://www.reuters.com/article/china-japan-lng/china-overtakes-japan-as-worlds-top-natural-gas-importer-idUSL4N1XN3LO*

5 *This figure includes both pipeline gas and LNG.*

6 *EIA, 2020. Country Analysis Executive Summary: China. [online] Available at: https://www.eia.gov/international/content/analysis/countries_long/China/china.pdf*

7 *Raimondi, P.P., 2019. Central Asia Oil and Gas Industry – The External Power' Energy Interests in Kazakhstan, Turkmenistan, and Uzbekistan. Fondanzione Eni Enrico Mattei [online] Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3386053*

8 *Wang, Y., and Zhen Z., 2018. Cost of Natural Gas in Eastern Chinese Markets: Implications for LNG Imports. IAEE Energy Forum. [online] Available at: https://www.iaee.org/en/publications/newsletterdl.aspx?id=747*

9 *Oil & Gas Journal, 2019. BP Reported Exiting Chinese Shale Gas PSCs. [online] Available at: https://www.ogj.com/exploration-development/reserves/article/17279159/bp-reported-exiting-chinese-shale-gas-pscs.*

10 *Wang, Y., and Zhu, Z. 2018. Cost of Natural Gas in Eastern Chinese Markets: Implications for LNG Imports.*

11 *Columbia University. Guide to Chinese Climate Policy: Synthetic Natural Gas. SIPA Center on Global Energy Policy. [online] Available at: https://chineseclimatee policy.energypolicy.columbia.edu/en/domestic-policies-0*

12 *EIA, 2020. Country Analysis Executive Summary: China.*

13 *Meidan, M., 2020. China's Energy Policies in the Wake of COVID–19: Implications for the next Five Year Plan. The Oxford Institute for Energy Studies. [online] Available at: https://www.oxfordenergy.org/publications/chinas-energy-policy-in-the-wake-of-covid–19-implications-for-the-next-five-year-plan/*

14 *BP, 2020. BP Statistical Review of World Energy 2019. Available at: http://www.bp.com/statisticalreview*

15 *Or securing LNG sources that are less susceptible to disruption. This would explain why Chinese buyers took a 20% stake in Novatek's 27 bcm/year Arctic LNG project.*

Chinese Gas Infrastructure

Figure 1
Source: Financial Times, 2016

China completed the first phase of its primary domestic gas pipeline system, the West-East pipeline, in 2005, providing 17 bcm/year in capacity. The Second West-East pipeline was completed in 2012 and has an annual capacity of 30 bcm. The Third West-East pipeline was completed in 2016 and also has capacity of 30 bcm/year, bringing the network's total capacity to 77 bcm/year. This pipeline system connected gas producing regions in the west to China's consumers on the coast.

In 2010, the Central Asia-China pipeline system was completed. This pipeline, which connects to the West-East network, allows China to import gas from Turkmenistan, Uzbekistan and Kazakhstan. The Central Asia-China pipeline is comprised of three lines—Lines A, B and C—which have a combined capacity of 55 bcm/year. Lines A and B were completed in 2010 and have a capacity of 30 bcm/year, while Line C was completed in 2014 and brought the total capacity to 55 bcm/year.[16] The Central Asia-China pipeline connects to the Second and Third West-East pipelines, with Lines A and B connecting to the Second pipeline and Line C connecting to the Third.

China's gas pipeline network extends beyond Central Asia: a pipeline with Myanmar brought 3–4 bcm/year to southern China in 2019, and in December 2019, the Power of Siberia pipeline with Russia was officially commissioned, with an eventual target capacity of 38 bcm/year.[17] However, in its first year, the Power of Siberia pipeline only transported 3.84 bcm.[18] Nonetheless, the Central Asia-China network remains the single largest source of China's pipeline imports, and that is before the eventual completion of Line D, which will add 30 bcm/year in capacity.[19] Expanding capacity with all three of China's sources of pipeline imports (Russia, Myanmar, and Central Asia) is critical if Beijing is to have even a hope of reaching its goal of doubling the share of natural gas in its primary energy consumption without vastly increasing its LNG imports.

THE ENERGY BALANCE OF CENTRAL ASIA

As a whole, Central Asia plays a far greater role in global gas production than it does in oil; 11.7% of the world's gas reserves are located in the region compared to just 1.8% of world oil reserves.[20] Nearly all of the region's gas resources are located in Turkmenistan, which has a staggering 19.5 trillion cubic meters (tcm)—almost 10% of global supply, making it the fourth most gas-rich country in the world.[21] Kazakhstan and Uzbekistan, on the other hand, have 2.7 and 1.2 tcm, respectively.

Turkmenistan's capacity as an exporter is also strengthened by its small population of just 5.9 million people, which allows it to export a far higher percentage of its overall production when compared to its neighbors. Uzbekistan has a population of 33.5 million and thus consumes nearly all of its production (43.4bcm out of a total production of 56.3 bcm in 2019). Turkmenistan, on the other hand, produced 63.2 bcm in 2019 and only consumed 31.5 bcm, leaving more than half available for export. Kazakhstan is in a position similar to Uzbekistan, producing 23.4 bcm in 2019 and consuming 17.9 bcm.[22]

TURKMENISTAN

Turkmenistan is by far the most gas-rich of the three energy-producing Central Asian countries. In the last ten years, Turkmenistan is also the country which experienced the most rapid turn from Russia to China; in 2011, one year after the Central Asia-China pipeline was completed, China became the number one destination for Turkmen gas exports. China's overall imports from Turkmenistan rose sharply from 3.5 bcm in 2010 to 24.1 bcm in 2014. Meanwhile, all exports to Russia ceased in 2016 (they had previously been roughly 11 bcm/year from 2010 to 2014).[23] In 2017, Turkmenistan

[16] *Pirani, S., 2019. Central Asian Gas: Prospects for the 2020s. The Oxford Institute of Energy [online] Available at: https://www.oxfordenergy.org/publications/central-asian-gas-prospects-for-the-2020s/*

[17] *Gazprom, 2020. Power of Siberia: Facts and Figures. [online] Available at: https://www.gazprom.com/projects/power-ofsiberia/*

[18] *Gazprom, 2020. Power of Siberia's First Year: Reliable Operation, Increased Supplies, above-Target Amounts. [online] Available at: https://www.gazprom.com/press/news/2020/december/article519895/#:~:text=At%20present%2C%20Gazprom%20keeps%20ramping,China%20via%20Power%20of%20Siberia.&text=In%20the%20year%20since%20the,the%20gas%20exports%20in%202021*

[19] *Rather than follow the same route of Lines A, B, and C, Line D is planned to transport gas from Uzbekistan through Kyrgyzstan and Tajikistan.*

[20] *BP, 2020. BP Statistical Review of World Energy 2019.*

[21] *BP, 2020*

[22] *Idem.*

[23] *Elliot, S., 2019. Gazprom agrees to resume gas imports from Turkmenistan, S&P Global Platts [online] Available at: https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/041619-russias-gazprom-agrees-to-resume-gas-imports-from-turkmenistan*

Turkmen Gas Production vs. Consumption, bcm, 1985–2019

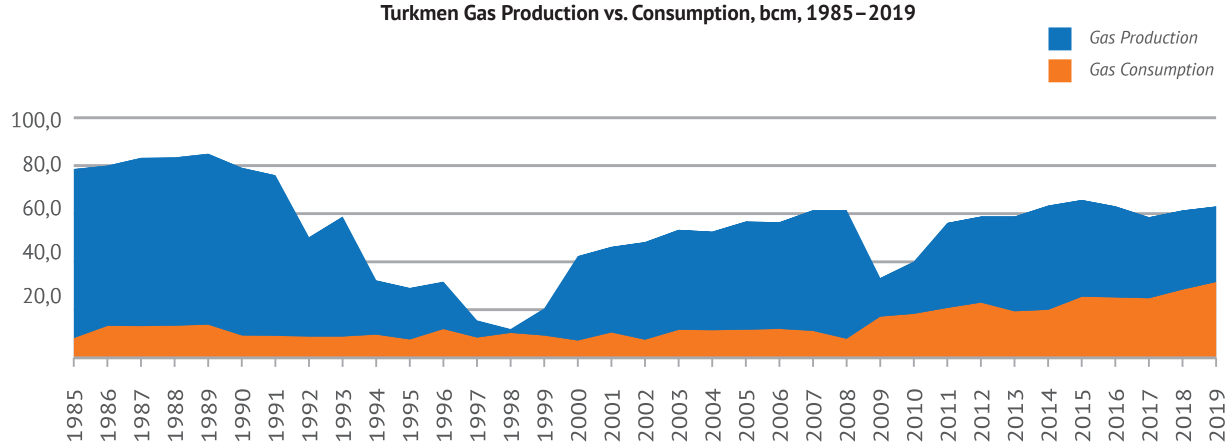

Figure 2
Source: BP, 2020

suspended its exports to Iran over a payment dispute.[24] One year later, Turkmenistan exported a total of 37 bcm of gas—34.5 bcm went to China. According to a production sharing agreement (PSA) signed in 2007, Turkmenistan will export at least 30 bcm to China each year for 30 years.[25]

China has taken a particularly active role in upstream development in Turkmenistan. The Galkynysh field, located in south-eastern Turkmenistan, is the second-largest gas field in the world. The first phase of development was completed in 2013 by Chuanqing Drilling Engineering Company, a subsidiary of the China National Petroleum Corporation, or CNPC. Initial production capacity was 10 bcm/year and began in 2014. According to the Turkmen government, production capacity at Galkynysh has reached 30 bcm/year, although the government believes that further development could increase this to 95 bcm/year.[26] CNPC also has a 35-year PSA which covers the right bank of the Amu Darya river and extends to the border with Uzbekistan, which is known as the Bagtyarlyk field. In 2009, CNPC's subsidiary, PetroChina, purchased the rights to the PSA for $1.1 billion. The field in question is estimated to have roughly 1.3 tcm. The field's output plateaued in 2013 at 13 bcm/year, all of which is destined for China through the Central Asia-China pipeline.[27]

CNPC is not the only foreign firm engaged in hydrocarbon exploration and production in Turkmenistan; Petronas of Malaysia produces oil and gas offshore in Block 1 in the Cas-

Turkmen Gas Exports by Destination, bcm, 2010

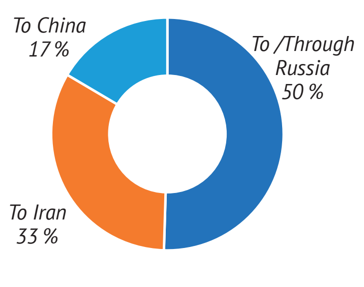

Figure 3
Source: BP, 2020

Turkmen Gas Exports by Destination, bcm, 2014

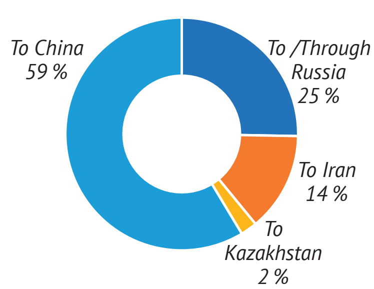

Figure 4
Source: BP, 2020

Turkmen Gas Exports by Destination, bcm, 2018

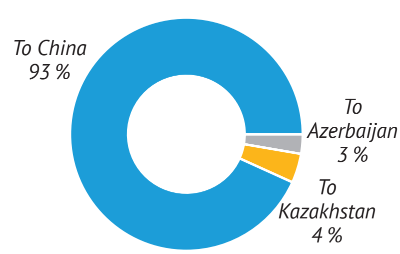

Figure 5
Source: BP, 2020

[24] *Reuters, 2017. Turkmenistan halts gas exports to Iran over payment row, Tehran says. [online] Available at: https://www.reuters.com/article/us-iran-turkmenistan-gas/turkmenistan-halts-gas-exports-to-iran-over-payment-row-tehran-says-idUSKBN14L1AC*

[25] *Pirani, S., 2019. Central Asian Gas: Prospects for the 2020s.*

[26] *Idem.*

[27] *Idem.*

pian Sea, having produced a cumulative 18 bcm between 2011 and 2019. In fact, Petronas became the first non-Turkmen producer to actually sell gas to Turkmengaz.[28] In addition to Petronas, foreign firms from the United Kingdom, South Korea and the UAE are also active in Turkmen gas production. However, what is most striking is the relative absence of Russia.

In 2003, Russia and Turkmenistan signed a 25-year Cooperation Agreement in which Gazprom would purchase Turkmen gas through the Soviet-era Central Asia-Center pipeline. After Turkmenistan blamed Gazprom for an April 2009 pipeline explosion near the Turkmen-Uzbek border, Gazprom suspended all imports from Turkmenistan indefinitely. After all, gas demand in both Europe and Russia was in decline at the time. After eight months of negotiations Gazprom resumed imports, now based on a fluctuating European price formula rather than a fixed contract. Prior to the explosion, Gazprom was importing 50 bcm/year but only agreed to import a maximum of 30 bcm/year under the new agreement. In April 2010, Gazprom announced it would only import 10.5 bcm that year, citing low demand.[29]

The timing of the explosion and Gazprom's decision to reign back Turkmen imports is important; just as Gazprom was engaged in price negotiations to end its moratorium on Turkmen gas, China completed construction on Lines A and B of the Central Asia-China pipeline system. From 2010 to 2014, when Line C was completed, the balance of Turkmen gas exports had shifted dramatically. In 2010, 50% went to Russia and only 17% to China; in 2014, 59% went to China and only 25% to Russia.[30]

Exports to Russia stopped entirely in 2016 as a result of a price dispute with Gazprom and only recently resumed, with Turkmenistan agreeing in mid–2019 to sell 1.1 bcm to Gazprom[31]—10% of the volumes exported to Russia in the early–2010s. Gazprom has traditionally been absent in the Turkmen upstream, preferring instead to take custody of the gas at the border. Historically, Turkmenistan has acted as Russia's swing producer, supplying gas to meet demand in Europe when Russia's own domestic supplies were unable.[32] While 1.1 bcm is a rather modest volume given historical precedent, it likely represents an effort on behalf of Turkmenistan to diversify, if only a little bit, away from China, upon whom it has become entirely reliant for nearly all gas exports.

UZBEKISTAN

The situation is quite different in Uzbekistan. As discussed earlier, Uzbekistan's population is significantly larger than that of Turkmenistan. As a result, Uzbekistan consumes roughly 75% of the gas it produces. So, even though Uzbekistan only produced 7 bcm less than Turkmenistan in 2019, its total exports that year were 13 bcm, roughly one-third those of its southern neighbor. Of those exports, a little less than half (6.5 bcm) went to China, while 3.8 bcm went to Russia.[33] Like in Turkmenistan, Russia's share of the Uzbek export portfolio has decreased over the last decade; in 2011, it imported 8 bcm. However, that same year, China did not import Uzbek gas at all. In Uzbekistan, Chinese imports have not completely taken the place of Russia's.

Overall output and domestic consumption are not the only differentiating factors between Uzbekistan and Turkmenistan. Importantly, Russian firms are still a dominant force in Uzbek production. In 2018, Lukoil was the largest foreign company operating in Uzbek upstream and was responsible for a quarter of all gas output that year. Lukoil has two PSAs and has invested heavily in Uzbek upstream: it built a 4.4 bcm/year gas treatment facility at the Gissar complex

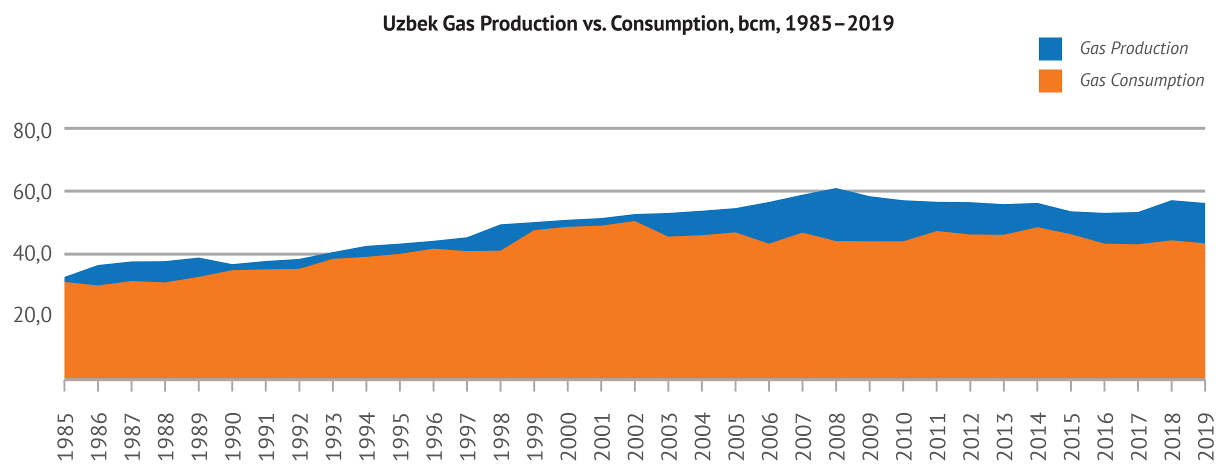

Figure 6
Source: BP, 2020

[28] *Idem.*
[29] *Crude Accountability, 2012. Gazprom [online] Available at: https://crudeaccountability.org/campaigns/turkmenistan/whos-who-in-turkmenistan-petroleum-company-dossiers/gazprom/*
[30] *BP, 2020.*
[31] *Konarzewska, N., 2019. Russia Resumes Natural Gas Imports from Turkmenistan, New Eastern Europe. [online] Available at: https://neweasterneurope.eu/2019/05/31/russia-resumes-natural-gas-imports-from-turkmenistan/*
[32] *Reuters, 2017. Turkmenistan halts gas exports to Iran over payment row, Tehran says.*
[33] *Pirani, Simon, 2019.*

Uzbek Gas Exports by Destination, bcm, 2010

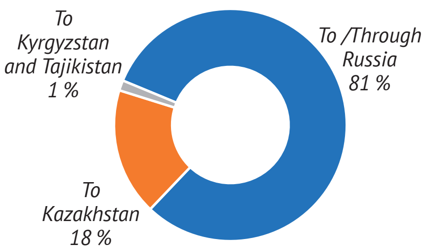

Figure 7
Source: BP, 2020

Uzbek Gas Exports by Destination, bcm, 2014

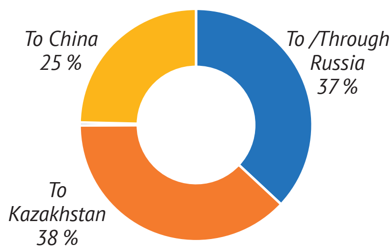

Figure 8
Source: BP, 2020

Uzbek Gas Exports by Destination, bcm, 2018

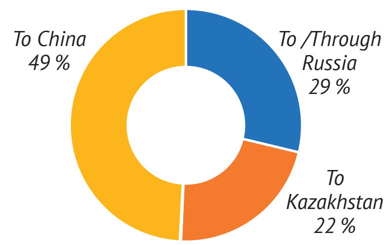

Figure 9
Source: BP, 2020

and launched the second phase of an 8 bcm/year processing complex at Kandym, the two fields in which Lukoil has PSAs.

In 2019, Uzbek output was responsible for over 80% of Lukoil's total gas production outside of Russia, and Uzbekistan is home to 46% of the firm's proved reserves. According to Lukoil's 2019 annual report, "[i]n 2019, gas production increased by 4.5% year-on-year to 35.0 billion cubic meters, driven by the development of our projects in Uzbekistan".[34] Importantly, Lukoil has invested in Uzbek upstream in an effort to better serve Asian consumers; so even though Russian companies occupy a dominant position in the country, the actual gas being produced is still mostly destined for China. Despite Lukoil's primacy in the Uzbek gas sector, it is not alone. Gazprom entered Uzbekistan in 2004 and holds a PSA in the Shakhpakhty field, among other smaller holdings. Gazprom's fields supply the Central Asia-Center pipeline, a Soviet-era pipeline that connects to Russia's own gas network. Gazprom produces its own gas in Uzbekistan in addition to buying gas from Uzbekneftegaz.

While Uzbekistan has a significant Russian presence, Chinese firms are active as well. The China National Oil Development Corporation, a subsidiary of CNPC, discovered three gas fields in Bukhara; drilling began in 2017 under a license held by a CNPC-Uzbekneftegaz joint venture. Despite China's dominant position in Uzbekistan's export portfolio, Chinese companies are actually responsible for very little of Uzbekistan's output. In 2017, Uzbekneftegaz was responsible for 81% of the country's gas production, Lukoil was responsible for 15%, and the rest was produced by Gazprom and the other producers, such as BP and Epsilon Development Company from the United States.[35]

KAZAKHSTAN

Like Uzbekistan, Kazakhstan's population consumes a significant portion of its gas output; in 2019, the country produced 23.4 bcm and consumed 17.9 bcm. Unlike its peers, however, Kazakhstan is both an importer and an exporter. Kazakhstan imported 5.1 bcm from Russia and 1.8 bcm from Uzbekistan in 2019 while exporting 6.5 bcm to China and 20.5 bcm to Russia.[36] In 2018, Kaztransgaz signed a contract

Kazakh Gas Production vs. Consumption, bcm, 1985–2019

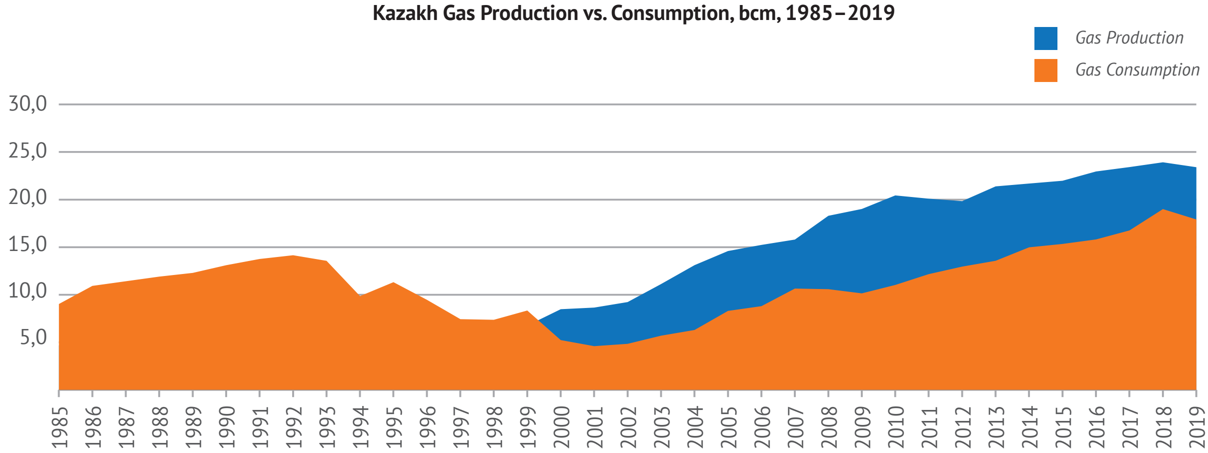

Figure 10
Source: BP, 2020

[34] *Lukoil, 2020. 2019 Annual Report. [pdf] Available at: https://www.lukoil.com/FileSystem/9/469462.pdf*

[35] *Pirani, S., 2019.*

[36] *BP, 2020.*

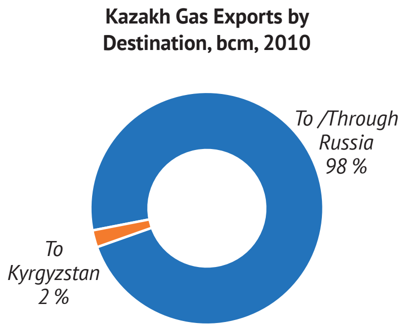

Figure 11
Source: BP, 2020

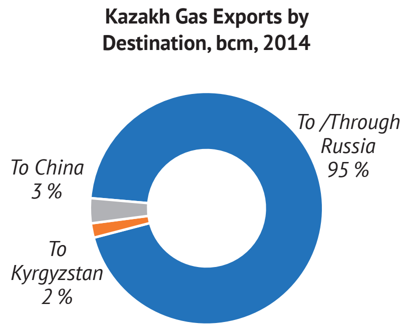

Figure 12
Source: BP, 2020

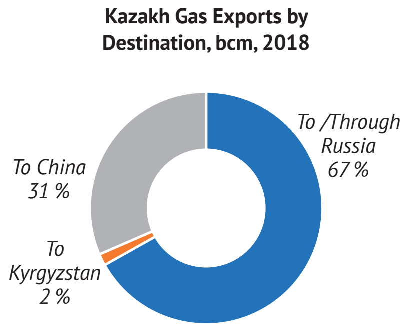

Figure 13
Source: BP, 2020

with PetroChina International in which it is obligated to provide 10 bcm/year from 2019–2023. Kazakhstan's gas production is centered around three fields—Kashagan, Tengiz, and Karachaganak—which were collectively responsible for 76% of production in 2018. The Tengiz field, for example, has produced 25.5 billion barrels of oil since 1993. The TengizChevroil Company, which owns and operates the field, is owned by Chevron (50%), ExxonMobil (25%), Kazmunaigaz (20%), and Lukarco (5%), a subsidiary of Lukoil.

Similarly, the Karachaganak giant field, one of the world's largest gas fields, is operated by Karachanagak Petroleum Operating (KPO), a joint venture between Eni (29.25%), Royal Dutch Shell (29.25%), Chevron (18%), Lukoil (13%), and Kazmunaigaz (10%). a forty-year Final Production Sharing Agreement was signed in 1997, and in 2017 the field produced 26 million cubic meters of gas per day.[37] The third giant field, the Kashagan offshore field, is one of the largest oil fields in the world. The North Caspian Operating Company, which will last until 2041, is comprised of Kazmunaigaz, Eni, ExxonMobil, Royal Dutch Shell, and Total (16.88% each), along with CNPC (8.33%) and Inpex (7.56%). While these consortia produce a combination of oil and gas, one thing is clear: Kazakhstan is open to foreign investment and as such enjoys the presence of Russian, Chinese, American, and European firms. Kazakh gas exports are expected to decrease significantly in the next few years, with exports to China forecasted to peak in 2023. Interestingly, while exports to China increased sharply from 2017–2018 (from 1.1 bcm to 5.8 bcm), overall exports to Russia remained relatively steady during the 2010s. Of all Kazakh gas exports in 2018, 67% went to Russia and 31% went to China.

THE FUTURE OF CENTRAL ASIAN GAS IN CHINA

Kazakhstan, Uzbekistan and Turkmenistan represent one of the most valuable strategic energy assets within China's reach, a position which will almost guarantee that their share of China's gas import portfolio will continue to grow. Turkmenistan alone provides roughly 10% of China's natural gas, and the region as a whole provides between 15% and 18%. With the addition of the recently commissioned Power of Siberia pipeline, which is intended to eventually bring 38 bcm of Russian natural gas to China each year, and the potential future construction of Power of Siberia 2 (+50 bcm/year)[38] and Line D of the Central Asia-China pipeline (+30 bcm/year), China could potentially escape its dependence on LNG imports if gas consumption does not increase beyond 8% of current overall primary energy consumption (305 bcm in 2019).[39] However, Beijing has explicitly stated its intention of doubling its gas consumption in an effort to combat pollution and fulfil the country's climate change pledges; pipeline gas alone could not achieve this goal, meaning that LNG would continue to play a key role in China's energy mix. The Chinese government is aware of this; at the moment, China's LNG import capacity is 70 million tons per annum (Mtpa); an additional 140 Mtpa are planned for 2023. However, notable progress has only been made on 40 Mtpa of the planned buildout.[40] In times of peace, this situation may not necessarily be intolerable, and oftentimes LNG is actually price competitive with pipeline gas along the coasts.[41]

[37] *Raimondi, P.P., 2019.*

[38] *Galtsova, A. and Huang, T., 2020. New' Gas from Russia to China via Power of Siberia–2 Pipeline: New Route and New Strategic Opportunities, IHS Markit. [online] Available at: https://ihsmarkit.com/research-analysis/new-gas-from-russia-to-china-via-power-of-siberia-2-pipeline.html*

[39] *BP, 2016.*

[40] *Meidan, M., 2020. China Day 2020 Summary: Geopolitical Shifts and China's Energy Policy Priorities. The Oxford Institute for Energy Studies. [pdf] Available at: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/03/Geopolitical-shifts-and-Chinas-energy-policy-priorities.pdf?v=79cba1185463*

[41] *Wang, Y. and Zhu, Z., 2018.*

If China is serious about replacing coal with gas in its primary energy mix, LNG imports will suffice. However, it would be ill-advised to develop a dependence upon those imports without either sufficient pipeline capacity to maintain that level of consumption or maintaining the capacity to switch back to coal in the event of supply disruption. In this scenario, Chinese reliance upon Central Asian imports would rise, and Beijing may feel the need to take measures to ensure the security of those supplies, such as developing "early warning and defence mechanisms" in the region, possibly through security partnerships or an increased intelligence presence.[42] Considering Central Asia's historical position in the Russian sphere of interest, this could create tension between the two countries and should be handled carefully.

CONCLUSION

Since the completion of the Central Asia-China pipeline in 2010, a clear trend has emerged in Central Asia's gas sector: Turkmenistan has completely shifted away from Russia and is now almost entirely reliant upon China, its largest consumer by far. Turkmenistan has also been subject to the highest level of involvement by Chinese firms in upstream activity of the three countries. Uzbek gas exports to China overtook those to Russia in 2018. Unlike in Turkmenistan, Russian firms remain dominant in Uzbek exploration and production, although Chinese firms like CNPC are gaining a foothold. Kazakhstan has the most diversified international presence in its energy sector, although the country's primary useful resource from Beijing's perspective is oil. While Kazakhstan does export significant amounts of gas to China, Russia is still Kazakhstan's primary export market (including gas exported to other countries through Russia). In short, Turkmenistan has turned towards China completely, Uzbekistan's export portfolio has turned to China although it retains a robust presence of Russian firms, and Kazakhstan's primary export market is still Russia, although China's share of Kazakh exports is rising fast.

Given that Turkmenistan supplies roughly 10% of China's gas — partly as a result of Turkmenistan's disputes with Gazprom in 2009–10 and 2016–19 — any attempt by Russia to reassert itself into Turkmenistan's export portfolio could threaten one of China's most significant overland gas sources. And while China has not come to dominate the gas markets in Uzbekistan and Kazakhstan, it will eventually face a dilemma: prioritize achieving its emissions targets, which would entail doubling natural gas' share of the Chinese energy mix in part by increasing imports from Central Asia, or prioritize its relationship with Russia, which could be jeopardized if Beijing crowded Moscow out and deprived it of marginal producers for meeting European demand.

[42] *Bin, H., 2014. Oil and Gas Cooperation between China and Central Asia in an Environment of Political and Resource Competition. Petroleum Science 11, pp. 596–605.*

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POLITICISATION OF DEPENDENCY HEDGING IN CHINA'S NATURAL GAS IMPORTS

Tristan Kenderdine

Abstract

China has institutionalised a state political hedging strategy on natural gas imports. By building out new infrastructure, reorganising domestic institutions and diversifying import channels between ocean-borne LNG and Central Asian and Russian pipeline gas, China has established a series of geoeconomic hedges. This paper examines China's state-market Eurasian gas and LNG access policy. It examines China's domestic pipeline infrastructure and import channels as well as the development of the new PipeChina state-owned enterprise and the prospects for developing new price-setting institutions. The paper then looks at the institutional architecture of Central Asia's gas exports, arguing that lack of proactive domestic political development means that the Central Asian exporters of Turkmenistan, Uzbekistan and Kazakhstan have only replaced one political dependency in Russia for a new dependency in China. The paper looks at China's hedging policies in the Russian Arctic and the Power of Siberia and at the prospects for strategic import policies to be implemented on LNG and piped gas, with particular regard to the Eurasian states. We find that China's import demands and institutional hedging strategies for gas imports are advanced but limited by unsophisticated institutionalisation of foreign, trade and industry policy, whereas the Central Asian exporters are institutionally limited by underdeveloped economic governance regimes.

Keywords: Belt and Road, China, energy policy, geoeconomic policy, geoindustrial policy, Kazakhstan, liquefied natural gas, natural gas, pipeline infrastructure, Russia, Turkmenistan, Uzbekistan

Политизация вопросов хеджирования зависимости от импорта природного газа в Китае

Аннотация: *Китай институционализировал государственную стратегию хеджирования импорта природного газа. Создавая новую инфраструктуру, реорганизуя внутренние институты и диверсифицируя каналы импорта между СПГ, центральноазиатским и российским трубопроводным газом, Китай создал систему геоэкономических гарантий. В данной статье рассматривается государственная политика Китая в области доступа на евразийский рынок газа и СПГ. В нем рассматривается внутренняя трубопроводная инфраструктура Китая и каналы импорта, а также развитие нового государственного предприятия PipeChina и перспективы новых ценообразующих институтов. Далее в статье рассматривается институциональная схема экспорта газа из Центральной Азии и утверждается, что в связи с отсутствием активного внутриполитического развития центральноазиатские экспортеры: Туркменистан, Узбекистан и Казахстан сменили политическую зависимость от России в пользу Китая. В статье рассматривается политика Китая при хеджировании газа из Российской Арктики и трубопровода «Сила Сибири» а также перспективы реализации стратегии импорта СПГ и трубопроводного газа из государств Евразии. Можно утверждать, что потребности Китая в импорте и институциональные стратегии хеджирования импорта газа достаточно развиты, однако ограничены в связи с институционализацией внешней, торговой и промышленной политики, в то время как центральноазиатские экспортеры институционально ограничены недостаточно развитыми режимами экономического управления.*

Ключевые слова: «Один пояс — один путь», Китай, энергетическая политика, геоэкономическая политика, геоиндустриальная политика, Казахстан, сжиженный природный газ, природный газ, трубопроводная инфраструктура, Россия, Туркменистан, Узбекистан

PIPELINE TIANXIA – CHINA'S INSTITUTIONALISATION OF HEDGING POLICY

China's energy mix has expanded to include more natural gas and liquefied natural gas (LNG). Combined piped gas and ship-borne LNG currently comprise around 8 percent of China's energy mix, half of which is imported. Import sources are roughly evenly split three ways between (1) the Central Asia Gas Pipeline (CAGP) crossing from Kazakhstan carrying mostly Turkmenistan gas, (2) the Russian Power of Siberia pipeline gas and (3) ship-borne LNG, with China having a long-term stake in Russia's Arctic Yamal LNG project. China's geoeconomic policy around natural gas imports has clear potential for politicisation, with impacts on both the supply countries and for other regional importing countries such as Japan. China has previously politicised the sell-side of strategic commodities, notably banning rare earth exports to Japan[1] and has consistently politicised the buy-side of Australian iron ore under the China Iron and Steel Association cartelisation scheme.[2] Creating new buy-side dependencies in LNG and piped gas creates new forms of institutional power through which to exercise foreign policy via strategic price-setting and import volume control.

This paper explores the political economy and geoeconomic space between China's engagement with the global marketised LNG trade, the potential for closed-market LNG trade between Russia and China in the Arctic, and China's dual political hedge of land-based pipeline gas from both Central Asia and Russia. Ultimately, the paper argues that LNG is a proxy commodity for understanding the possible future institutional form of a China parallel strategic commodity import regime, dominated by geoeconomic political hedging rather than market fundamentals. This inversely impacts the market states operating in the global economy due to the gravity of the institutional negative space led by an alternate China import system as well as a series of institutional inversions where acute conflicts may arise where the dual trade systems disharmoniously converge.

CHINA'S DOMESTIC STATE-MARKET GAS INFRASTRUCTURE

International gas trade is measured in billion cubic meters, or bcm. China's 2019 natural gas consumption was 307.3 bcm,[3] with demand projected to almost double to 550 bcm by 2030.[4] Domestic production was around 170 bcm in 2019,[5] leaving around a 140 bcm reliance on imports in 2020 and market space for up to 380 bcm of imports by 2030. 133 bcm was imported in 2018, so this growth is on a smooth upward curve with China importing natural gas both from pipelines and from LNG with around 75 bcm in LNG imports in 2018, that is, roughly half of all imports come from ocean-borne LNG and half from overland pipes.[6] China's state gas policy is to diversify dependencies on all energy sources and also to provide an alternative to coal-burning in urban winter heating plans.[7] The technology of LNG was developed in the late 19th and early 20th centuries.[8] But a viable global trade in ocean-borne LNG tankers only really developed since the 1950s and has experienced a renaissance since the United States shale gas boom in the 21st century.[9] In recent decades, the technologies of liquefaction, ocean transit and regasification have been deployed at greater scale. While natural gas in European consumer markets is mostly used for heating and residential use, LNG, particularly in Japan and increasingly in China, is used for electricity generation. The global LNG supply market is diversified with large exporters such as Qatar, Australia, United States, Russia, Malaysia, Indonesia and Malaysia as well as a range of smaller Middle East and African exporters. However, Russia's Arctic-LNG Project creates the possibility of China importers and Russian exporters creating a closed trade model running parallel to the global competitively and open-priced ocean-borne LNG system. This is effectively the state contract pricing regime of an overland gas pipe applied to a commodity which should be fungible in international LNG markets. Arctic LNG Project I is a joint venture between China National Petroleum Corporation (CNPC, the listed arm of state-owned PetroChina), Total and Novatek.[10] Phase II will go into production soon. Arctic LNG (20 percent owned by CNPC and 9.9 percent Silk Road Fund)[11] has a current annual operating capacity of 24 bcm,[12] but the second project is planned with the future Novatek Arctic LNG development plans based on fields with 380 bcm and 1,800 bcm (total stock, not annual flow).[13] For perspective, Qatar, the world's largest LNG exporter, exported 104.8 bcm in 2018.[14]

Natural gas pipeline imports into China come mostly from Central Asia and more recently Russia, with a marginal pipeline from Myanmar.[15] The Power of Siberia pipeline from Russia has capacity for 38 bcm annually with gas distributed to nine north-eastern China provinces. The Central Asia Gas Pipeline has been operational in some form since 2009 with three lines A, B and C and a planned fourth line D. The combined gas pipeline network of Turkmenistan, Uzbekistan, and

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1 King, A. and Armstrong, S. 2013. Did China really ban rare earth metals exports to Japan? East Asia Forum. [online] Available at: https://www.eastasiaforum.org/2013/08/18/did-china-really-ban-rare-earth-metals-exports-to-japan/

2 Cai, P.Y., 2009. The China 'spygate' affair and China's steel industry chaos, East Asia Forum. [online] Available at: https://www.eastasiaforum.org/2009/07/19/the-china-spygate-affair-and-chinas-steel-industry-chaos/

3 BP, 2020. Statistical Review of World Energy. [pdf] Available at: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/downloads.html

4 Clemente, J., 2019. China Soaring Past Japan In Liquefied Natural Gas Imports, Forbes. [online] Available at: https://www.forbes.com/sites/judeclemente/2019/11/01/china-soaring-past-japan-in-liquefied-natural-gas-imports/?sh=54f14a57626b

5 Xu, M.Y. and Singh, S., 2019. UPDATE 1 - China's 2020 gas consumption to reach 320 bcm - CNPC research, Reuters. [online] Available at: https://www.reuters.com/article/china-gas/update-1-chinas-2020-gas-consumption-to-reach-320-bcmbcm-cnpc-research-idUSL4N28M1VG

6 Xu, M.Y. and Singh, S., 2019. UPDATE 1 - China's 2020 gas consumption to reach 320 bcm - CNPC research.

7 Clemente, J., 2019. China Soaring Past Japan In Liquefied Natural Gas Imports.

8 Chen, H.C., 2008. History of the Development of LNG Technology. American Institute of Chemical Engineers Annual Conference Proceedings. [online] Available at: https://folk.ntnu.no/skoge/prost/proceedings/aiche-2008/data/papers/P139095.pdf

9 Grigas, A., 2017. The New Geopolitics of Natural Gas. Cambridge, MA: Harvard University Press.

10 In Chinese, the projects are referred to as 北极LNG (Beiji LNG) but in Russian as Ямал СПГ (Yamal LNG). In English, Yamal LNG or Arctic LNG were interchangeable for Phase 1, but Phase II seems to be universally referred to as Arctic LNG 2.

11 Xinhua, 2018. Yamal LNG project reaches full production capacity. [online] Available at: http://www.xinhuanet.com/english/2018-12/12/c_137666821.htm

12 For reference, 1 billion cubic meters of natural gas equals 0.73 million metric tons of LNG, and 1 million metric tons LNG equals 1.38 billion cubic meters of natural gas.

13 Staalesen, A., 2016. Novatek presents plans for new Arctic LNG, Barents Observer. [online] Available at: https://thebarentsobserver.com/ru/node/507

14 Statista, 2019. Major liquefied natural gas exporting countries in 2019 (in billion cubic meters). [online] Available at: https://www.statista.com/statistics/274528/major-exporting-countries-of-lng/

15 Liu, D., Yamaguchi, K., and Yoshikawa, H., 2017. Understanding the motivations behind the Myanmar-China energy pipeline: Multiple streams and energy politics in China. Energy Policy, 107, pp. 403–412.

Kazakhstan has a total capacity of 55 bcm per year.[16] While the total operational capacity at the cross-border Khorgos gas pipeline metering station is 55bcm, the regional make-up and actual throughput vary.[17] In 2018, Turkmenistan gas exports to China were 33.2 bcm, Uzbekistan 10 bcm and Kazakhstan 7.1 bcm.[18] In 2019, only a combined 47.9 bcm was imported.[19] First fiscal quarter numbers for China in 2020 were down slightly on 2019 — 10.1 bcm imported in the first three months of 2020 through the CAGP compared with 11.5 the previous year.[20] This is against 2020 first quarter China domestic production of 47.8 bcm and total domestic consumption of 78.5 bcm.[21] Second quarter imports were around the same, with total 2020 first half imports reaching 19.88 bcm.[22]

China's domestic hydrocarbon energy production mix comprises serious capacity in both oil and gas domestic production, including a new gas field discovered by PetroChina in Xinjiang in 2020.[23] This will add to PetroChina's Changqing, Tarim, Sichuan and Qinghai gas fields which already produce over 100 bcm of natural gas per year.[24] PetroChina Western Pipeline Corporation originally operated the CAGP hub at the Khorgos Compressor Station as the China-side beginning of the domestic West-East pipeline. However, China's gas imports are increasingly coordinated by a single entity, PipeChina. Established in 2019, PipeChina has begun to absorb China's gas infrastructure from the three existing upstream oil and gas state-owned enterprises (SOEs) with the ostensible goal of marketising the midstream to promote market competition for downstream SOEs, local governments and private enterprises to lease capacity.[25] PipeChina now owns and operates the domestic pipeline infrastructure connecting to the CAGP, Power of Siberia and the Shwe pipeline from Myanmar. Currently, the Myanmar pipeline only imports about half its capacity, the gas from which is of poor quality, while the increase in the Central Asian pipeline capacity is dependent on the completion of Line D of the CAGP from Turkmenistan, which has no firm construction commitments.[26] China's natural gas import regime is thus hedged between domestic production, overland pipeline imports and ocean-borne LNG imports. This diversified market structure though is coming under increasing monopolisation on the import side by PipeChina.

DEVELOPMENT OF THE PIPECHINA MONOPOLY

The major institutional development in China's gas import strategy has been a domestic reorganisation of the midstream SOE distribution operation. National Petroleum and Natural Gas Network Group Co., Ltd (国家石油天然气管网集团有限公司), known as PipeChina (国家管网) was established on 9 December 2019 to assume the monopoly functions of China's oil and gas pipeline infrastructure.[27] As well as the backbone trunk infrastructure for distributing the Central Asian Gas Pipeline and the Power of Siberia pipeline, PipeChina has already taken over the majority of China's LNG regasification terminals, with three additional large regasification terminal projects to come under its control upon completion. When Shandong's Longkou Nanshan LNG facility comes online, PipeChina will control 35.6 bcm of coastal regasification facilities, more than three times the combined capacity of remaining LNG terminals. [28] How China's domestic pipeline and LNG infrastructure is institutionally organised will be increasingly significant to global market participants. Moreover, the price-setting mechanisms that China state buyers will use to determine China's imports will shape the global price of gas, both piped and LNG.[29]

PipeChina's policy is prescribed to develop a national domestic pipeline network of 163,000 km from the current 64,000.[30] This is a mandate to massively expand and consolidate the national integrated pipeline and LNG terminal network from the existing holdings of the national oil companies. The new pipeline infrastructure SOE breaks into the previous monopolies of PetroChina (China National Petroleum Corporation, CNPC as the listed entity), Sinopec (China Petroleum & Chemical Corporation) and CNOOC (China National Offshore Oil Corporation) to create a new monopoly

[16] *S&P Platts, 2020. Central Asian countries discussing shared cut in gas supplies to China: Uzbekneftegaz. [online] Available at: https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/050520-central-asian-countries-discussing-shared-cut-in-gas-supplies-to-china-uzbekneftegaz*

[17] *Shaban, I., 2020. Central Asian countries discussing shared cut in gas supplies to China, Caspian Barrel. [online] Available at: http://caspianbarrel.org/en/2020/05/central-asian-countries-discussing-shared-cut-in-gas-supplies-to-china/*

[18] *Bhutia, S., 2019. Is new Russia-China gas pipeline a threat to Turkmenistan? Eurasianet. [online] Available at: https://eurasianet.org/is-new-russia-china-gas-pipeline-a-threat-to-turkmenistan*

[19] *Xinhua, 2020. Central Asia natural gas pipeline transported more than 47.9 billion cubic meters of gas to China in 2019. [online] Available at: http://www.xinhuanet.com/2020-01/06/c_1125427050.htm*

[20] *CNPC, 2020. Central Asia Natural Gas Pipeline transported more than 10 billion cubic meters in the first quarter. [online] Available at: https://www.cnpc.com.cn/cnpc/shudubk/202004/88b6cab564574a24a23445b1595f9af4.shtml*

[21] *Xinhua, 2020. China's natural gas apparent consumption edges up in Q1. [online] Available at: http://xinhuanet.com/english/2020-05/04/c_139030092.htm*

[22] *Zhou, F., 2020. Central Asia Natural Gas Pipeline transported 19.88 billion cubic meters of gas, Yicai. [online] Available at: https://www.yicai.com/news/100717387.html*

[23] *Hydrocarbons Technology, 2020. PetroChina discovers large gas reserve in Xinjiang region. [online] Available at: https://www.hydrocarbons-technology.com/news/petrochina-gas-reserve-xinjiang/*

[24] *CNPC, 2020. Natural Gas & Pipelines. [online] Available at: https://www.cnpc.com.cn/en/naturalgaspipelines/naturalgas_index.shtml*

[25] *Xu, M.Y. and Manekar, S., 2020. PipeChina to take on $56 billion of pipelines to boost network access, Reuters. [online] Available at: https://www.reuters.com/article/us-china-pipeline-idUSKCN24O2BU*

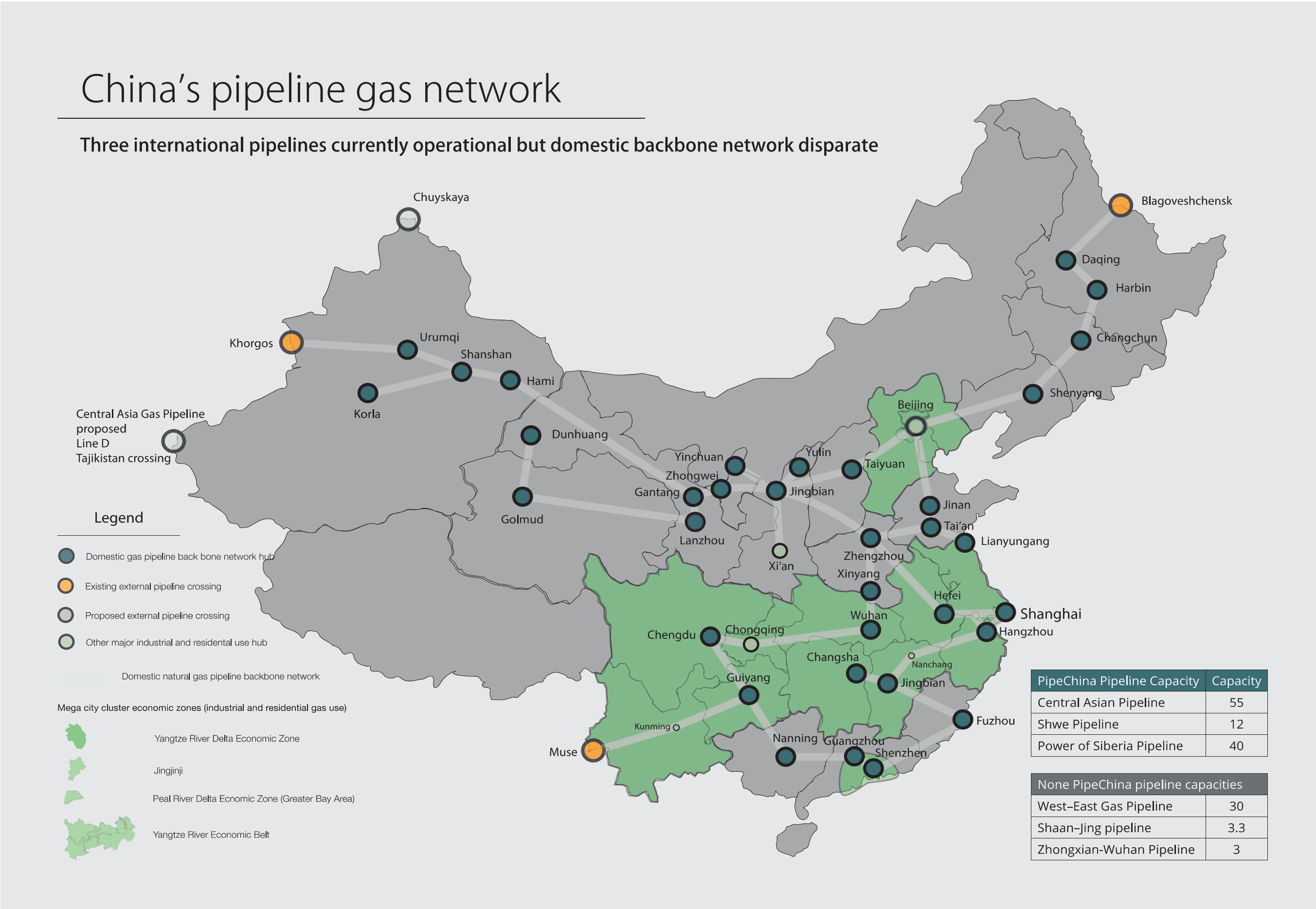
[26] *Xu, M.Y. and Manekar, S., 2020. PipeChina to take on $56 billion of pipelines to boost network access.*

[27] *PipeChina, 2020. Group Profile. [online] Available at: https://www.pipechina.com.cn/gywm/jtjj.html; Xinhua, 2019. Promote High-quality Development of the Oil and Gas Industry – An Interview with the Leader of the National Pipeline Company. [online] Available at: http://www.xinhuanet.com/fortune/2019-12/09/c_1125324497.htm*

[28] *Tank Storage Mag, 2020. Construction starts on 20m t/y Longkou Nanshan LNG project. [online] Available at: https://www.tankstoragemag.com/2020/05/19/construction-starts-on-20m-t-y-longkou-nanshan-lng-project/*

[29] *'China' is used here and throughout as an adjectival noun, describing nouns in place of the more conventional 'Chinese'. This is to separate the ethnonym and demonym from the nation state of the People's Republic of China which is not wholly synonymous with the ethnicities, people or civilisation of China.*

[30] *S&P Platts, 2020. Insight from Shanghai: China's grand plan for gas market competition at odds with dominance of NOCs. [online] Available at: https://www.spglobal.com/platts/en/market-insights/blogs/natural-gas/121520-china-natural-gas-market-competition-pipechina-co2-emissions*



PipeChina Pipeline Capacity	Capacity
Central Asian Pipeline	55
Shwe Pipeline	12
Power of Siberia Pipeline	40

None PipeChina pipeline capacities	
West–East Gas Pipeline	30
Shaan–Jing pipeline	3.3
Zhongxian-Wuhan Pipeline	3

Figure 1. China domestic pipeline infrastructure
Source: Author

industry.[31] The three stated goals in establishing PipeChina were to firstly ensure separation of pipeline infrastructure from production and sales, creating the possibility for future market competition, secondly to develop a single integrated national pipeline network, and thirdly to plan and construct a national pipeline trunk network, to better service the national network.[32] This is the same approach that China central planners have taken to internet backbone infrastructure, state electricity grid planning and intercontinental railways development. The three upstream oil and gas SOEs have been moving infrastructure to PipeChina, and both upstream SOEs and downstream SOEs, local governments and private enterprises will compete to lease capacity. In July 2020, PipeChina bought 391.4 billion yuan[33] in assets from PetroChina and Sinopec.[34] PipeChina's other major acquisition of 2020 was the Yulin-Jinan pipeline, the Shaanxi to Shandong trunk line from Sinopec, essentially taking control of the Shaanxi-Beijing trunk pipeline.[35] PipeChina also absorbed a 75% stake in the Dalian LNG terminal and a 60% stake in Beijing Pipeline in late December 2020.[36] PipeChina charges public tariffs for using port infrastructure for LNG import at the seven existing terminals it now

[31] *Xin, Z., 2020. China's oil giants spin off pipeline assets, China Daily. [online] Available at: https://www.chinadaily.com.cn/a/202007/25/WS5f1b8ff8ba31083481725bffc.html*

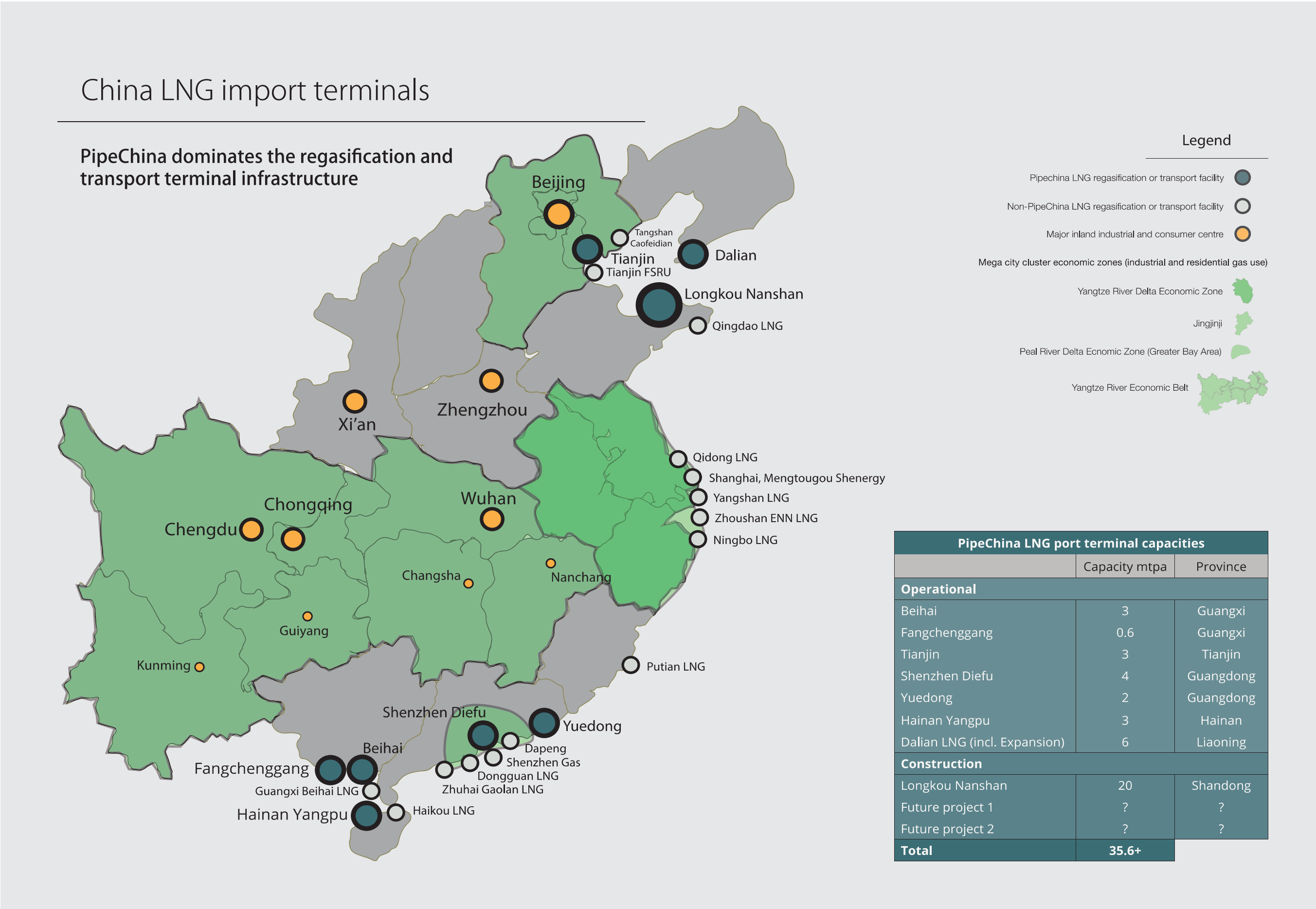
[32] *Xin, Z., 2020. China's oil giants spin off pipeline assets.*

[33] *Xu, M.Y. and Manekar, S., 2020.*

[34] *Tank Storage Mag, 2020. PipeChina offers access to LNG and crude infrastructure. [online] Available at: https://www.tankstoragemag.com/2020/10/15/pipechina-offers-access-to-lng-and-crude-infrastructure/*

[35] *Klass, C., 2020. Sinopec unit sells gas pipeline asset to PipeChina, Argus. [online] Available at: https://www.argusmedia.com/en/news/2125326-sinopec-unit-sells-gas-pipeline-asset-to-pipechina;*
Sinopec. General Information of the Pipeline Network and Sales of Sinopec Gas Company. [online] Available at: http://www.sinopec.com/listco/en/products_service/nature_gas/

[36] *Argus, 2020. PipeChina pays $6bn for Chinese LNG, gas assets. [online] Available at: https://www.argusmedia.com/en/news/2171615-pipechina-pays-6bn-for-chinese-lng-gas-assets*



PipeChina LNG port terminal capacities

	Capacity mtpa	Province
Operational		
Beihai	3	Guangxi
Fangchenggang	0.6	Guangxi
Tianjin	3	Tianjin
Shenzhen Diefu	4	Guangdong
Yuedong	2	Guangdong
Hainan Yangpu	3	Hainan
Dalian LNG (incl. Expansion)	6	Liaoning
Construction		
Longkou Nanshan	20	Shandong
Future project 1	?	?
Future project 2	?	?
Total	**35.6+**	

***Figure 2. China domestic LNG regasification infrastructure*[37]**

operates, with a further three under construction.[38] This leaves the rest of China with 16 LNG terminals with a combined capacity of 13.1 bcm, while PipeChina will hold ten LNG terminals with a combined capacity (including the new terminal under construction at Longkou Nanshan in Shandong) at 35.6 bcm. Sylvie Cornot-Gandolphe has argued that China's energy strategy could reach a combined import capacity of 300 bcm, evenly split between pipelines and LNG terminals by the middle of the 2020s; PipeChina's domestic infrastructure holding of both pipelines and LNG terminals is likely to grow both in gross terms and as a ratio of the national system.[39]

PipeChina's significance here is threefold: first in controlling the terminal assets for LNG imports, PipeChina can use price-mechanisms on LNG docking berth quotas to manipulate trade flows to more nationally strategic locations, such as Guizhou and Hainan.[40] Second, by managing the infrastructure of both LNG terminals and pipelines, PipeChina can effectively manage national policy on political hedging between the two import sources. And third, by creating a unified actor in the midstream distribution space, China's central government can more easily implement price controls on city-gate gas consumption through PipeChina. PipeChina has already demonstrated its geoeconomic policy implications in LNG port operations. In allocating quotas for 2021 imports, PipeChina made more regasification berths available in lower demand but higher strategic value southern Guangxi and Hainan ports while releasing fewer

[37] *S&P Global Platts, 2020. Analysis: China's new LNG regas projects delayed amid COVID-19 impact, financial strain. [online] Available at: https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/070720-analysis-chinas-new-lng-regas-projects-delayed-amid-covid-19-impact-financial-strain; Cornot-Gandolphe, S., 2019. China's Quest for Gas Supply Security: The Global Implications.; Hellenic Shipping News, 2020. China to lead global LNG regasification capacity additions from new-build projects with 25% share by 2024, says GlobalData. [online] Available at: https://www.hellenicshippingnews.com/china-to-lead-global-lng-regasification-capacity-additions-from-new-build-projects-with-25-share-by-2024-says-globaldata/; Reuters, 2021. Sinopec to build $2.8 billion LNG terminal in eastern China. [online] Available at: https://www.reuters.com/article/uk-china-lng-sinopec-terminal-idUSKBN2341C2; Reuters, 2021. Factbox: China's LNG import terminals and storage facilities. [online] Available at: https://www.reuters.com/article/us-china-gas-terminal-factbox-idUSKCN1V60OA; Klass, C., 2020. PetroChina eyes end-2023 start-up for Jieyang LNG, Argus. [online] Available at: https://www.argusmedia.com/en/news/2117183-petrochina-eyes-end2023-startup-for-jieyang-lng; Farrer, G., 2020. LNG regasification: why there's still plenty of gas in the tank, Wood MacKenzie. [online] Available at: https://www.woodmac.com/news/opinion/lng-regasification-why-theres-still-plenty-of-gas-in-the-tank/*

[38] *Argus, 2020. PipeChina pays $6bn for Chinese LNG, gas assets.*

[39] *Cornot-Gandolphe, S., 2019. China's Quest for Gas Supply Security: The Global Implications. Institute Français des Relations Internationales. [pdf] Available at: https://www.ifri.org/sites/default/files/atoms/files/cornot-gandolphe_s_china_quest_gas_supply_security_2019.pdf*

[40] *Argus, 2020. PipeChina pays $6bn for Chinese LNG, gas assets.*

berths in the developed eastern and northern port centres. This signalled a clear intent from central government to use the SOE to develop spatial and strategic planning policy imperatives. Hainan is slated to be developed into a new free trade zone, and the Guangxi port clusters of Beihai and Fanchenggang are integral hubs in the Maritime Silk Road plan to connect deeply inland Chongqing with Singapore via the New Land-Sea Corridor spatial plan.

China's wider hydrocarbon and petrochemical geoeconomic access policies are also more internationalised than previous industrial commodities under the rapid growth era. China's petrochemical industry is organised into a cartel under the China Petrochemical International Capacity Cooperation Enterprise Alliance, effectively an attempt to cartelise both supply and demand-sides to create a whole value chain approach to achieving strategic access to energy resources through the Belt and Road economies.[41] Coordinating industrial park investment, leveraging policy bank capital and securing institutionalisation of commodity prices can ensure not only stable supply but also political control of offshore industrial production bases and their inputs. The ICC Petrochemical Industry Alliance consists of seventy major petroleum and chemical SOEs and semi-private enterprises, led by China's three major SOE hydrocarbon producers PetroChina (the share market listed arm of China National Petroleum Corporation), Sinopec and China National Offshore Oil Corporation (CNOOC). The structure and early operational processes of PipeChina seem to indicate that PipeChina is not part of the wider ICC Petrochemical Industry Alliance. While the three other domestic hydrocarbon SOEs and PipeChina are all nominally governed by the State-owned Assets Supervision and Administration Commission SASAC and the National Energy Administration NEA, PipeChina appears to have a more direct front-end facing international markets. The pipeline and LNG terminal monopoly is more complete for PipeChina than the pseudo-monopolies of the other major hydrocarbon SOEs, and the exporting countries that PipeChina will engage with are also more stable than the players in the global oil market. The combination of these institutional factors should mean that PipeChina is able to operate more independently in global gas markets and more efficiently in strategic operations domestically.

Central Asia and Russia Supply-Side Institutions: A Weak Geoeconomic Lever

Structurally, China Eurasian pipeline gas import strategy centres on building out a trunk line system for natural gas connecting China with both Russia and Central Asia.[42] China's long term spatial plan for its Near Abroad envisions Eurasian trunk line connections, not only in gas but in Ultra-high Voltage (UHV) electricity networks, internet backbone and railways. In gas, there is clear policy potential for China to politicise the buy-side dependency by building strategic institutional levers for state price and volume import control. However, there has been little geoeconomic hedging policy from either the three Central Asian exporting states or Russia. China's import demands and institutional hedging strategies for non-market gas purchases are advanced but limited by its own internal institutional contradictions. However, political and policy architecture in the supply countries also have the potential to upset a China buy-side geoeconomic hedge. Whereas the Central Asian exporters are institutionally limited by underdeveloped economic governance strategies, Russia's foreign geoeconomic policy remains ambiguous.

The Central Asia Gas Pipeline from Turkmenistan, Uzbekistan and Kazakhstan to China comprises three parallel pipes, A, B and C, with plans for line a future line D. Line A and Line B are dedicated Turkmenistan lines inaugurated in 2009 and 2010, with a combined operational capacity of 30 bcm per year. While the gas exported through lines A and B are exclusively Turkmenistan to China, both Uzbekistan and Kazakhstan are integral strategic transit countries with the pipe crossing into China at Khorgos. Line C, inaugurated in 2014 is a combined Turkmenistan, Uzbekistan, Kazakhstan usage pipeline with a capacity of 25 bcm. Turkmenistan is allotted 10 bcm, Uzbekistan 10 bcm and Kazakhstan 5 bcm; operationally though, the Uzbek throughput is closer to 7 bcm per year. The as-of-yet incomplete Line D would theoretically carry 15 bcm of exclusively Turkmenistan capacity. Turkmenistan in particular highlights the one-way China dependency problem, with 90 percent of Turkmenistan's gas exports flowing through this single CAGP contract with China.[43] This is indicative of the political risk Central Asian gas exporters face with China-facing energy trade, a one-way dependency.[44] Despite the pandemic and the force majeure notices issued to major China LNG importers, China LNG imports actually increased through 2020 by around 10% to around 89 bcm.[45] This is from a total of around 131 bcm for all gas (pipe and LNG) for the whole of 2019, and a domestic production of 73.3 bcm of natural gas in 2019.[46] This 2020 glut scenario demonstrates that the possibility of export cuts from the Central Asian gas exporters are not as effective a political hedge as China's political hedge of not buying. The Central Asia-China framework has not been tested in a gas scarcity scenario, but the LNG hedge and reliance on international markets are a tested hedge in the case of a potential CAGP politicised shut-off.

41 Kenderdine, T., 2020. China's Petrochemical Enterprise Alliance and Iran Oil Trade, Middle East Institute. [online] Available at: https://www.mei.edu/publications/chinas-petrochemical-enterprise-alliance-and-iran-oil-trade

42 Northeast Asian Gas and Pipeline Forum, 2000. a Long-Term Vision of Natural Gas Trunkline in Northeast Asia. [online] Available at: http://www.nagpf.info/reesearch/1research.htm

43 Hess, M., 2020. Central Asian Gas Exports to China: Beijing's Latest Bargaining Chip?, Foreign Policy Research Institute. [online] Available at: https://www.fpri.org/article/2020/06/central-asian-gas-exports-to-china-beijings-latest-bargaining-chip/?

44 Foley, R., 2021. Can Central Asian gas exporters rely on China?, Eurasianet. [online] Available at: https://eurasianet.org/analysis-can-central-asian-gas-exporters-rely-on-china

45 Chen, A.A. and Muyu, X., 2020. China on course for record LNG imports as industries recover, expand, Reuters. [online] Available at: https://www.reuters.com/article/us-china-gas-demand-winter/china-on-course-for-record-lng-imports-as-industries-recover-expand-idUSKCN26G0WI

46 S&P Platts, 2020. China's 2019 crude imports up 9.5%, gas import growth slows. [online] Available at: https://www.spglobal.com/platts/en/market-insights/latest-news/oil/011420-chinas-2019-crude-imports-up-95-gas-import-growth-slows#:~:text=China's%20gas%20imports,latest%20data%20GAC%20data%20showed

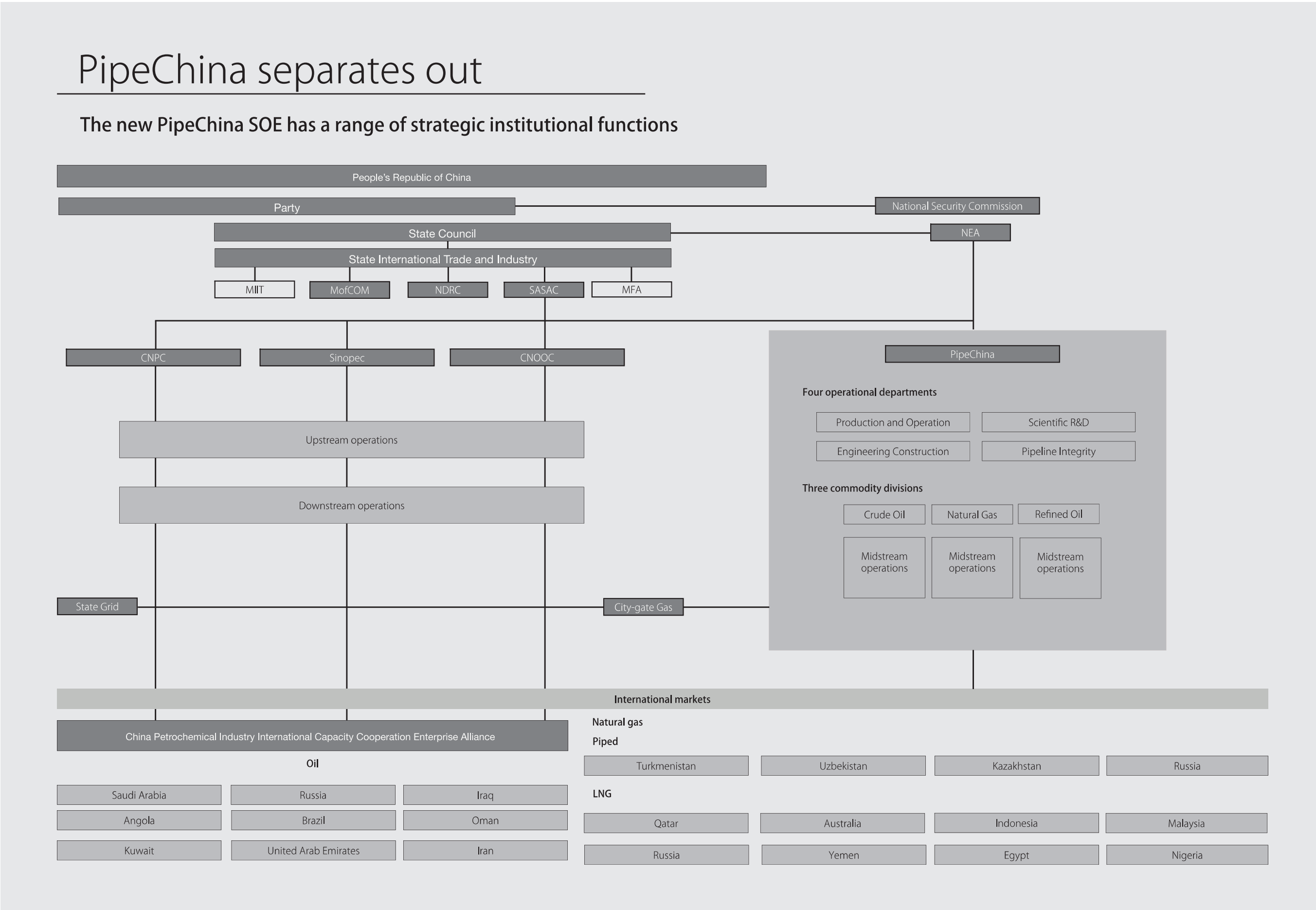


Figure 3. PipeChina's position in China's hydrocarbon import ecosystem[47]

As a result of the *force majeure* period in 2020 Kazakhstan did cut gas exports to China, and Uzbekistan has established a policy to halt gas exports altogether.[48] Both Kazakhstan and Uzbekistan's role in the Central Asia-China gas matrix is mostly as transit economies, allowing the transfer for gas from Turkmenistan to China. Kazakhstan's established domestic cross-country pipeline system connects Khorgos to Lianyungang port via China's domestic West-East pipeline system. Kazakhstan's own hydrocarbon exports remain mostly crude oil through a separate pipeline system connecting its Caspian oilfields with Dalian port infrastructure in northeast China. Despite potential in Kazakhstan's large hydrocarbon sector, it remains capital poor, with an absence of processing facilities, this despite the advance of China investment in the Kazakh industrial structure over the past decade.[49] The change in demand-side price pressures that China brings to the Eurasian piped gas export market still has the potential to bring marketised price-setting institutions to Central Asian exporters.[50] However, as the Kazakhstan piped gas is generally more expensive than LNG market prices, China's imports from Kazakhstan are a key China tool for variable supply politicisation.[51] While China's potential as the new westward gas axis for Central Asia remains great, the threat of economic dependence falls on the Central Asian side.[52]

Uzbekistan plans to stop exporting gas through the CAGP pipeline entirely and focus on value-added processing domestically. Uzbekneftegaz has developed a new liquefaction plant with a delayed expected operation beginning in July 2021 with a capacity of 3.6 bcm which is part-owned by

[47] *Sohu, 2019. Picture shows the status of domestic oil pipeline construction. [online] Available at: https://www.sohu.com/a/289746951_100941; Chen, Y.L., 2019. Organizational structure of National Pipeline Network Company determined, Sina Finance. [online] Available at: https://finance.sina.com.cn/roll/2019-12-09/doc-iihnzhfz4609553.shtml; PipeChina, 2021. Central acceptance of 2021 remaining National Pipe Network Group LNG receiving station capacity. [online] Available at: https://www.pipechina.com.cn/gpkf/tzgg/1794.html; PipeChina, 2021. Announcement on central acceptance of 2021 LNG receiving station window. [online] Available at: https://www.pipechina.com.cn/gpkf/tzgg/1763.html*

[48] *S&P Platts, 2020. China's 2019 crude imports up 9.5%, gas import growth slows.*

[49] *Yau. N., 2020. Tracing the Chinese Footprints in Kazakhstan's Oil and Gas Industry, The Diplomat. [online] Available at: https://thediplomat.com/2020/12/tracing-the-chinese-footprints-in-kazakhstans-oil-and-gas-industry/*

[50] *Kenderdine, T., 2020. China's Demand Impact on Eurasia Gas Pricing. ENERPO Journal, 8(1), pp. 11–14.*

[51] *Marzec-manser, T., 2020. Expensive pipeline gas to support China's LNG demand, Independent Commodity Intelligence Services. [online] Available at: https://www.icis.com/explore/resources/news/2020/06/23/10522287/expensive-pipeline-gas-to-support-china-s-lng-demand*

[52] *Kenderdine, T., 2019. Geoeconomics of Natural Gas in Eurasia. Geopolitics, 24(2), pp. 523–527.*

China.[53] Platts reports that Uzbekneftegaz is to invest in the Oltin Yo'l gas to liquid project and expand the Shurtan gas chemical complex.[54] Uzbekistan's national gas production was 60 bcm in 2019 with a planned expansion to 72 bcm by 2030.[55] The Uzbekistan policy shift would reduce exports of unprocessed gas to zero by the end of the 2020s. However, while Uzbekistan's move towards gas processing in-country may improve ability to service domestic consumers, it is unlikely to have any impact on regional dynamics as export levels were so low. Uzbekistan is thus caught between self-reliance and geoeconomic dependency.

Russia is less affected by China's international hedging strategy due to its natural gas relationships with Europe and Central Asia. Russia's dynamic relationship with European and China pipeline export markets, Arctic LNG exports and the continued arbitrage on the import-export spread from Russia's Central Asian pipeline gas supply allow Russia some political leverage in gas exports.[56] The Power of Siberia is the third cross-border gas pipeline into China after the CAGP and Myanmar pipeline, giving Russia a hedge against China import politicisation.[57] Power of Siberia complements the Arctic LNG complex which is an all-in-one extraction, liquefaction and transport facility. Stage 2 of Arctic LNG will tap a field of approximately 380 bcm, or 10 years of full capacity of Power of Siberia,[58] with another major undeveloped field nearby containing around 1.8 trillion cubic meters, or nearly 50 years' capacity of the Power of Siberia pipeline.[59] The ability of Russia to export both piped and LNG gas to China without using international markets gives Russia an effective hedging strategy for the coming decades of China's likely increased politicisation of gas imports.

The biggest factor in any change in demand remains China's central government policy priorities in energy mix. The China Central Asia Gas Pipeline was a political opportunity for the Central Asian gas exporting economies to diversify exports away from Russia and thus create an institutional environment to allow for a better pricing regime. However, the Central Asian gas exporting states have failed to develop their own national strategic hedge against China buy-side dependency. China has now successfully built a pipeline supply into its national strategic energy dependency hedge.[60] Central Asian gas exporters remain essentially reactive and waiting to take both policy signals and price signals from Beijing. Thus, the institutional framework of China introducing more competition into the regional hydrocarbon exporting mix has only really resulted in trading a dependency on Russia import markets for China, without the institutional development needed to hedge political risk by the exporting economies. Whatever the future importance of Central Asia pipeline gas in China's energy mix, the economic geographic structure favours China's politicisation over any strategic policy outcome of Russia or the Central Asian exporters. To maintain a permanent counter to the dependence on Central Asia and Russia piped gas, China is likely to continue development of an import strategy of importing roughly equal amounts of pipeline gas and LNG and roughly equal amounts of LNG gas through the global markets and through the semi-closed Arctic LNG project. China's geoeconomic hedges thus balance imports between piped gas from dependent Central Asian exporters, piped gas from Russian exporters, Russian LNG which can act more like a monopoly during a political crisis, and global LNG markets. Ultimately, China's strategic leverage on both Russian and Central Asian pipelines remains the LNG trade and vice versa.

CHINA'S POLITICAL HEDGING POSES PARALLAX EURASIAN GEOECONOMIC RISK

The policy implications of China's political hedging of energy import policy for Eurasian states are more acute than any geopolitical risk posed by China's Belt and Road foreign trade and industrial policy. For exporting states in Central Asia and Russia, there is as yet no great political risk in developing greater export capacity with China or with allowing China to invest in upgrading domestic industrial structures in host economies. In LNG, China's import dependency strategy is beginning to mirror Japan's, and yet a new array of China policies and institutions are emerging to manage this buy-side dependency in novel ways. The gravity of global institutional rule-setting and price-taking behaviours, though, are now shifting from Japan to China in the LNG trade and solidifying a China import advantage in overland pipeline trade. China's strategic import dependency hedging of both LNG and piped natural gas through PipeChina is perhaps the clearest indicator of future policy institutionalisation across a wider range of strategic energy commodities.

In terms of practical policy development, China's Belt and Road policy, Eurasian geoeconomic expansion policy and natural gas political hedging strategy mimic China's domestic strategies in other network industries such as rail and

[53] *S&P Platts, 2020. Central Asian countries discussing shared cut in gas supplies to China: Uzbekneftegaz. [online] Available at: https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/050520-central-asian-countries-discussing-shared-cut-in-gas-supplies-to-china-uzbekneftegaz; Afanasiev, V., 2021. Uzbekistan Reveals New Deadline for $3.6bn Gas-to-liquids Project, Upstream. [online] Available at: https://www.upstreamonline.com/production/uzbekistan-reveals-new-deadline-for-3-6bn-gas-to-liquids-project/2-1-942900*

[54] *Idem.*

[55] *S&P Platts, Central Asian countries discussing shared cut in gas supplies to China.*

[56] *Ehsan, R., Taghizadeh-Hesary, F., Yoshino, N. and Sarker, T., 2020. Russian Federation–East Asia Liquefied Natural Gas Trade Patterns and Regional Energy Security. Asian Development Bank Institute. [pdf] Available at: https://www.adb.org/publications/russian-federation-east-asia-liquefied-natural-gas-trade-patterns-security*

[57] *Hydrocarbons Technology, 2020. PipeChina opens another section of Russian natural gas import pipeline, 4 December. [online] Available at: https://www.hydrocarbons-technology.com/news/pipechina-opens-another-section-of-russian-natural-gas-import-pipeline/; China National Petroleum Corporation. Overview of the Myanmar-China Oil & Gas Pipelines. [online] Available at: https://www.cnpc.com.cn/en/myanmarcsr/201407/f115a1cc6cdb4700b55def91a0d11d03/files/dec09c5452ec4d2ba36ee33a8efd4314.pdf*

[58] *Staalesen, A., 2016. Novatek presents plans for new Arctic LNG, Barents Observer. [online] Available at: https://thebarentsobserver.com/ru/node/507*

[59] *Staalesen, A., 2016. Novatek presents plans for new Arctic LNG.; Gazprom, 2020. Power of Siberia, The largest gas transmission system in Russia's East. [online] Available at: https://www.gazprom.com/projects/power-of-siberia/*

[60] *Fazilov, F. and Chen, X.M., 2013. China and Central Asia: a Significant New Energy Nexus. European Financial Review. [online] Available at: https://core.ac.uk/download/pdf/232742424.pdf*

electricity and in other strategic import commodities such as soy and iron ore. This domestic institutionalisation of geoeconomic hedging will not simply result in international price frictions between states competing for imports from global markets. In times of extreme glut or scarcity, China's institutionalisation of political hedging in strategic import commodities can become a geoeconomic tool of convenience or malice. For both the small Central Asian gas exporting states and Russia, overreliance on China as purchaser and a reactionary energy policy from domestic governments is both a geopolitical and a geoeconomic risk, which could be mitigated with a policy of pursuing open market operations, global market-derived pricing and delivery systems protected by international law.

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NATURAL RESOURCES AS A BLESSING AND A CURSE: THE CASE OF KAZAKHSTAN

Altynay Kozhabekova

Abstract

The presence of natural resources can be advantageous and disadvantageous at the same time. This viewpoint article covers both sides of the energy resource abundance in the case of Kazakhstan. The first section sheds light on how Kazakhstan has used pipeline politics as a form of complex balancing to secure its sovereignty and avoid becoming a client state of Russia post-USSR dissolution. However, Kazakhstan has also faced the resource curse like many other states. This viewpoint suggests that the explanation for this condition is hybrid in nature. In other words, both political and economic aspects provide possible reasons behind the decline in economic growth and underdevelopment of non-commodity sectors.

Keywords: complex balancing, Dutch disease, Kazakhstan, pipeline politics, resource curse

Природные ресурсы как благо и проклятие: случай Казахстана

Аннотация: *Наличие природных ресурсов может быть выгодным для политического и экономического развития любой страны, хотя в некоторых случаях, возможен обратный эффект. В этой статье рассматриваются обе стороны изобилия энергоресурсов Республики Казахстан. Первая часть работы посвящена благоприятному влиянию энергоресурсов на внешнюю политику государства через так называемую концепцию комплексного балансирования. Комплексное балансирование помогло Казахстану укрепить суверенитет после обретённой независимости. Несмотря на такой благоприятный расклад, ресурсы так же могут негативно влиять на состояние государства. Казахстан столкнулся с так называемым ресурсным проклятием. Вторая часть данной работы посвящена этому самому ресурсному проклятию Казахстана, которому есть два вероятных объяснения. Здесь рассматриваются как политические, так и экономические аспекты для дальнейшего уточнения возможных причин замедления/спада экономического роста несырьевых секторов и экономики государства в целом.*

Ключевые слова: Казахстан, комплексное балансирование, ресурсное проклятие, голландская болезнь

INTRODUCTION

The abundance of natural resources may become both a blessing and a curse for any state. Kazakhstan is no exception. The Central Asian post-Soviet state, which declared its independence in 1991, has endured various challenges in securing its position as an independent and sovereign nation. Kazakhstan may be the state with the ninth-largest territory in the world and one of the richest in terms of natural resources, but the country faces the problem of its landlocked nature. Border disputes, economic dependence on Russia and the absence of transit roads/pipelines — the legacy of USSR policies — are among the other challenges the newly-emerged state encountered following the Soviet Union's dissolution.

This viewpoint article argues that the role of natural resources in a state's security cannot be overlooked, especially in the case of Kazakhstan. The regional leader of Central Asia has followed a "multi-vector approach" to its foreign policy from the early years of its independence, resulting in deep engagements with various actors. Kazakhstan has chosen this path to protect its sovereignty, avoid dependence on Russia and access the global system/economy despite being landlocked. The multi-vector approach was first noted within the Strategy on the Formation and Development of Kazakhstan as a Sovereign State.[1] Based on this Strategy, Kazakhstan's primary foreign policy goal was to shape a beneficial external environment and to establish a fertile ground for the stable development of the country through political and economic reforms. This multi-vector approach has shaped the nature of Kazakhstan's economic engagements over energy resources. Economic relations with multiple great powers within the energy sector of Kazakhstan has integrated those powers into the security matters of the state. The presence of multiple actors with common interests ensures the preservation of the status quo in the region.

[1] *Strategy on the Formation and Development of Kazakhstan as a Sovereign State, 1992.*

This viewpoint article will shed light on 1) how Kazakhstan has used pipeline politics as a form of complex balancing to secure its sovereignty and avoid becoming a client state and 2) why Kazakhstan has also faced the resource curse.

COMPLEX BALANCING

Complex balancing is a strategy developed by Evelyn Goh,[2] originally used to describe Southeast Asian regional order and state behavior. According to her theoretical approach, complex balancing is not about balancing military power per se. It is rather about the balance of influence within different sectors. It is about the balance of coercive power, i.e., economic agreements and other possible ways that would inevitably result in the engagement of multiple significant powers in regional security.[3] To achieve this goal, states use various methods and mechanisms to gain influence. This can be achieved through membership in intergovernmental and regional organizations, declarations of national sovereignty, foreign investment deals, diplomatic maneuverings, etc.[4] Deterrence is the essence of complex balancing combined with subtle acts of mediating, diluting and persuading major powers that there is a need to reassess their interests and policies.[5] Goh explains that the primary goal is not balancing the power but the normalization of the strategic competition among those powers within the region.[6] Politicizing the balancing behavior and "broadening the scope and domain of balancing" will inevitably result in encompassing more elements that are not linked to the military power within the notion of the "balancing" concept.[7] The goal pursued by the regional actors is to shift the nature of the balance from the balance of power to the balance of influence. Investment deals and economic engagement can be used as tools for complex balancing. This creates the web of overlapping positive-sum interests by the great powers who would rather preserve the status quo than waste money in a costly "battle/argument". The pipeline politics of Kazakhstan can be explained with the same logic.

The means by which Kazakhstan manages its pipeline politics and welcomes foreign direct investments in the energy industry from multiple major actors is a vivid example of complex balancing which helped the country secure sovereignty and avoid becoming a client state of Russia. After the dissolution of the USSR, Kazakhstan found itself in an unstable position. The dependency on Russia in many sectors was one of the primary problems (and still is to a lesser extent). At the time, all of Kazakhstan's pipelines were flowing to Russia due to the Soviet legacy. Oil and gas pipelines in the region were meant to link and connect the USSR internally and were predominantly directed towards Russia and onwards to other parts. This has made Kazakhstan dependent on the pipelines which Russia largely controlled, and those were the only access routes to foreign markets. Up until 1997, the only primary pipeline was the Atyrau — Samara from Kazakhstan to Russia.[8] The dependency on Russian pipelines resulted in a Russian monopoly over Kazakh resource exports. Russia could control the quantity and prices of Kazakh oil/gas, which reduced the state's revenues considerably. As a newly emerged state with an unstable economy, Kazakhstan had no capacity to overcome the problem through the construction of new pipelines.

Moreover, at the time, Kazakhstan was unable to fully develop its massive oil and gas fields due to the absence of the capital required to construct adequate infrastructure. Thus, Russian pipelines were the only available option within the first years of independence. Gradual involvement of China and the US in the energy field of Kazakhstan under its multi-vector foreign policies resulted in the decrease of Russian leverage over Kazakh energy exports. Nazarbayev pursued the policy of inclusion and welcomed both Chinese and Western companies instead of focusing on only Western entities as Azerbaijan did.

When Kazakhstan more or less achieved economic recovery, it started planning out long-term foreign policy goals. Among many strategies outlined, there was a need to construct new pipelines that would bypass Russia and secure economic independence. Since Kazakhstan did not commit to any region and actors due to multi-vectorism, the goal was to export oil/gas by any means available within a short period of time. This was the top priority of foreign policy. The goal was met with the help of China.

From an economic perspective, the People's Republic of China (PRC), as a rising power that requires a constant energy supply, has been eager to step into the region to make beneficial deals. With the enormous speed at which the state's industry was developing, China has found itself with energy demand far greater than its domestic production. In 1993, the PRC became a net importer of oil products, and in 1996 it became a net importer of crude oil.[9] Since then, oil imports have increased to the point that China surpassed the US as the world's largest crude oil and gas importer in 2017 and continues to hold the title up until now (2021).[10] Moreover, due to the "Go Out" strategy, the PRC has been interested in keeping Chinese companies active in construction and infrastructure development abroad considering domestic overcapacity.[11]

From a security perspective, diversification of energy suppliers has been among the primary goals set by the Chinese

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[2] *Goh, E., 2005. Great Powers and Hierarchical Order in Southeast Asia: Analyzing Regional Security Strategies. Journal of International Security, 32(3), pp. 113–157*

[3] *Goh, E., 2005. Great Powers and Hierarchical Order in Southeast Asia: Analyzing Regional Security Strategies.*

[4] *Idem.*

[5] *Idem.*

[6] *Idem.*

[7] *Idem.*

[8] *Energy Information Administration, 1997. Country Analysis Briefs: Caspian Sea Region. [online]. Available at: http://www.eia.doe.gov/emeu/cabs/caspconf.html*

[9] *Leung C. K., Li, R. and Low, M., 2010. Transitions in China's Oil Economy, 1990–2010. [pdf] Available at: http://esi.nus.edu.sg/docs/esi-bulletins/transitions-in-china%27s-oil-economy-1990-2010_eurasian-geography-and-economics.pdf*

[10] *EIA, 2018. China surpassed the United States as the world's largest crude oil importer in 2017. [online] Available at: https://www.eia.gov/todayinenergy/detail.php?id=34812*

[11] *Nash, P., 2012. China's "Going Out" strategy, Diplomatic Courier. [online] Available at: https://www.diplomaticourier.com/posts/china-s-going-out-strategy*

administration. In 2019 alone, 67.3 percent of China's oil supply was imported from abroad.[12] This dependency is estimated to reach the 80 percent mark by 2040.[13] Due to this dependency on outside sources, China is concerned about the diversification of importers for security reasons. Given the political instability of its importers (e.g., the Middle East), China is trying to secure stable oil and gas inflow. The logic behind diversification is simple yet important. If anything happens to one importer (sanctions or other political problems) that might stop/delay the export of natural resources, another one would cover the missing share. Pipeline construction is another priority for the PRC, which receives much of its LNG supply via the narrow Strait of Malacca, a strategic chokepoint. This "agenda" has been behind the BRI initiative, which among other economic interests, includes the construction of land-based pipelines. Taking all of these into account, it is evident that the security of energy supply sources is crucial for the PRC's growth and development. The construction of pipelines would respond to those economic and security needs.

China has helped Kazakhstan to loosen the dependency on Russia while diversifying its own energy sources. In 2005, the Kazakhstan-China oil pipeline opened, while in 2009, a massive gas pipeline was inaugurated between Central Asia and China. Turkmenistan, Uzbekistan and Kazakhstan exported gas to China through this pipeline.[14] These two alternative channels for Kazakh oil and gas provided direct access to foreign markets, bypassing Russia. From this moment, Kazakhstan gained greater autonomy from Moscow and had an opportunity to decrease its economic dependence. Aside from China, the US and Russia, the EU has been quite consistent on its plans to transport gas and oil from the Central Asian region to diversify its energy market and decrease dependency on Russian energy sources. The huge Trans-Caspian Gas Pipeline (TCGP) and larger Southern Gas Corridor have been under development and will provide access to the European energy market via Turkey and Azerbaijan.[15] Kazakhstan did not comment on its decisions to be a part of this project or not, which gives it space to maneuver between the EU and Russia. This has demonstrated its advantageous position, which allows the state to use its energy resources to influence and interact with multiple players simultaneously through various economic deals. For example, the EU's energy market diversification needs and Kazakhstan's valuable energy sources have aided in the regime's preservation. The EU is careful in asserting pressure on human rights and democratization in Kazakhstan due to the desire for these resources.[16] At the same time, the EU's proposed project has helped Kazakhstan find a compromise with Russia's Gazprom,[17] which allows the flow of Kazakh resources to the European energy market: a win-win situation for Kazakhstan and its authorities in any case. Omelicheva and Du imply that Kazakhstan is following the "strategy of inclusion".[18] In other words, it welcomes FDIs from various actors and is open to negotiating on deals with Russia, China, the EU and the US. This complex balancing and web of overlapping interests allow Kazakhstan to use its resources to reach political goals and gain security. Pipeline politics have increased the stake of security for the great powers who benefit from Kazakh resources.[19] The presence of multiple "customers" has helped the Central Asian leader make the most suitable deals and gain concessions from all actors while managing to "create" the interest of the major powers in regional security. Russia, China, the EU and the US all have an interest in maintaining security in Central Asia.

THE RESOURCE CURSE

Despite the positive outcome of the resource abundance for state security, there remains a negative impact. Energy resources may become a curse for any state, but the effect on a newly emerged state with a hybrid regime has been quite extensive. The resource curse, sometimes referred to as the paradox of plenty, is a term used to define the resource-rich state's failure to take advantage of the resource abundance for the general welfare.[20] Generally, the presence of ample energy resource reserves would be seen as something favorable; in the case of Kazakhstan, this article has shown how energy resources have become a tool for complex balancing. However, resource-rich states tend to have high rates of conflict, authoritarianism and economic instability/stagnation than other "normal" states. Various economic/political theories and hypotheses have been developed to explain the essence of the resource curse through different variables. In the case of Kazakhstan, a hybrid of both economic and political explanations are useful.

The apparent economic explanation for the resource curse in Kazakhstan is the so-called Dutch disease. Dutch disease refers to the situation in which resource revenues negatively impact other sectors by causing inflation, exchange rate appreciation and the shift of labor/capital from other sectors to the resource sector. In fact, for quite an extended period, sectors other than mining have remained underdeveloped despite "diversification" strategies declared by the Kazakh authorities.[21] The share of crude oil and natural gas

12 EIA, 2018. China surpassed the United States as the world's largest crude oil importer in 2017.

13 Idem.

14 Cesar, B. and Alvarez, M., 2015. China–Kazakhstan energy relations between 1997 and 2012. Journal of International Affairs, 69(1), p. 62.

15 Vanderhill, R., Joireman, S. and Tulepbayeva, R., 2020. Between the bear and the dragon: multivectorism in Kazakhstan as a model strategy for secondary powers. International Affairs, 96(4), pp. 975–993.

16 Anceschi, L., 2014. The tyranny of pragmatism: EU–Kazakhstani relations. Europe–Asia Studies, 66(1), p. 8.

17 Anceschi, L., 2014. The tyranny of pragmatism: EU–Kazakhstani relations. p.9

18 Omelicheva, M.Y. and Du, R., 2018. Kazakhstan's multi-vectorism and Sino-Russian relations. Insight Turkey 20(4), p. 102.

19 Vanderhill, R., Joireman, S. and Tulepbayeva, R., 2020. Between the bear and the dragon: multivectorism in Kazakhstan as a model strategy for secondary powers.

20 NRGI reader, 2015. The Resource Curse: The Political and Economic Challenges of Natural Resource Wealth. [pdf] Available at: https://resourcegovernance.org/sites/default/files/nrgi_Resource-Curse.pdf

21 Esanov, A., 2010. Economic Diversification: The Case for Kazakhstan, Revenue Watch Institute. [pdf] Available at: https://resourcegovernance.org/sites/default/files/RWI_Econ_Diversification_Kazakhstan.pdf in Kazakhstan's total exports was over 50 percent by 2000.[22] According to 2019 reports, this share has now reached 67 percent.[23] This boom has caused enormous problems for the agricultural sector. Kazakhstan, the Soviet agricultural state, became a state importing food from outside, raising food security issues.

Kazakhstan exports raw materials and imports finished goods. The uneven distribution of "attention" has resulted in the inability of local producers to compete with foreign goods in the domestic market. The switch to the export of natural resources and commodity-based economic path/behavior has impacted the Kazakh economy negatively in the long run. It may take decades to reverse the outcome of such a policy since agriculture and other industry sectors are extremely underdeveloped. Temporary state protectionism, such as non-commodity sector subsidies and import tariffs, is necessary to overcome the negative impact of Kazakhstan's resource curse.

Meanwhile, a political explanation suggests that the presence of natural resources diminishes the value and importance of taxes for the government.[24] If the state apparatus does not have to rely on taxes and be accountable to taxpayers, it is more likely for the given state to become or remain authoritarian. Massive revenues from the export of energy resources lead to the alienation of citizens from the state budget. This may be one of the reasons behind the political passiveness of the population. Officials are less dependent on the citizens who have no access to information on the revenues and spending. On the contrary, states are more responsive to the citizens in the systems where governments must rely on taxes. These countries are more likely to transition into democracy or are already democratic.

In Kazakhstan, the state budget is mostly derived from the export of natural resources to the point that Qasym-Zhomart Toqaev, president of Kazakhstan, had to cut the state budget in March 2020, following the sharp drop in oil prices.[25] This shows the importance of oil/gas revenues for Kazakh government spending. Many post-Soviet states were expected to transition to democracy after the USSR dissolution. Most of the states in "transition" are neither dictatorial nor directed toward democracy.[26] According to Carothers, some post-Soviet states are in the "grey zone" with limited attributes of democratic political life and serious democratic deficits.[27]

Nick Kennedy argues that Kazakhstan has an illusion of democracy and is more authoritarian in nature.[28] Steven Levitsky and Lucan A. Way label Kazakhstan's political system as a form of competitive authoritarianism.[29] In competitive authoritarian regimes, formal democratic institutions are widely viewed as the principal means of obtaining and exercising political authority. Likewise, there was no power transition despite the resignation of the long-term ruler Nursultan Nazarbayev and the presidential elections.[30] Kyrgyzstan has served as an example of a messy political succession for Kazakh decision-makers.[31] Currently, Nazarbayev is the "Elbasi" (leader of the nation) and the head of the security council. There is an expected dynastic succession in the long term.[32]

The preservation of the regime has been possible due to the commodity revenues. In this sense, the abundance of natural resources is indeed a curse for the state and its citizens. This tendency towards authoritarianism can be alleviated through the intensified transparency of revenues and enhanced connection between the government and population.[33] Citizen participation in budgeting or direct distribution of wealth (e.g., cash transfers) is essential.

CONCLUSION

As a newly independent state, Kazakhstan has faced various challenges in becoming the regional leader of Central Asia that it is today. Through the careful complex balancing of the influence and economic needs of great powers, the landlocked country was able to avoid becoming a Russian client state while diversifying its access to energy markets and ensuring regional security. Achieving all of these objectives required the multi-vector policy approach that Kazakhstan has followed since 1992. Growing relations with China, which was interested in energy resources and economic expansion, relations with the US established given the nuclear weapons and facilities in Kazakhstan and the EU's interest in diversifying its energy market helped Kazakhstan to maximize its interests while balancing out the dependency on Russia post-USSR dissolution. Complex balancing by the Kazakh government helped attract foreign investment in energy sectors and prevented a certain great power from being economically dominant in the country and the region.

All these developments were possible due to the positive "blessing" impact of the resources. However, natural resources can also become a curse. Immense energy reserves have led to the underdevelopment of non-commodity-based sectors in the Kazakh economy. There are two explanations for this condition in the case of Kazakhstan: economic and

[22] Akhmetov, A., 2017. Testing the Presence of the Dutch Disease in Kazakhstan. [pdf] Available at: https://mpra.ub.uni-muenchen.de/77936/1/MPRA_paper_77936.pdf

[23] TrendEconomy, 2021. Annual International Trade Statistics by Country (HS02) Kazakhstan. [online] Available at: https://trendeconomy.com/data/h2/Kazakhstan/TOTAL

[24] NRGI reader, 2015. The Resource Curse: The Political and Economic Challenges of Natural Resource Wealth.

[25] RFE/RL, 2020. Kazakhstan To Cut State Budget Following Sharp Drop In Oil Prices. [online] Available at: https://www.rferl.org/a/kazakhstan-to-cut-state-budget-following-sharp-drop-in-oil-prices/30477699.html

[26] Carothers, T., 2002. The End of the Transition Paradigm. Journal of Democracy, 13(1), pp. 5–21.

[27] Carothers, T., 2002. The End of the Transition Paradigm. pp. 5–21

[28] Kennedy, N., 2019. Kazakhstan: The Illusion of Democracy, International Policy Digest. [online] Available at: https://intpolicydigest.org/kazakhstan-the-illusion-of-democracy/

[29] Levitsky, S. and Way, L.A., 2002. Elections Without Democracy. The Rise of Competitive Authoritarianism. Journal of Democracy 13(2), pp51–65

[30] Kennedy, N., 2019. Kazakhstan: The Illusion of Democracy

[31] Idem.

[32] Idem.

[33] NRGI reader, 2015.

political. Overall, the export of commodities has resulted in inflation, exchange rate appreciation and the shift of labor/capital from other sectors. Moreover, the massive resource revenues enabled the elite to counter the transition to democracy due to the autonomy from citizen taxes. These two aspects have resulted in the drop in the economic growth, middle-income trap and general decline in the performance of the state. There is need for state interference in the "free" sectors to fix the economic problems. But whether or not Kazakh authorities are willing to change this situation is another question.

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