

Russia's Global Energy Role: War, Sanctions, and the Energy Transition

By Paul J. Saunders



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ENERGY INNOVATION REFORM PROJECT

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Cover: A Russian ice-capable liquefied natural gas carrier at Sabetta, a port on Russia's Yamal Peninsula. Russia's ability to build or procure similar vessels will profoundly affect its future LNG exports.

Energy Innovation Reform Project is a non-partisan non-profit organization dedicated to promoting policies that advance innovation in energy technologies and practices to improve the affordability, reliability, safety, and security of American energy supplies and our energy economy. EIRP was founded in Washington, DC in 2013. Its work combines policy reports, scholarly research, and economic modeling with creative efforts to bridge partisan differences over energy policy.



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Abbreviations

bcm	billion cubic meters
BTU	British thermal unit
CPS	Current Policies Scenario
ESS	Economic Security Strategy
EU	European Union
EV	electric vehicle
GDP	gross domestic product
GHG	greenhouse gas
GW(e)	gigawatt electrical
HALEU	high-assay low-enriched uranium
IEA	International Energy Agency
IT	information technology
LNG	liquified natural gas
mbd	million barrels per day
NSS	National Security Strategy
OPEC+	Organization of the Petroleum Exporting Countries plus other countries
SMR	small modular nuclear reactor
STEPS	Stated Policies Scenario
UAE	United Arab Emirates
VVER	water-water energy reactor

Executive Summary

Russia's energy exports affect US national interests given their significance to both Russia's economy and the global economy. Yet Russia's role in the global energy system is under increasing pressure from the convergence of US and Western economic sanctions and an ongoing but uncertain global energy transition; even as Washington seeks to damage Russia's economy and sap Moscow's tax revenue, international efforts to reduce fossil fuel consumption could threaten the economy and tax receipts too. The evolution of Russia's global energy role during the next 5–10 years will influence the country's domestic and foreign policies, its relations with China and India, and the success of Russian aspirations to enlist the Global South in dismantling the international system built by the United States and its allies in the post–World War II and post–Cold War eras.

The reality of Russia's integration into the global energy system—and its specific consequences for America and its allies in Europe and Asia—has constrained policy toward Russia, especially efforts to punish Moscow over the 2022 invasion of Ukraine. The collapse in Russia's natural gas exports to Europe has imposed high costs on European and other countries that rely upon imported liquified natural gas (LNG). This result highlights unavoidable interdependence, and the costs of sudden disruptions and decoupling, in 21st century economies.

Russia has had mixed success in adapting to US and Western sanctions, which have been in place now for two years. It has largely succeeded in redirecting its oil exports, albeit at reduced efficiency and higher cost. Past exports to Europe now go to India and (to a lesser extent) China. In 2023, India imported some 40% of Russia's oil—having imported virtually no Russian oil before February 2022—and China imported 45–50%. Russia's coal industry has likewise generally accommodated to the new environment, though its coal producers face growing pressure from increased transportation costs. China and India have each increased imports of Russian coal, and in 2023, the United Arab Emirates imported around three-fifths of Russia's former coal exports to Europe. Russia's natural gas sector has struggled much more than its oil and coal sectors. Russia currently lacks the capacity to reorient or offset most of its former pipeline natural gas exports to Europe, and these exports fell by 83% between 2021 and 2023.

Notably, Russia's global energy role extends beyond the country's well-known fossil fuel reserves, production, and exports. Rosatom, the Russian state nuclear energy firm, dominates global nuclear reactor exports (70%), holds the largest market share in uranium enrichment services (46%), and has \$200 billion in orders. While Finland has canceled a planned Rosatom nuclear power plant, other countries—including Egypt, Hungary, and Turkey—are proceeding with ongoing projects. The United States and the European Union have refrained from banning Russian nuclear fuel imports, as these markets are much less flexible than fossil fuel markets. Russia is also an important producer of energy-related minerals and metals, such as nickel. Still, Russia's mining and metallurgy firms confront transportation problems (as the coal sector does), as well as limited access to technology and financing.

Looking to the future, restrictions on investment and technology will likely pose compounding challenges for Russia's energy sector. In oil and natural gas, declining production in existing fields is forcing Russian companies to pursue expensive and technically demanding projects in the country's Arctic regions. With some justification, US policymakers appear to hope that these projects will be more difficult for Russia to

carry out, though Russia seems to be developing and acquiring necessary LNG production technologies. If Ukrainian strikes on Russian energy targets expand in pace and scope, they could also have lasting effects. In addition to limitations on developing new capacity, restrictions on Russia's access to spare parts is likely complicating maintenance and repairs in the oil and gas sectors and elsewhere.

Russia's natural gas exports face not only production obstacles but also infrastructure obstacles. Addressing these will require either additional pipelines to export natural gas to China and to other markets, or additional ice-class LNG carriers that can operate in the Arctic, along Russia's Northern Sea Route—or more likely will require both. Russia seems to be developing an indigenous LNG production capability, but probably lacks capacity to build enough ice-capable LNG carriers. Even if Russia can build additional pipelines, the price of pipeline gas exported to China is reportedly over 40% lower than Gazprom's prices for its few remaining European customers.

In the coal and other mining industries, enterprises that support isolated and politically sensitive monotowns may edge toward unprofitability in the face of narrowing margins, labor shortages, and increasing tax burdens. Over time, US and Western governments might be more willing to impose sanctions on Rosatom's core businesses once these governments develop alternative nuclear fuel supplies and Rosatom completes ongoing construction projects that directly affect allied countries, whether as customers or subcontractors. Rosatom's nuclear exports may also experience greater pressure from intensifying Chinese efforts to compete in these markets. China's huge state investment in its rapid ongoing domestic buildout of nuclear power plants may help its firms in competing not only on price, but also on technology.

For America, Russia's evolving global energy role has four important implications. First, despite the economic and technological pressure on Russia, the country's political system is not on a trajectory to near- or mid-term collapse. Instead, Russia could be entering a period of enduring stagnation. In such circumstances, leaders in Moscow are more likely to pursue domestic repression than foreign accommodation. That said, sustained low oil prices could put heavier pressure on Russia's government.

Second, Russia is reorienting not only its energy trade, but also its foreign relations. In the Russia-China relationship, Beijing seems to be gaining more from this than Moscow. In Russia-India relations, New Delhi thus far appears willing to accommodate important US preferences; whether this situation endures remains to be seen. Russia is in a stronger position to build economic and political influence through its energy and energy-related mining industries in smaller markets, such as those in Africa, where Russian officials have signed 20 civil nuclear cooperation agreements in addition to pursuing extractive industry projects.

Third, considering the extent to which US allies in Europe and Asia rely on imported LNG, and considering ongoing efforts to slow or stall Russian Arctic LNG projects, a timely increase in US LNG production and exports could both assist US allies and raise questions about the economic viability of Russia's projects. US pressure on Russia—through sanctions and through military assistance to Ukraine—is ultimately an effort to buy time in the hope that escalating costs will eventually encourage a change in Russian policy. Delaying potential growth in US LNG exports wastes some of this time that other US policies are buying through costs to other US sectors and, of course, to Europe and to Ukraine itself.

Finally, while existing US and Western sanctions are increasing inefficiency, inconvenience, and costs for Russia's energy sector. Russia has so far found solutions. Some might not be good, but most are good enough. Russia's fundamental challenge is that according to President Vladimir Putin, his country was already technologically behind in 2018. Russia had not caught up to the US and the West—or to China—before Putin's invasion of Ukraine. And, as Putin himself has said, "technological lag and dependence translate into reduced security and economic opportunities." In pursuing costly self-isolation from the West, Russia is considerably deepening its dependence on China. This greater reliance on Beijing won't serve either Russia's interests or America's.

1. Introduction

This paper reflects an effort to foresee how Russia's global energy role may evolve over the next 5–10 years. Because Russia is pursuing an inherently unpredictable war against Ukraine, and Ukraine is increasingly targeting Russia's energy infrastructure, the analysis is unavoidably speculative. On a wider scale, the global economy and its energy requirements are also subject to unexpected and dramatic change. Nevertheless, because Russia is a major participant in the global energy system, and currently a US adversary, understanding its energy future should be an important component in U.S. policymaking.

The ongoing global energy transition makes this only more complex, in that Russia's energy production and exports will be evolving alongside changes in the global energy system. Moreover, notwithstanding widespread aspirations surrounding reductions in global fossil fuel consumption, the global energy future is no more foreordained than the world's political, economic, social, or technological future. In this paper, the phrase “energy transition” refers to efforts to reduce fossil fuel consumption but does not imply any specific end state or timeline.

As this analysis focuses on Russia's global energy role rather than its domestic energy policy, it limits discussion of energy strategy to significant energy-related exports, such as fossil fuels and nuclear reactors as well as certain minerals and metals important to the energy transition. Exports from the hydro, solar, and wind power sectors are unlikely to alter Russia's global energy role meaningfully in the near term.¹ Russia's electric vehicle and battery manufacturing are similarly weak.² Russia's electricity exports are excluded as well. These are modest—\$1.16 billion in 2022—and inherently limited to immediate neighbors, including Finland (30.2% of exports in 2022), Latvia (22%), China (18.7%), Kazakhstan (12.1%), Lithuania (10.3%), Mongolia (4.48%), Georgia (1.89%), and Azerbaijan (0.32%).³

Organizationally, the paper has five principal sections. Section 2 outlines how Russia's global energy role affects the United States. Section 3 reviews Russia's energy strategy and section 4 presents Russia's prewar expectations for its energy exports. After this, section 5 describes near-term and potential longer-term impacts of Russia's war, US and Western sanctions, and the energy transition. Section 6 suggests some policy implications for the United States.

2. Russia's Global Energy Role and Its Impact on US National Interests

Russia is among the world's leading powers and is likely to remain so for some time. Despite ups and downs, Moscow's leaders—Russian or Soviet—have been influential in European politics and security for centuries and in global affairs for at least seven decades. Especially in the post–World War II period, Russia's energy resources and related technical capabilities have been an important pillar sustaining its economy, political system, and international role. Conversely, sustained low energy prices during the 1980s arguably contributed substantially to the Soviet Union's collapse.⁴ Russia's energy resources and its role in the global energy system can powerfully affect US national interests.

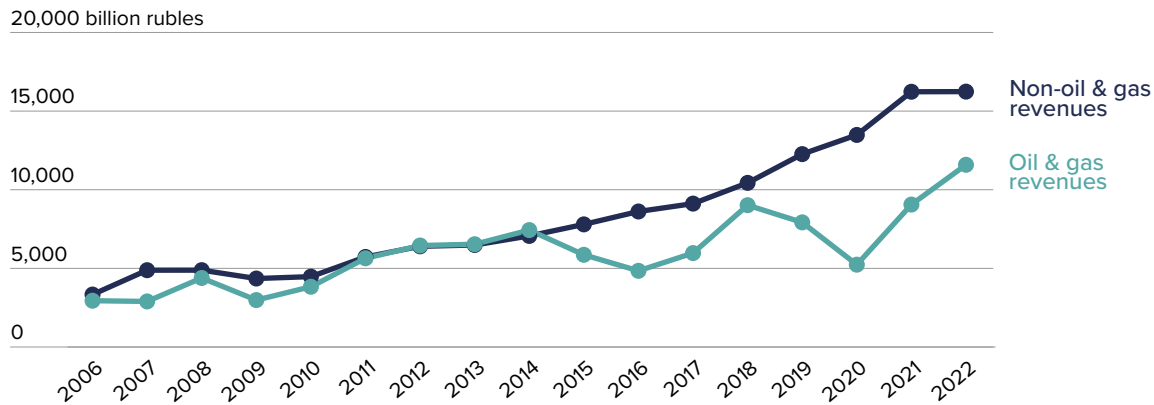
Russia's Energy Sector in Russia

Russia's energy sector matters in Russia today because past export earnings allowed the Russian government to amass hundreds of billions of dollars in foreign currency reserves,⁵ because taxes on the oil and natural gas industries have comprised a large share of Russia's federal government budget,⁶ and because the sector and supporting industries employ hundreds of thousands of Russian workers⁷ and contribute importantly to Russia's gross domestic product.⁸ As a result, Russia has avoided heavy international borrowing (eliminating a source of potential vulnerability) and has had greater resources to devote to leadership priorities, including infrastructure, social welfare, military modernization, and war. Oil and gas revenues have also permitted Russia's government to use various economic means to coopt elites and citizens alike.

Russia's government has consistently sought to diversify its economy and its federal budget away from heavy reliance on fossil fuels and had partially succeeded in developing other economic sectors prior to 2022. Indeed, it has done so to a greater extent than many Western observers appreciate. Russia's federal budget revenues from all sources excluding oil and natural gas grew at an average rate of about 11% between 2006 and 2021 before stagnating in 2022.⁹ Wide year-to-year variations in oil and gas revenues have produced considerable swings in the share of oil and gas revenue among all revenues, especially at times of unusually high or low energy prices.

Figure 1 illustrates the steady increase in non–oil and gas revenues in Russia's federal budget as well as declines in oil and gas revenues connected to lower oil prices in 2009–2010, 2015–2017, and 2019–2020. Except in the 2012–2014 period, non–oil and gas revenues have comprised over half of all federal budget revenues; they reached a peak share of 72% during 2020, when a Russian–Saudi Arabian price war and the COVID-19 pandemic sent oil prices to around \$40/barrel or lower for much of the year. While oil and gas revenues (and underlying export volumes and prices) are the most important single factor driving year-to-year changes in Russia's federal budget, Russia's government made important progress in reducing its dependence on oil and gas revenues prior to its invasion of Ukraine. The pre-2022 Russian federal budget thus operated with a much greater cushion from non–oil and gas revenues than it had in the earlier post-Soviet period.

Figure 1. Russia's Federal Budget (billions of rubles)



Source: Ministry of Finance of the Russian Federation, “Brief Annual Information on Federal Budget Execution (bln. rub.),” https://minfin.gov.ru/en/statistics/fedbud?id_4=119255-brief_annual_information_on_federal_budget_execution_bln_rub.

Russia's Energy Sector in the World

Russia's energy sector matters outside Russia because the country's exports form a key part of the global energy system. Russia's fossil fuels—especially its oil and natural gas—are the dominant components of its energy sector both domestically and internationally. At the end of 2020, Russia held an estimated 107.8 billion barrels in proved oil reserves, or about 6% of total global proved oil reserves, and 37.4 trillion cubic meters in proved natural gas reserves, or nearly 20% of global reserves.¹⁰ In 2021, the last full year before its invasion of Ukraine, Russia produced an average of 10.9 million barrels per day (mbd) of oil, approximately 12.2% of global production, and 701.7 billion cubic meters (bcm) of natural gas, about 17.4% of world production.¹¹ Russia produced 434 million metric tons of coal in 2021,¹² about 5.5% of global production amounting to 7,889 million metric tons.¹³

While Russia's average oil consumption was approximately 3.4 mbd in 2021, or about 31% of its production, its oil exports that year comprised about one-eighth of all internationally traded oil. Russia's liquified natural gas (LNG) exports were around 7.7% of all internationally traded LNG.¹⁴ These are very substantial shares in a world in which supply and demand remain finely balanced and approximately 10% of the population still does not have access to electricity.¹⁵ Most significant, however, was that in 2021 Russia's pipelines provided 167 bcm—49%—of the total 341 bcm of natural gas from all sources imported by Europe.¹⁶ On top of this, Russia's LNG exports to Europe accounted for an additional 17.4 bcm, or 5.1% of Europe's natural gas imports.¹⁷ Russia's coal exports were about 18% of internationally traded coal in 2021; Russia was the third-largest exporter, behind Australia and Indonesia, which were responsible for almost 29% and 27%, respectively.¹⁸ Russia's oil and gas exports have also provided diplomatic leverage, though to a lesser extent than many inside and outside the country expected.

Russia's energy sector extends beyond its fossil fuel reserves and production to include the country's role as the world's top supplier of nuclear reactors and a leading source of nuclear fuel. Russia's state nuclear company Rosatom holds 70% of the global nuclear reactor export market, and in January 2023 had orders for 34 reactors in 11 countries (totaling some \$200 billion).¹⁹ Russia likewise had 8% of global uranium reserves in 2021 and some 46% of global enrichment capacity in 2020.²⁰ Russia remains the sole commercial provider of the high-assay low-enriched uranium (HALEU) necessary for many advanced nuclear reactor designs.²¹ These designs, now under development in the United States and

other countries, could be quite significant to US efforts to win back a major role in global nuclear energy markets and in providing zero-emission electricity and heat. Rosatom is also reportedly supplying highly enriched uranium to China for use in fast breeder reactors, which produce plutonium that could be used for nuclear weapons.²² This action comes amid a significant Chinese nuclear buildup.

Russia is likewise a significant producer of energy-related minerals and metals, including nickel—a key lithium-ion battery material for electric vehicles (EVs) and other purposes—as well as cobalt (also in EV batteries), germanium (solar panels in space applications), palladium and other platinum group metals (catalytic converters to reduce internal combustion engine emissions), selenium (thin-film solar panels), silicon (solar panels), and vanadium (grid-scale batteries).²³ When Russian forces invaded Ukraine, Russia's nickel exports were sufficiently important in global markets that uncertainty surrounding US and Western economic sanctions drove a 61% increase in nickel prices in one day (March 7, 2022) and forced the London Metal Exchange to suspend trading.²⁴

Finally, Russia generated 4.8% of global greenhouse gas emissions in 2020; this put Russia in fourth place behind China (32.6%), the United States (12.9%), and India (6.6%).²⁵ Russia's energy sector is its leading source of emissions, including power, heat, energy extraction, and methane (natural gas) leaks from pipelines and other sources.²⁶

Russia's Energy Sector and US National Interests

Russia's energy sector, and especially its global role, can affect US national interests in many ways:

- Russia's energy sector supports the country's overall economic health and political stability, as well as its ability to finance various activities, such as waging its war in Ukraine, modernizing its nuclear and missile arsenals, importing high-tech goods and other sensitive items, and assisting partners, including Belarus and other countries.
- Russia and its leading energy firms can harm US companies and consumers by engaging in unfair competition, colluding with other market participants, or causing collateral damage to global markets. Russia's post-2016 participation in OPEC+ export quotas supported higher oil prices.²⁷ Later, the 2020 Russia–Saudi Arabia oil price war significantly damaged the US oil industry and the investors backing it.
- Russia's nuclear energy industry can provide sensitive nuclear technologies to foreign governments, companies, or other actors and, like its oil and gas industries, can hurt US companies through unfair competition. Nuclear reactor sales (and ongoing fuel sales and spent fuel management) can establish deep and lasting relationships with other governments. Supplying highly enriched uranium to China's breeder reactors, and thus possibly facilitating China's expansion of its nuclear arsenal, undermines US security.
- Russia's foreign energy policy can serve as an instrument to wound, to help, and/or to develop or deepen relationships with other countries. Threats to cut off energy exports, or offers to provide energy supplies at subsidized prices, can provide Russian officials with leverage. While Russia's effort to exert energy leverage has thus far not succeeded in halting European support for Ukraine, it has imposed considerable economic costs on European governments, companies, and citizens.
- Russia's energy sector can contribute to, or undercut, international attempts to reduce global greenhouse gas emissions, both through Russia's domestic policies and through its exports.

For these and other reasons, understanding Russia's energy sector and its possible evolution over the coming decade is an important foundation for informed US decisions across multiple areas, including economic policy, energy and climate policy, foreign policy and diplomacy, and national security.

3. Russia’s Energy Strategy and Policy

Russia’s likely future role in the global energy system depends in part on Russia’s energy strategy and its role in Russia’s broader economic, national security, and foreign policy goals. Energy is a critical facilitator of Russia’s goals in each of these areas.

Russia’s government has a rather elaborate strategic planning process, likely due in part to legacies of the Soviet planned economy.²⁸ Several official planning documents address energy and its importance for Russia in varying detail. Table 1 presents several of these documents. Most of Russia’s core strategic planning documents predate its invasion of Ukraine, US and Western economic sanctions, and the collapse of Russia’s pipeline natural gas exports to the European Union. Those developments have manifestly required substantial adjustments in the Russian government’s approach to energy and energy exports. Nevertheless, the Russian leadership’s prewar energy strategies remain a useful guide to its priorities today.

Table 1. Key Russian Planning Documents

Document name	Most recent update
Foreign Policy Concept	2023
State Program for the Development of the Atomic Energy Complex	2023
Low-Carbon Development Strategy	2022
National Security Strategy	2021
Energy Strategy to 2035	2020
Consolidated Strategy for the Development of the Manufacturing Industry to 2024 and for the Period to 2035	2020
Strategy for the Development of the Arctic Zone and Guaranteeing National Security for the Period to 2035	2020
Strategy for the Development of the Mineral Resource Base to 2035	2018
Economic Security Strategy to 2030	2017
Climate Doctrine	2009

Source: Author’s compilation

The 2021 National Security Strategy (NSS) lists various tasks necessary to guarantee Russia’s economic security, including these energy-related tasks:

- “Provision of sustainable fuel and energy supply to the population and participants in the national economy, increase of energy efficiency of the economy, and effective management of the fuel and energy complex”

- “Development of technologies for the transmission of electricity from renewable and alternative sources of energy, [and] the development of low-carbon energy”
- “Intensive technological renewal of foundational sectors of the economy” including the energy sector.²⁹

Interestingly, the 2017 Economic Security Strategy (ESS) differs considerably from the NSS in its perspective on renewable, alternative, and low-carbon energy as well as on energy efficiency. In fact, the ESS states explicitly that “the main challenges and threats to economic security” include “changes in the structure of global energy demand and the structure of their consumption, the development of energy-saving technologies and the reduction of material intensity, and the development of ‘green technologies.’”³⁰

The gap between the NSS and the ESS may reflect the evolution of official Russian perspectives between 2017 and 2021 as well as the two documents’ differing purposes. In its passages on energy, the NSS concentrates on guaranteeing adequate domestic energy and electricity, where new technologies and greater efficiency may be desirable in that both contribute to reaching that goal. In the ESS, the discussion of energy is oriented toward its central role in Russia’s economy; from this perspective, official anxiety over evolving global market conditions that diminish the value of Russia’s fossil fuel reserves and exports is understandable. Russia’s Security Council staff have reportedly proposed updating the Economic Security Strategy “in connection with new threats due to changes in geopolitical conditions.”³¹

The Energy Strategy, approved in 2020, more directly addresses the tension between Russia’s reliance on fossil fuels and changing global energy markets. The Energy Strategy expresses pride in Russia’s role as “a major producer, consumer, and exporter of all types of hydrocarbon energy resources” and describes Russia’s fossil fuel sector as an engine of the country’s economy and development. “The fuel-energy complex should make its contribution and help other sectors of the economy in the achievement of national goals and in the resolution of the Russian Federation’s strategic development tasks.”³² The NSS echoes this view, stating that one key task for the government is the “development of market, energy, engineering, innovation, and social infrastructure with the goal of accelerating the growth of the Russian economy.”³³

Yet the Energy Strategy simultaneously acknowledges that “in the global energy system, including Russia’s, processes are advancing that are highly likely to lead to structural changes in the 2030s–2040s.”³⁴ In Russia’s Energy Strategy, the energy transition is a looming reality rather than a potential threat, though Russia’s government expects a longer and slower decline in global fossil fuel demand than the International Energy Agency (IEA) and other Western forecasters.³⁵

The Foreign Policy Concept reflects this view as well. It describes the “structural transformation of the world economy [and] its transfer to a new technological basis,” including in energy, and it calls for “enhancing the Russian presence on the world markets [and] increasing the non-resource based, non-energy export.”³⁶ This post-invasion document further seeks “diversification of economic ties in order to re-direct them to the states that pursue a constructive and neutral policy toward the Russian Federation, while remaining . . . open to the pragmatic cooperation with the business circles of the unfriendly states.”³⁷ Similarly, the 2021 NSS refers to “reduction of the use of the US dollar in realizing external economic activity” as a goal,³⁸ while the 2023 Foreign Policy Concept asserts that “new national and trans-border payment systems are becoming widespread” after complaining about “the abuse by certain states of their dominant position in some spheres.”³⁹

Fossil Fuels

Abundant fossil fuels have served as pillars of the Soviet Union's and Russian Federation's domestic economic development and as leading elements of their integration into the international economy. Historically, this integration included not only East-West energy trade—e.g., the Soviet Union's Cold War-era natural gas exports to West Germany—but also subsidized energy deliveries to Soviet bloc nations in Europe; subsidized post-Soviet deliveries to Belarus, Ukraine, and others; the USSR's export-funded development assistance; and, more recently, outbound Russian foreign investment from state-controlled firms like Gazprom and Rosneft and private companies like Lukoil. Russia's official strategy documents reflect the role of oil and natural gas as the economic backbone of Russia's national power and a foundation of domestic stability.

Russia's Strategy for the Development of the Mineral Resource Base—an overarching document that covers Russia's extractive industries, including fossil fuels as well as mining—foresees declining global demand for coal and oil but increasing demand for natural gas.⁴⁰ The Energy Strategy's stated production scenarios, developed before Russia's invasion of Ukraine, reflect this expectation.⁴¹ For oil, the optimistic scenario sees annual production that increases from 556 million tons (11.36 mbd) in 2019 to just 560 million tons (11.45 mbd) in 2035. In the pessimistic scenario, annual oil production declines to 490 million tons (10.01 mbd) over the same period, a reduction of almost 12%.⁴²

Russia's legacy West Siberian fields, where roughly half of Russian production is concentrated, are being increasingly depleted; some estimates suggest that about 30% of the region's reserves have been extracted.⁴³ Nevertheless, it was logical for Russia to continue developing those fields prior to its invasion of Ukraine, as they were the origin points for a vast network of pipelines to Europe, which was historically Russia's largest export market.⁴⁴ Intensified drilling has so far failed to offset declining production.⁴⁵ Considering that Russia's average oil recovery factor (the share of a given field's oil that can be extracted economically) is just 28%,⁴⁶ these fields require advanced technologies such as enhanced oil recovery to sustain production.⁴⁷

Dwindling output in West Siberian oil fields has in turn pushed Russian producers toward greenfield projects in the more technically challenging Arctic and Eastern Siberian Sea Basin. Even as Russia's government and energy companies look north and east for new oil, they are focusing on the same regions—and their environmentally and technically challenging conditions—as sources for new natural gas, particularly liquified natural gas. Russian officials appear to see natural gas as a lower-emissions alternative to coal that will likely remain attractive for international customers for several decades to come, especially in the developing world.

The Energy Strategy foresees an increase in total natural gas production from 727.6 bcm in 2018 to between 859.7 and 1,000.7 bcm by 2035, depending on circumstances. This includes an increase in pipeline exports from 220.6 bcm in 2018 to between 255.4 and 300.6 bcm by 2035, though such an increase could be challenging given that Russia's enormous pipeline gas exports to Europe (167 bcm in 2021) fell sharply after Russian officials developed and released this document.⁴⁸

Moscow had taken a strategic decision to invest substantially in developing LNG export capacity even before Russia's invasion of Ukraine forced greater reliance on LNG terminals to deliver Russian natural gas. Since the invasion, LNG infrastructure has become even more important; Russia needs it not only to expand gas exports, but also to export gas previously sent to Europe by pipeline. Otherwise, that gas will be stranded inside Russia, where it might or might not be used.

Russia has two principal LNG export terminals, Gazprom's Sakhalin-2, on the island of Sakhalin in Russia's Far East, and Novatek's Yamal LNG, on the Yamal Peninsula in the Russian Arctic, though

Gazprom and Novatek each also operate medium-size facilities in the Baltic Sea (Gazprom's Portovaya and Novatek's Cryogas-Vysotsk). Russia has almost two dozen small-scale LNG plants.⁴⁹ In 2022, Yamal LNG's production was about 62% of Russia's total LNG production for export, while the smaller and older Sakhalin-2 facility was responsible for about 34%.⁵⁰

Before the war, Russia's expectations that it could grow into a major LNG power were raised by the discovery and exploration of several new fields. In 2018, Novatek had discovered the Severo-Obzskoye field in Ob Bay, with an estimated 320 bcm in gas,⁵¹ while Gazprom was exploring both the Kara Sea Dinkov and Nyarmeykoye fields, with over 500 bcm in gas between them,⁵² and the "75 Let Pobedy"⁵³ field, with 200 bcm. While offshore, the Severo-Obzskoye discovery was in an area with only 12-meter water depths, less demanding technically than deeper finds.⁵⁴

Russia's top energy infrastructure priorities have included multiple projects to increase LNG exports from the Russian Arctic as part of a wider plan to develop the Northern Sea Route.⁵⁵ Russia's Arctic Strategy states that the country's Arctic region provides 80% of its natural gas production and 17% of its oil production, and that large-scale projects there stimulate demand for and production of high-technology goods in other Russian regions.⁵⁶ In addition, the Mineral Resource Strategy notes that the Northern Sea Route would "create conditions for the development of the mineral-resource base" in Russia's Arctic.⁵⁷ The Arctic Strategy provides a region-by-region list of specific priority projects.

Nuclear Energy

The Soviet Union became the world's first country to connect a nuclear reactor to its electric grid in 1954, and it committed to export its first reactor in 1958 through an agreement with the former Czechoslovakia.⁵⁸ Post-Soviet Russia has emerged as the world's leading nuclear fuel and nuclear reactor provider, with control of nearly half of the world uranium enrichment and conversion market and 70% of the reactor export market.⁵⁹

Nuclear energy contributes significantly to the Russian economy. Russia ranks fifth globally in nuclear electricity generation capacity with almost 28 GW(e), behind the United States, France, China, and Japan; but it is fourth in generation as a result of Japan's extensive shutdown of nuclear reactors following the 2011 Fukushima nuclear accident.⁶⁰ Russia produces about 20% of its electricity from nuclear power plants and has plans to expand this share to 25% by 2045.⁶¹

Russia's state-owned nuclear monopoly Rosatom oversees more than 300 companies across the nuclear reactor and fuel supply chains, which perform functions ranging from uranium mining and enrichment, to reactor design, construction, and operation, to back-end cycle activities such as used nuclear fuel and radioactive waste management.⁶² In addition to forming the core of Russia's civil nuclear industry, Rosatom is responsible for manufacture of nuclear weapons, management of a nuclear-powered icebreaker fleet, and operation of nuclear science and technology research institutes. However, the company's work extends far beyond the nuclear sector; Rosatom's other high-tech businesses work on additive manufacturing, composite materials, quantum computing, and robotics as well as hydrogen and wind power.⁶³

The Energy Strategy notes that the country "has undertaken active participation in the construction of atomic power stations abroad since 2008" and that Russia "leads in the creation of new technologies for atomic energy."⁶⁴ Yet the Energy Strategy is oriented overwhelmingly toward modernizing Russia's domestic nuclear sector and identifies only two main tasks for Russia's government: improving the "efficiency" of nuclear energy, especially the life-cycle economic competitiveness of new nuclear plants; and developing new technologies for "parallel operation of thermal and fast neutron reactors to ensure a closed fuel cycle."⁶⁵

The 2014 State Program for the Development of the Atomic Energy Complex takes a similar approach. The original State Program largely served to define key economic and technical goals, to allocate federal budget funds, and to define performance measures.⁶⁶ However, a major 2021 revision adds a substantial introductory section to the document that provides wider domestic and international framing for the government's policies and priorities. This new text explicitly states that one of Rosatom's goals is to strengthen Russia's role in international nuclear markets.⁶⁷ In 2023, Russia's government revised this portion of the State Program to note "unprecedentedly massive sanctions pressure" on Russian government and private entities.⁶⁸

Nevertheless, Russia's formal strategy documents do not concretely describe the roles of nuclear reactor exports and of Rosatom in Russia's overall international strategy. It is important also to consider Russia's actions and how they might reflect its aims.

The fact that nuclear energy remains expensive relative to other electricity generation in Russia—evident in the Energy Strategy's call for greater "efficiency"—has been a constraint on Russia's large and highly developed domestic nuclear sector during much of the post-Soviet period. The slower pace of domestic reactor construction following extensive new grid connections in the 1970s and 1980s was one factor that drove Rosatom into international markets as it sought to sustain the country's considerable nuclear energy assets.⁶⁹ Over the last two decades, Rosatom has aggressively expanded its overseas presence, building new reactors in China, Egypt, Hungary, India, Iran, and Turkey.⁷⁰ Of the 439 nuclear power reactors in operation globally in 2021, 38 were in Russia and 42 were Russian VVER-type reactors in other countries.⁷¹ Twenty-one of the 52 reactors under construction internationally use Russian VVER technology.⁷²

Russia has become a dominant player in the global nuclear fuel supply chain partly for similar reasons—that is, because of limited domestic opportunities—and partly thanks to post-Cold War US nonproliferation efforts, through which the United States imported low-cost uranium nuclear fuel derived from Soviet nuclear warheads and stockpiles (at the expense of America's domestic nuclear fuel supply chain).⁷³ While Rosatom accounts for just 6% of global uranium mining, the company has controlling stakes in a company owning two uranium mines as well as smaller but notable shares in four other Kazakh uranium mines; Kazakhstan has been a major supplier to the European Union.⁷⁴ Russia's Energy Strategy notes that overseas joint uranium mining projects have expanded due to challenging market conditions (that is, high domestic costs) and calls for greater domestic production.⁷⁵ Rosatom controls 46% of global enrichment capacity.⁷⁶

Beyond increasing its exports of VVER reactors, Rosatom is working to develop new generations of nuclear reactors. These include small modular nuclear reactors (SMRs), a less expensive alternative to traditional multi-billion-dollar nuclear plants. Russia's *Akademik Lomonosov*, the world's first floating commercial nuclear power plant, incorporates two reactors with a combined capacity of 70 MW and began commercial operations in Russia's Far East in 2020.⁷⁷ Rosatom is building an onshore SMR at Ust-Kuyga that is scheduled to start operations in 2028.⁷⁸

Minerals and Metals

With the world's largest contiguous landmass, Russia holds extensive reserves of metals and rare earth minerals. Russia also has a highly developed metallurgical industry—a legacy of Soviet-era industrialization—and is a top-10 producer of many base metals, accounting for roughly 13% of titanium, 10% of nickel, 6% of aluminum, and 4% of iron and copper globally. In addition, Russia produces 36% of the world's palladium and is the single largest source of this metal.⁷⁹ Russia is also the world's third-largest exporter of cobalt, which is important for the currently dominant EV battery chemistry, and the second-largest exporter of vanadium, used in steelmaking and large-scale energy storage. In contrast to its energy sector, Russia's mining industry is largely privately owned (excluding Rosatom's uranium mining).⁸⁰

Ores, metals, and minerals made up about 17% of Russian exports in 2021, a much smaller share than fossil fuels but a greater share than chemical products and agriculture.⁸¹ Mining and metallurgy have outsized political significance, however, due to their role in supporting so-called monocities and monotowns—communities overwhelmingly dependent on a single industry. In Russia, monotowns are especially prevalent in Siberia and the Urals region;⁸² Norilsk, the home of Nor Nickel (formerly Norilsk Nickel), is among the most prominent. Nor Nickel is the world's largest single producer of nickel,⁸³ with 78,000 employees.⁸⁴ Nor Nickel alone is responsible for 1% of Russia's GDP.⁸⁵

Russia's Strategy for the Development of the Mineral Resource Base of the Russian Federation to 2035, approved in December 2018, covers strategy for all extractive industries, including fossil fuels as well as metals and diamonds.⁸⁶ The Mineral Resource Strategy divides "economically significant" minerals into three categories: those where resources are sufficient to meet Russia's needs to 2035 (group 1, including natural gas, coal, iron, nickel, cobalt, platinum group metals, and others); those where resources are sufficient for today but not until 2035 (group 2, including oil, gold, silver, zinc, diamonds, and others); and those where resources are currently insufficient (group 3, including uranium, lithium, titanium, some rare earths, and others).⁸⁷

One key function of the strategy is to define exploration targets in each category. The document confidently describes Russia as having "practically all well-known types of useful minerals" either on its territory or beneath its continental shelf⁸⁸ and asserts that Russia's "surplus of mineral resources" is one of its economy's "most important competitive advantages."⁸⁹ Notably, the Mineral Resource Strategy does not fix production targets beyond 2024.⁹⁰

Russia also sets out its mining strategy within a larger 2020 manufacturing strategy document, the Consolidated Strategy for the Development of the Manufacturing Industry of the Russian Federation to 2024 and for the Period to 2035, which incorporates both near-term goals defined in President Vladimir Putin's 2018 "May decrees"⁹¹ and longer-term aims. An appendix to the document includes "priority directions" for ferrous and nonferrous metallurgy, rare metals, and rare earths. For ferrous and nonferrous metals, these include contributing to Russia's wider economic development, meeting demand in the domestic market, strengthening Russia's role in global and regional markets, and improving competitiveness, among others.⁹² With respect to rare metals and rare earths, Russia's goals likewise focus on meeting domestic needs—including in the defense sector—and taking advantage of growing export opportunities.⁹³

The Consolidated Manufacturing Strategy notes that the manufacturing sector (including mining and metallurgy) produces about 14% of Russia's GDP and employs 10.1 million people.⁹⁴ Produced in 2020—before Russia's invasion of Ukraine and, more specifically, before Russia's mass conscription—the Consolidated Manufacturing Strategy states that enterprises are "competing for qualified personnel" and that there is a "deficit of highly-qualified cadres" in some regions as well as a "disbalance" of professional qualifications, which does not align with enterprise needs.⁹⁵ The document also notes the manufacturing sector's "high dependence on the availability of borrowed funds" and "shortage of working capital," and points further to businesses' reliance on "their own sources of funds for development" and thus "limited growth rates."⁹⁶

Within the context of Russia's foreign policy, the Russian government's mining strategy appears straightforward: to minimize dependencies on imports, to invest in mines in non-Western countries to meet additional needs, and to use its position in the global metals and minerals market to win additional geopolitical influence. The latter includes strengthening its hand in dealing with Europe, the United States, and other advanced economies whose manufacturing, high-tech products, and clean energy systems hinge on access to metals and rare earths. It also includes expanding Russia's influence in Africa and Latin America through investment in mining projects there and eventually challenging China's dominance in rare earth minerals refining. In 2020, a Russian deputy industry and

trade minister said that Russia would invest \$1.5 billion in rare earth minerals with a goal of becoming the world's second-largest producer after China by 2030.⁹⁷

Climate Change

Russia's energy strategy largely defines its climate strategy. As a leading fossil fuel producer, consumer, and exporter, Russia's economy and federal budget depend so heavily on fossil fuels that the 2017 ESS described "green technologies"—intended to reduce fossil fuel consumption—as a threat to Russia. Russia's Climate Doctrine, adopted in 2009, reflects these realities; it describes the "strategic goal" of Russia's climate policy as guaranteeing "security and sustainable development."⁹⁸ The document prioritizes Russia's present-day economic interests and emphasizes adapting to climate change rather than reversing, stopping, or mitigating it.

The Russian government's low-carbon development strategy—formally the Strategy for Social-Economic Development of the Russian Federation with Low Levels of Greenhouse Gas Emissions to 2050—takes a broadly similar approach. Approved just four months prior to Russia's invasion of Ukraine, the low-carbon strategy acknowledges impending climate change impacts, foresees risks to Russia's security and development, and calls for adaptation to minimize these risks.⁹⁹

The low-carbon development strategy goes somewhat further than the Climate Doctrine, however, in that it acknowledges Russia's participation in various international climate agreements, states that over 60 countries have pledged to achieve carbon neutrality in the 2050–2060 period, and outlines policies to achieve a 70% reduction in Russia's GHG emissions from 1990 levels by 2030 and "low emissions levels" by 2050.¹⁰⁰ Yet even in the strategy's "intensive" scenario, Russia's emissions fall by slightly less than 14% from 2019 levels; an additional net reduction of about 43% from 2019 levels is to be achieved by more than doubling figures for the absorption of carbon dioxide by Russia's forests and other natural systems.¹⁰¹ Russia's president has pledged that his country will achieve carbon neutrality by 2060,¹⁰² in line with a similar announcement from Chinese President Xi Jinping, though Putin's promise also likely relies heavily on absorption.

The Russia government's desire to engage with the United States and to an even greater extent with the European Union has substantially shaped its climate strategy and policy at key moments. For example, when Russia's State Duma ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change in 2004, Vladimir Putin was actively cultivating Germany's then-chancellor and Social Democratic Party leader Gerhard Schröder and other European leaders. One of the Russian government's top objectives at the time was to secure Germany's participation in the Nord Stream 1 pipeline—Putin and Schröder signed a framework agreement in 2005. Even more important, Russia's government was seeking the EU's agreement to Russia's World Trade Organization accession; contemporary accounts suggest that Putin pursued ratification of Kyoto as a diplomatic gesture to the EU.¹⁰³

More recently, amid Western attempts to isolate Russia following its annexation of Crimea, the 2015 Paris Agreement negotiations offered an opportunity for Putin to present his government as a responsible international player. Russia signed the agreement despite domestic opposition from industrial lobbyists, although it did not ratify until 2019. Likewise, Putin participated in President Joe Biden's April 2021 Leaders Summit on Climate—an early Biden administration initiative, held at a time when Putin was still studying his new American counterpart. At the meeting, Putin stated that Russia "is genuinely interested in stepping up international cooperation" on solutions to climate change.¹⁰⁴ More recently, at the 2022 United Nations climate summit, Russia's climate envoy asserted that his country could achieve carbon neutrality sooner if "there were no sanctions, or restrictions or any discriminatory approaches" toward Russia's economy.¹⁰⁵

Engagement with European businesses (and EU regulations and expectations) may have provided even more powerful incentives for Russian enterprises to reduce their emissions than Russia's national climate objectives. The proliferation of environmental, sustainability, and governance (ESG) standards across global financial markets prompted publicly traded companies, including high emitters such as Novatek and Rusal, to develop and publicize corporate strategies for the energy transition that could help the firms to secure and retain Western investment.¹⁰⁶

Energy-intensive Russian industrial firms likewise faced a potential loss of competitiveness in exports to the European Union as the latter pursued a planned carbon border adjustment mechanism.¹⁰⁷ Indeed, in a likely reference to this European policy, Russia's low-carbon development strategy states that new regulations on hydrocarbons could violate World Trade Organization rules.¹⁰⁸

Russia's economic decoupling from Europe following its February 2022 invasion of Ukraine seems likely to undercut these incentives and pressures.

4. Forecasts and Realities

Russia's role in the global energy system has already evolved considerably since Russia's invasion of Ukraine. US and Western sanctions, and responses to the sanctions, have thus far been the main drivers of Russia's changing role. Over the next 5–10 years, however, additional factors will exert increasing influence over Russia's place in global energy. These will include longer-term effects of sanctions, global economic conditions, and geopolitics.

These factors are discussed in the next chapter. But before considering them, it is important to understand pre-invasion forecasts of Russia's future energy production and exports as well as the war's impacts so far. These forecasts, which establish an important baseline in considering how Russia's global energy role could evolve, are discussed below.

Russian Expectations

Russia's prewar forecasts reflect expectations that Russian oil's role in the global economy could slide somewhat by 2035, but that the country's coal and especially its natural gas could grow in importance. Though Russia's oil and coal forecasts have survived largely intact—so far—its natural gas projections are far off-target and poorly positioned for recovery.

Russia's 2020 Energy Strategy foresaw declines in the country's oil and gas condensate extraction by 2035; yet during the same period, it sought substantial increases in natural gas extraction in East Siberia and the Far East, in LNG production, and in pipeline export capacity to the east. The Energy Strategy likewise expected essentially flat coal supplies in the domestic market while aiming for a significant expansion in Russia's global market share. More generally, Russia's government planned for a near doubling of the share of its energy exports going to Asia. Table 2 presents selected indicators and targets in the Energy Strategy.¹⁰⁹

Table 2. Russia's Energy Strategy to 2035: Selected Indicators

Indicator	2018 (base level)	2024	2035
Volume of oil and gas condensate extraction (million metric tons)	555.9	555–560	490–555
Volume of LNG production (million metric tons)	18.9	46–65	80–140
Gas export pipeline capacity (bcm)	240	363	425
In the western direction	240	325	325
To countries in the Asia-Pacific region	0	38	80
Ratio of gas extraction volume in East Siberia and the Far East to the base level	1	2.6	4.2

Indicator	2018 (base level)	2024	2035
Volume of Russian coal supply in the internal market (million metric tons)	181	174–192	170–196
Share of the world coal market	14%	18–20%	23–25%
Share of Asia-Pacific countries in the overall volume of Russia's energy resource exports	27%	40%	50%
Share of atomic energy plants of generation 3+ and modernized operating power units at atomic energy plants with extended service life in Russia's installed nuclear generation capacity	13%	26%	40%

Source: Russia's Energy Strategy, Appendix No. 1, in Government of the Russian Federation, «Показатели реализации Энергетической стратегии Российской Федерации на период до 2035 года,» 2020, <http://static.government.ru/media/files/w4sigFOiDjGVDYT4lgsApssm6mZRb7wx.pdf>.

Looking back at these indicators following Russia's invasion of Ukraine, several points stand out:

- Russian officials aimed to send a steadily escalating share of Russia's energy exports to Asia, reaching 50% by 2035, but to do so while maintaining exports to Europe and other Western markets.
- Russian officials were planning for sharp increases in LNG production capacity, adding about 3–6 times the country's 2018 production by 2035.
- Russian officials expected only modest increases in pipeline natural gas export capacity to Europe between 2018 and 2024, presumably largely from the Nord Stream 2 pipeline's entry into service, and no capacity increases to Europe between 2024 and 2035.
- After successfully completing the Power of Siberia gas pipeline to China, to be operating at capacity in 2024, Russian officials foresaw a doubling of pipeline gas export capacity to Asia between 2024 and 2035, requiring one or more additional pipelines.
- Russian officials hoped to win a greater share in global coal markets, despite expecting that market to shrink, suggesting that they thought other market participants would either lose market share or exit the global coal market.

Like other forecasters, however, Russian officials constructed reference cases that assumed “relative geo-economic stability,” including “the absence of significant external risks, shocks, and global political conflicts, as well as sharp fluctuations in energy markets.”¹¹⁰ While Putin might have expected a short, victorious war in Ukraine that bent but did not break these assumptions, the actual war that occurred has shattered them.

In addition to transforming Russia into an adversary for the United States and most of its allies, Russia's invasion of Ukraine prompted US and Western sanctions. These include US bans on importing Russian oil, LNG, and coal;¹¹¹ European Union bans on importing coal and seaborne crude oil and refined oil products;¹¹² an EU decision to wind down natural gas imports from Russia;¹¹³ an oil price cap tied to US and Western shipping and insurance services;¹¹⁴ and a host of sanctions on individuals and companies.¹¹⁵ Over time, the United States¹¹⁶ and the European Union¹¹⁷ also restricted investment in key sectors of Russia's economy, including energy and mining (and, of course, defense), and blocked sensitive technology exports to Russia. Russia responded to these measures with various efforts to

pressure its EU customers; ultimately, Moscow preemptively slashed pipeline gas exports. Russian officials likely sought to provoke political crises across the EU and to weaken NATO's unity.

Notwithstanding turmoil that sent prices soaring in the weeks before Russia's invasion of Ukraine and the months afterward, global oil markets largely stabilized in 2023. Markets have absorbed the war's uncertainties, and Russia has generally succeeded in redirecting its oil exports from Europe to China, India, and other customers. At the end of 2023, a top Russian cabinet official said that China was importing 45–50% of Russia's oil and refined product exports, while India was taking another 40%.¹¹⁸ India, which was not a significant Russian market before the war, absorbed the largest share of redirected exports, both for domestic consumption and for refineries that resold oil products in Asia and elsewhere.¹¹⁹

Russia surprised US officials and US Energy Information Administration analysts with its ability to redirect its oil exports.¹²⁰ This required Russia to assemble many hundreds of oil tankers to replace tankers provided or insured by firms in Price Cap Coalition countries; the result is the so-called shadow fleet. This fleet is more expensive and less efficient for Russia, in that transporting equivalent quantities of oil over longer distances requires more time and more tankers. Despite this, it has worked sufficiently well to sustain Russia's oil revenue and at times to yield record gains.¹²¹ (Russia and other OPEC+ countries voluntarily limited oil production in 2023 in a partly successful effort to sustain oil prices despite a weak global economy.¹²²) Nevertheless, some analysts suggest that this approach—requiring the purchase of aging tankers at skyrocketing prices—has diminishing value for Moscow.¹²³ Russia has continued limited pipeline oil exports to Europe, which Russian officials estimate at 4–5% of their country's overall exports.¹²⁴

Russia has been considerably less successful in maintaining natural gas export volumes, though this reflects not only Western actions but also Russia's decision to abruptly curtail its pipeline gas exports to Europe. Table 3 shows the sharp reduction in Russia's natural gas exports during 2022 as well as the importance of pipeline gas exports to Europe within Russia's overall natural gas exports; between 2021 and 2022, Russia's pipeline exports to Europe fell by approximately one-half. Moreover, Russia continued to export pipeline gas to Europe at decreasing levels through the summer of 2022, and its pipeline gas exports declined further in 2023, plunging to an estimated 28.3 bcm—an 83% reduction from 2021 levels.¹²⁵ Russia has thus far lacked the infrastructure and shipping necessary to reroute its gas exports.

Table 3. Structure of Russia's Natural Gas Exports (bcm)

	2018	2019	2020	2021	2022
Pipeline natural gas	222.4	220.7	197.4	201.3	125.3
To Europe	193.8	188.0	167.7	167.0	85.4
LNG	24.9	39.1	41.8	39.5	40.2
Total natural gas	247.3	259.8	239.2	240.8	165.5

Sources: Energy Institute, "Statistical Review of World Energy 2023," 72nd ed., https://www.energyinst.org/_data/assets/pdf_file/0004/1055542/EI_Stat_Review_PDF_single_3.pdf; bp, "Statistical Review of World Energy," various years (2019, 2020, 2021, 2022).

Russia's efforts to find new markets for its coal exports, like similar efforts for oil, have generally been successful. In 2021, Russia shipped 28% of its coal to Europe (including Ukraine); this share fell to under 1% in the first nine months of 2023.¹²⁶ A large share of Russia's former coal exports to Europe went to Asia, which took 55% of Russia's coal in 2021 and 70% in the first nine months of 2023. But in the first nine months of 2023, the largest share went to the United Arab Emirates, which absorbed almost 17% of

Russia's coal exports during that period, about three-fifths of the share that had gone to Europe, despite importing virtually no Russian coal in 2021. Within Asia, China's and India's shares grew considerably, while those of Japan and South Korea—the second- and third-largest markets for Russia in 2021—collapsed. Russia's principal constraint in redirecting its coal exports has been its domestic rail capacity; coal shipments dominate Russian rail cargo but face growing competition from more profitable goods as Russia rearranges its imports to replace those previously acquired from Europe and the United States.¹²⁷

Russia's nuclear exports present a more mixed picture, though one still largely favorable to Russia. Finland's government forced the abandonment of a nuclear plant construction contract with Rosatom (by announcing its unwillingness to issue a construction permit),¹²⁸ and Bulgaria is considering selling portions of a partially completed Russian nuclear plant to Ukraine,¹²⁹ but Hungary, Turkey, and others have continued projects that commenced before Russia's 2022 invasion of Ukraine. Meanwhile, the United States and many European governments are working to end their reliance on Russian nuclear fuel,¹³⁰ and Westinghouse has won new nuclear fuel contracts in Bulgaria, Finland, and Slovakia.¹³¹ Moreover, in part due to earlier efforts to reduce costs, Russian firms hold significant stakes in uranium mines in Kazakhstan.¹³² Some Western firms rely on Kazakhstan's uranium supplies as a means to diversify away from Russia.¹³³ Despite Russia's invasion of Ukraine and its aftermath, Rosatom has retained its leading position in nuclear reactor and nuclear fuel markets.

Russia's largest metal producers have so far avoided large-scale sanctions, in part due to the industry's integration into global supply chains. Nevertheless, the United States has targeted gold and diamond mining enterprises, some prominent Russian mining executives such as Vladimir Potanin of Nornickel, and, most recently, an aluminum plant.¹³⁴ Many Western firms have stopped dealing with Russian suppliers, including Nornickel; in mid-2022, Vladimir Potanin told investors that “the introduction of voluntary sanctions by international suppliers of equipment, spare parts, materials and technologies, has posed serious challenges for the execution of our strategic investment program.”¹³⁵ Nornickel reports that the company's nickel production fell 5% from 2022 to 2023 and could decline 7–12% from 2023 levels in 2024.¹³⁶

The ongoing war has more directly affected Russian steel company NLMK. In February 2024, a Ukrainian drone appears to have struck its principal manufacturing facility in Lipetsk, resulting in a large fire.¹³⁷ Reflecting the complexities of today's global economy, NLMK has a US subsidiary that continues to operate manufacturing sites in western Pennsylvania and northern Indiana.¹³⁸ (While hardly scarce, steel is an important input in many large-scale energy projects, including renewable energy, such as in wind turbine towers.)

Broadly speaking, global markets for metals and critical minerals have adapted to Russia's invasion of Ukraine and to US and other Western responses. While some prices soared in the short term, prices have largely stabilized at or near prewar values with lower Russian market shares.¹³⁹

Overall, Russia has—so far—maintained sufficient oil and coal production and exports to avoid material disruption to those two industries. Russia's nuclear sector has similarly faced limited damage from Western policies, including sanctions, in no small part due to continuing Western reliance on Rosatom for nuclear fuel and enrichment services. There has been less resilience in Russia's natural gas sector, where exporters have faced great challenges in redirecting their products.

Macroeconomic Conditions and Forecasts

The overall health of the global economy over the next 5–10 years, and the demand for energy that it generates, will establish the market for energy exporters, including Russia. Against the backdrop of tight energy markets and a faster-than-expected economic recovery from COVID-19, Russia's February

2022 invasion of Ukraine tipped global energy markets into a protracted energy crisis. European natural gas and electricity prices increased by as much as 15 times their early 2021 levels.¹⁴⁰ Europe's energy crisis quickly affected other markets, as EU efforts to source substantial volumes of non-Russian gas (particularly from the United States and Qatar) strained global LNG markets. Uncertainty surrounding Russia's oil exports similarly drove inflation in the United States and other countries.

In the near term, the International Monetary Fund sees slowing growth in advanced economies and stalled growth in emerging market and developing economies, with advanced economies dragging down overall global growth from 3.5% in 2022 to projected levels of 1.5% and 1.4% in 2023 and 2024, respectively.¹⁴¹ For Russia, the IMF's forecasts for China (growth slowing somewhat from an estimated 5.0% in 2023 to a projected 4.2% in 2024) and India (growth at an expected 6.3% each year, down from 7.2% in 2022) are perhaps more important, considering that these two countries are its most important oil customers and that EU countries continue to scramble for LNG—including Russian LNG—on international markets. Looking further ahead, the IMF projects relatively stable global growth in the 2025–2028 period, with emerging market and developing economies averaging around 4% growth and advanced economies rebounding somewhat, with average growth between about 1.5% and nearly 2%.¹⁴²

Notwithstanding these economic growth forecasts, the International Energy Agency's Stated Policies Scenario (STEPS) expects global energy demand to increase at an average annual rate of only 0.7% through 2030.¹⁴³ In this scenario, global coal consumption peaks in the early 2020s and falls to somewhat above 80% of current levels by 2030; oil and gas consumption continue to increase in the early 2020s, but peak just before 2030.¹⁴⁴ IEA has reduced its 2030 and 2040 global natural gas consumption projections each year in its 2020, 2021, 2022, and 2023 outlooks due to a range of factors, including the COVID-19 pandemic, Russia's invasion of Ukraine, and weaker growth expectations among emerging market and developing economies.¹⁴⁵

In fall 2022, the IEA projected that Russian fossil fuel exports would never again reach 2021 levels due to peaking global oil demand and sanctions on Russia's energy sector.¹⁴⁶ Indeed, in STEPS, the IEA saw Russia's share of internationally traded energy falling from around 20% in 2021 to 13% in 2030.¹⁴⁷ By 2023, IEA forecasting stated that Russia's share of internationally traded gas could decline by half between 2021 and 2030 as new projects begin production in the United States and Qatar.¹⁴⁸ STEPS is the IEA's most favorable scenario for Russia's energy exports, in that its additional scenarios assume greater success in reducing fossil fuel consumption globally.¹⁴⁹

Nevertheless, the IEA's post-2020 forecasts have prompted some controversy due to a methodological change. IEA's STEPS model assumes that governments implement their "stated policy ambitions," that is, policies that are aspirational but not actually in place.¹⁵⁰ While IEA discouraged considering STEPS as a reference case for this reason, the agency stopped using its so-called Current Policies Scenario (CPS)—based strictly on existing policy—because agency officials found it "difficult to imagine" that governments would not be more ambitious in seeking to reduce emissions.¹⁵¹ Some have asserted that the IEA faced pressure from climate policy advocates to discontinue using CPS.¹⁵²

As STEPS forecasts assume, on balance, that governments fully implement their stated aims, this scenario could forecast faster reductions in oil and natural gas demand than may occur—especially if some leading energy consumers are not able to meet their policy goals or do so more slowly than expected. This possibility is an important consideration in thinking about how the energy transition could affect Russia, especially following Russia's 2022 invasion of Ukraine, which has prompted many governments and societies to focus increasingly on energy security. While the EU has responded by redoubling efforts to reduce fossil fuel consumption, especially rhetorically, that approach is far from universal.

Notwithstanding more modest projected increases in energy demand, the IEA expects an average 3.4% annual growth in electricity demand globally from 2024 to 2026, with 85% of the increase outside advanced economies.¹⁵³ Though IEA forecasts that growth in clean energy will be sufficient to cover this new demand,¹⁵⁴ clean generation will cover demand on a net basis; that is, new clean generation (primarily in advanced economies and China) will equal or exceed new energy demand (primarily in developing economies and China). During the same period, IEA projects that global nuclear generation will grow by approximately 3% per year, with Asia leading this expansion.¹⁵⁵ At a 2023 global climate summit, roughly two dozen governments committed to tripling nuclear energy capacity by 2050,¹⁵⁶ though few of these would likely consider new Russian reactors.

Clean energy demand in the West and in China—a leading manufacturer of many clean energy systems—could boost demand for key outputs from Russia's mining sector. A 2020 World Bank study examining the energy transition's mineral requirements found that building sufficient clean energy to reach global climate policy targets could require a fourfold or greater increase in the world's annual production of 17 minerals and steel by 2050 and a doubling of current annual output by the early 2030s.¹⁵⁷ The 17 minerals include several important Russian mining products, such as iron, nickel, aluminum, copper, and cobalt.¹⁵⁸

5. War, Sanctions, and the Energy Transition

Several factors will shape how Russia's energy sector fits into the global energy system. Perhaps most consequential is the extent to which the United States and the West continue to enforce existing sanctions and to impose new sanctions targeting Russia's energy sector. This factor has two key dimensions: whether Russia ends its war with Ukraine in a manner that somehow eases the sanctions and their effects, and whether the sanctioning coalition remains unified, both on a transatlantic basis and within the European Union.

In the wake of Russia's 2014 seizure of Crimea and intervention in eastern Ukraine, and especially following its 2022 invasion of Ukraine, US and Western policymakers sought to apply diplomatic, military, and economic pressure to deter, damage, and coerce Russia. Because Russia's energy sector is one of the country's key assets and levers, policymakers placed this sector at the center of their economic strategy to influence Russian conduct.

US and Western officials appeared to hope, or perhaps even to expect, that sanctions would cause massive immediate damage to Russia's economy and force Moscow to change course in Ukraine.¹⁵⁹ This has not been the case. Nevertheless, sanctions have significantly affected Russia's energy sector and, over time, seem likely to accumulate greater impacts as they constrain Russia's development of energy infrastructure and technology and limit its access to investment. Sanctions could also have domestic political effects in Russia.

We cannot know how and when Russia's invasion of Ukraine might end or, for that matter, whether US and Western economic pressure will create internal political pressure that forces Russian leaders to withdraw their country's military forces from Ukraine or to accept other disadvantageous terms that stop the war. Similarly, how sanctions will affect Russia's economy over time and to what extent the Russian government can mitigate those effects is uncertain.

For the purposes of this analysis, the assumption is that war, conflict, or tensions in and around Ukraine will continue over the next 5–10 years and that the US and its allies will maintain or (more likely) tighten sanctions by adding new individuals and entities to sanctions lists and working to address leakage, loopholes, and other sanctions gaps.

Sanctions appear likely to remain in place indefinitely, either because the war continues indefinitely or, alternatively, because it ends in ways that do not remove the sanctions. In spring 2024, neither Russia nor Ukraine appears willing to offer the concessions required to persuade the other to end the war. Considering that Russia would likely seek sanctions relief and various other Western commitments (such as limitations on future arms supplies and deployments) in any negotiations to end the conflict, it is notable that the United States, NATO, and the European Union all appear unprepared to offer such concessions or other terms that Moscow would accept.

To be sure, Western, Russian, and Ukrainian diplomatic positions could change. Even so, an end to the war need not bring an end to the sanctions, especially if the war ends due to reductions in US and

Western assistance to Ukraine and involves a Russian victory. Nor is it obvious that US and/or European firms could easily resume trade in Russian energy commodities, manufactured goods, services, or technologies after a satisfactory deal that incorporated sanctions removal. Outstanding legal, logistical, political, and reputational hurdles could remain barriers for some time. Most notably, a resolution to the war would probably not end the US-Russia rivalry or widespread European concerns about Russia. More extreme outcomes, such as the collapse of Russia's government and its replacement with a friendlier alternative, might not help; having (from their perspective) reacted warmly to Russia's emergence from the collapse of the Soviet Union, Western governments and publics might respond more skeptically a second time.

Continued unity among the sanctioning coalition is harder to predict, particularly in view of US domestic politics and the EU's consensus-based approach to decision-making, which can allow a single member state—or a small group—to block action. In the United States, some sanctions are congressionally mandated and would require new laws to revoke, while others could be removed by presidential order (in some cases requiring congressional review). European Union sanctions require renewal by the European Council (an assembly of EU member-country heads of state and two EU officials) every six months. Some American sanctions could thus prove much more difficult to remove than their European counterparts; many US sanctions require broad political consensus for removal, while removal in the EU requires one or more governments to block consensus to continue them.

Fossil fuels

The United States and its European allies began efforts to limit Russia's access to energy technology and financing in 2014, following Russia's seizure of Crimea. This effort intensified sharply in the wake of Russia's large-scale invasion of Ukraine in 2022. Sanctions are constraining Russia's fossil fuel sector and shaping how enterprises do business but have not yet inflicted severe damage on this core component of Russia's economy.

Following the post-Crimea sanctions, Moscow launched an import-substitution program consisting of targeted state investments in domestic engineering and manufacturing capacity; this had some success but was more effective in producing manufactured components and machinery, such as pipelines and drilling rigs, than in developing high-technology items like control systems.¹⁶⁰ As of 2018, some 80% of Russia's oil and gas equipment was imported; for imports in areas like offshore technology and IT, the share was 90%.¹⁶¹ In April 2022, the president of Russia's Oil and Gas Equipment Manufacturer's Association (OGEMA) told a State Duma committee that "every valve, every pump is practically 90% foreign." Russia's energy industry equipment relies heavily on Japanese, German, and French "brains" as well, he said, explaining that refineries could fail "owing to the fact that some microchip, microelement or board is out of order."¹⁶²

While Russia has been able to obtain some critical components from China, including drilling and fracking equipment, other components will be available only through sanctions evasion. These constraints will not halt Russian production but will make some processes less efficient and could stall efforts to develop new Arctic oil projects.¹⁶³ Russia appears to have had some success in developing indigenous LNG technology—for example, in building Arctic liquefaction facilities.¹⁶⁴

Russia's remote, expensive, and technically demanding Arctic energy projects are especially important due to the declining productivity of Russia's legacy West Siberian oil and gas fields. Rosneft's flagship Vostok oil project, which was expected to produce and export as much as 2 mbd by 2030 has relied upon generous tax incentives. In 2019, Russian officials estimated that Russia's crude output could fall 40% to about 6.8 mbd by 2035 without new technology and tax policy support.¹⁶⁵ However, this claim might partly reflect internal lobbying for government funds.

Arctic gas production has likewise benefited from strong support from Russia's federal government through both tax breaks and direct financing, though the Kremlin might be moderating its support for Arctic LNG in the face of budgetary pressures.¹⁶⁶ Though the projects are clearly high on Moscow's priority list, US and Western restrictions on financing and technology appear likely to complicate Russia's efforts to maintain oil and gas production and to develop new Arctic production.¹⁶⁷

Moreover, Russia's Arctic energy projects are complex and costly due not only to the harsh environmental conditions, but also to the need to transport energy by pipeline or tanker. In much of the year, navigating Russia's Northern Sea Route still requires either icebreaker escorts or ice-capable oil tankers and LNG carriers, which are in short supply.¹⁶⁸

Sanctions have demonstrably complicated Russia's efforts to obtain ice-capable LNG carriers; South Korea's Hanwha Ocean Co. has been building the expensive vessels for Novatek and Japan's Mitsui but is now seeking another buyer for the Novatek ships. Mitsui is likewise attempting to sell the ships it ordered.¹⁶⁹ China's Hudong Zhonghua shipyard has built LNG carriers and has sought contracts to build Arc-7 ice capable ships for Russia's Arctic LNG projects, though the Chinese firms have relied on Western design assistance.¹⁷⁰ Russia is building its own ice-capable LNG carriers, but—without another solution—is unlikely to have sufficient shipbuilding capacity to meet its needs.¹⁷¹ In this case, LNG exports from Russia's Arctic will remain seasonal.

Nevertheless, if oil prices increase sufficiently, Russia's export earnings could remain steady or grow despite declining export volumes, as occurred in 2022.¹⁷² Without enough appropriate LNG carriers, this scenario is less likely in Russia's gas sector, where export pipelines serving non-European markets are limited.¹⁷³ Russia's government could further raise export duties to preserve federal budget revenue, though this could be at the expense of company investment in future production and/or export infrastructure. As noted earlier, the International Energy Agency's forward-looking scenarios assume declining Russian oil and gas exports due to the combination of sanctions and peaking global demand for these two fuels.¹⁷⁴

While Western import bans have had only modest effects on Russia's coal exports—2022 was a record year for Russian production—Russia faces other constraints.¹⁷⁵ One serious challenge is that coal exports are increasingly competing for access to the country's railways; as Russia has boosted imports from China and elsewhere to replace goods formerly imported from Europe, the capacity available for coal has gone down, and transportation prices have gone up.¹⁷⁶ Along with a stronger ruble, war-related discounts on Russian coal in global markets, and higher taxes, this trend contributed to industry-wide production costs exceeding earnings in the first half of 2023.¹⁷⁷

Looking ahead, Russian officials could face growing pressure to reduce taxes on coal, increase subsidies to the coal sector, and/or invest in greater rail capacity. Russian Railways is already behind schedule in implementing its Eastern Polygon Modernization Program—intended to boost capacity in Russia's eastern regions—in part due to insufficient financing and labor shortages.¹⁷⁸ So long as Russia's war in Ukraine continues, these two obstacles appear likely to remain in place. If higher-value imports continue to use a substantial share of Russia's rail capacity, Russian coal could face an export squeeze.

War-related distortions in Russia's natural gas sector could also affect the coal sector, in that both gas and coal are used widely in electricity generation, manufacturing, and heating. Because Russia is unable to export a substantial portion of its prewar natural gas production, Gazprom's revenue has declined, and the country has substantial excess natural gas capacity in its domestic market, having been forced to absorb a disproportionate share of production cuts.¹⁷⁹ Gazprom needs to raise funds for expensive infrastructure projects and was authorized to increase its domestic prices by 8% in July 2023 and again in July 2025.¹⁸⁰ A roughly equivalent price boost had occurred at the end of 2022 to compensate (partially)

for lost export revenue.¹⁸¹ The coal and gas industries are each lobbying for government support for infrastructure and, over 5–10 years, might also compete more intensely in domestic markets.

Export Markets

Russia's fossil fuel export earnings depend not only on its production and transportation, but also its success in finding markets and securing sufficiently high prices for its products. Oil exports are especially important for Russia because the industry yields more profits and thus more taxes than either natural gas or coal exports. Since Russia seems unlikely to lack buyers for its oil during the next 5–10 years, prices for this volatile global commodity are paramount.

Russia, Saudi Arabia, and other leading OPEC+ participants have thus far remained unified in reducing their oil exports to sustain higher prices. In early March, OPEC+ extended its voluntary limits through the second quarter of 2024.¹⁸² Saudi Arabia faces budgetary pressures that encourage efforts to maintain oil prices near or above \$100/barrel to minimize deficits.¹⁸³ From this perspective, Saudi Arabia's interest in high oil prices seems to align with Russia's. Moreover, Moscow's war in Ukraine likely limits its willingness to provoke Saudi rulers by engaging in unilateral profit-seeking. If Russian and Saudi Arabian leaders can work together to manage oil prices, and Western leaders remain understandably reluctant to stop Russian oil exports (as opposed to trying to limit Russia's earnings), Moscow can sustain its existing market position in the near to medium term.

Russia has had two principal challenges to its oil export relationships: payments and adequate shipping. The latter problem has largely been resolved, though Western governments could take additional steps to disrupt shipping.¹⁸⁴ The payment issue has been manageable so far, though some reports suggest that foreign banks are increasingly leery of potential secondary sanctions and, as a result, that Russian exporters are facing longer delays and even rejections.¹⁸⁵

Russia's oil sales to India, which amounted to 40% of its exports in 2023, have been particularly hard to arrange as the rupee is not fully convertible.¹⁸⁶ For this reason, Russian companies have pursued various convoluted means to repatriate their earnings, including using cryptocurrency exchanges and loans (with borrowing by sellers in rubles in Russia, and payment by buyers in rupees in India).¹⁸⁷ Nevertheless, the payment methods developed in this high-stakes commerce could become increasingly routine over time and might be adopted in other Russian trading relationships.

More recently, Ukraine has imposed new costs on Russia's oil sector and wider economy through drone attacks on refineries. In late February 2024, these attacks and Putin's desire to sustain low domestic prices before Russia's March presidential election contributed to a six-month Russian government ban on gasoline exports.¹⁸⁸ Russia's ability to acquire replacement parts could delay repairs at some facilities. If Ukraine can inflict damage more quickly than Russia can repair it, Russia could not only lose export revenue, but face a 20–30% gasoline shortage, requiring imports.¹⁸⁹

Russia's exports of value-added refined oil products like gasoline, diesel, and other fuels and lubricants reached \$67.4 billion in 2022, about half the dollar value of its crude oil exports that year, at \$133 billion.¹⁹⁰ If Ukraine were able to reduce Russia's oil product exports substantially over an extended period, this could be quite expensive for Russia's oil firms—especially as Moscow has been subsidizing domestic fuel prices for years. These subsidies totaled Rub 1.6 trillion during 2023, or roughly \$21 billion.¹⁹¹

In natural gas, Russia's long-term export plans have relied heavily on China to diversify away from dependence on Europe. Nevertheless, past Russia-China gas negotiations have moved slowly. Indeed, Russia-China talks on pipeline gas exports date as far back as 1997, with further meetings and signings in 2006, 2009, and 2011.¹⁹² Officials were able to agree on the natural gas price only in 2014, when

Russia's seizure of Crimea and intervention in eastern Ukraine began to strain its relationships with the United States, the EU, and EU member governments. In 2024, Power of Siberia has yet to reach its full export capacity of 38 bcm/year.

In 2019, Russia proposed Power of Siberia 2, a 4,100 km pipeline with 50 bcm/year capacity to bring gas from the Yamal Peninsula through Mongolia to northwest China.¹⁹³ Though construction has long been slated to begin in 2024, with deliveries by 2030, Russia and China have yet to conclude a final deal for Power of Siberia 2, which might cost \$34 billion to construct.¹⁹⁴ China now holds even more leverage in price negotiations than it did in 2014, when most observers saw Russia as giving in to Chinese pressure on the Power of Siberia contract in the face of earlier Western sanctions.

Thus far, China appears to be seeking and achieving deep discounts in comparison with Russia's gas exports to Europe.¹⁹⁵ And even at full capacity, Power of Siberia and the proposed Power of Siberia 2 could transport just over half the natural gas that Russia previously exported to Europe. For comparison, Russia exported roughly 167 bcm to Europe in 2021. By industry estimates, Russia could at most sell 120 bcm/year to Asia by 2030, at a much lower price than it fetched in Europe. Gazprom's 2024 export price to its remaining European customers is reportedly \$481.70 per thousand cubic meters, while its price for 2024 exports to China could be just \$271.60 per thousand cubic meters, about 43% lower.¹⁹⁶

Beyond this, if China wants additional Russian natural gas, Chinese negotiators might be able to leverage Russian pipeline deals (Gazprom) against Russian LNG deals (Novatek) or the reverse. Ultimately, Beijing would have to decide among three options: financing new pipelines, which create long-term mutual dependency and that was costly for Russia and its European customers in 2022; financing new Russian LNG export facilities, which reduce China's dependence on Russia as well as Russia's dependence on China; or financing both new pipelines and new LNG projects. At this point, Chinese firms have invested in the Power of Siberia pipeline (not yet at capacity), Novatek's Yamal LNG (at and even above capacity),¹⁹⁷ and Novatek's Arctic LNG 2 (not completed).

Finally, projections by China National Petroleum Corporation (CNPC) show the country's natural gas demand peaking in 2040.¹⁹⁸ If Chinese firms negotiate on this basis, they could expect new projects with long construction timelines to conflict with declining demand in their domestic market (unless they plan to reexport Russian gas). This could encourage the Chinese side to insist on shorter-term or more flexible contracts than Russian parties might prefer.

Beyond China, Russia's leading potential markets for near-term pipeline natural gas exports are in Central Asia. In mid-2023, Russia secured a two-year contract to export 2.8 bcm/year to Uzbekistan.¹⁹⁹ Kazakhstan and Uzbekistan have each experienced gas shortages as production declines, demand increases, and exporters strain to make contracted deliveries to China.²⁰⁰ Russia could also export gas to China through Central Asia or establish a (probably less commercially attractive) de facto swap arrangement, in which Russian supplies to the two countries facilitate their exports to China.

Russian officials have also long discussed a potential natural gas pipeline through Central Asia to Pakistan and India, though prospects for this effort appear poor.²⁰¹ Considering the time required to negotiate and build such a pipeline, it seems implausible within the next 5–10 years. In addition to exporting gas to China through Central Asia, Russia might be seeking to export additional gas to Europe through Turkey.²⁰² This is not prohibited by existing sanctions, though sensitive politically.

Table 4 presents Russia's actual fossil fuel exports for 2018, 2021, and 2022 as well as its 2024 and 2035 goals. It demonstrates starkly how Russia's invasion of Ukraine and its aftermath have derailed Russia's pipeline natural gas export plans. Notwithstanding its many challenges, some analysts have argued that Russia could—theoretically—restore pre-2022 natural gas export volumes if Moscow

finds ways to overcome financial, technical, and sanctions obstacles.²⁰³ Even without such obstacles, however, Russia appears quite unlikely to win prices comparable to its past exports to Europe; the prices in Russia's contracts with China strongly suggest this.

Table 4. Russia's Coal, Oil, and Natural Gas Exports and Energy Strategy Forecasts

	2018	2021	2022	2024 (forecast)	2035 (forecast)
Coal and coal-processing products (million metric tons)	210.3	Omitted	Omitted	Low 219 High 272	Low 257 High 392
Oil (million barrels)	1,944.1	Omitted	Omitted	Low 1,993.3 High 2,008.2	Low 1,818.0 High 1,879.2
Pipeline natural gas (billion cubic meters)	220.6	201.7	125.3	Low 243.9 High 250.4	Low 255.4 High 300.6
LNG (billion cubic meters)	26.9	39.6	40.2	Low 59.8 High 65.1	Low 108 High 189
Total natural gas (billion cubic meters)	247.5	241.3	165.5	Low 303.7 High 315.5	Low 363.4 High 489.6

Sources: bp, "Statistical Review of World Energy 2022," 71st ed., <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf>; Energy Institute, "Statistical Review of World Energy 2023," 72nd ed., https://www.energyinst.org/_data/assets/pdf_file/0004/1055542/EI_Stat_Review_PDF_single_3.pdf; Russia's Energy Strategy, Appendix No. 2, in Government of the Russian Federation, «Прогнозный топливно-энергетический баланс Российской Федерации до 2035 года,» 2020, <http://static.government.ru/media/files/w4sigFOiDjGVDYT4lqsApssm6mZRb7wx.pdf> (data for 2018 and targets for 2024 and 2035).

Note: The Russian Energy Strategy separately reports export forecasts for crude oil, diesel, mazut (a heavy fuel oil), gasoline, and other oil products. The figures in the table reflect only crude oil. To avoid comparing statistics reflecting different combinations of oil products, the table excludes 2021 and 2022 data from non-Russian sources.

Russia has been slowly increasing its LNG exports, which reached approximately 44 bcm in 2023, and has benefited from the expansion of the EU's LNG imports.²⁰⁴ While the United States has banned Russian LNG imports, the European Union, Japan, and South Korea have continued LNG purchases. If Russia can complete existing and planned LNG projects on time and can find suitable LNG carriers, the country could meet its 2035 LNG export targets.²⁰⁵ Setting aside the shipping problem, success in this area will depend heavily on Russia's quest to replace imported technology—an area where Moscow appears to be succeeding so far—and on financing, which in turn depends in part on demand.

Domestic and International Implications of the Energy Transition for Russia's Fossil Fuels

Separately from its invasion of Ukraine and the Western response, Russia's fossil fuel sector confronts an international effort to replace fossil fuels with low-carbon energy. This could have domestic and export implications for Russia.

Even prior to its 2022 invasion of Ukraine, Russia was making only a limited effort to develop low-carbon energy. Expanding hydropower is costly, nuclear energy has not been competitive with inexpensive natural gas, and solar and wind are a miniscule share of Russia's power generation—under 1% in 2022.²⁰⁶ Russia's adoption of electric vehicles has likewise been extremely slow (which limits potential reductions in domestic fuel consumption).²⁰⁷

The country's relatively small market hampers weak attempts to develop a domestic renewable power industry.²⁰⁸ Despite Russia's vast natural gas reserves, its hydrogen technology is behind its weakly developed solar and wind technology.²⁰⁹ Moreover, this industry relies on massive subsidies in the United States and other countries—not probable in Russia—and potential markets in the EU, Japan, and South Korea appear unavailable for some time. China—the world's largest market for solar and wind power—is likely inaccessible too as Beijing supports domestic manufacturers with better technology.²¹⁰

So long as Western sanctions on investment and technology continue, Russia seems likely to face great challenges in developing low-carbon energy at scale. The first post-invasion sanctions prompted Russia's government to announce new support for its traditional energy industry rather than aiding new industries.²¹¹

These trends suggest that Russia is unlikely to make a major effort to build and deploy renewable energy to reduce GHG emissions during the next 5–10 years. The greatest opportunity for Russia could well be in improving energy efficiency, in that the Russian economy's energy intensity—the energy consumed per unit of GDP—is high by global standards.²¹² That said, a considerable effort seems unlikely, both because Russia has excess natural gas in its domestic market and because the collapse of EU-Russia trade has reduced pressure from the EU's forthcoming carbon border adjustment mechanism, which would impose duties on carbon-intensive imports.

Notwithstanding formal statements that the energy transition poses threats to Russia's economy, the country's leaders appear to be less concerned about developing alternatives than governments in many other oil- and natural gas-exporting countries. This is likely in part because Russian policymakers argue—with some justification—that the movement away from hydrocarbons will proceed more slowly than many of their Western counterparts may expect. It might also reflect Russia's reluctance to sacrifice concrete near-term interests in pursuit of indeterminate long-term benefits.

The energy transition appears likely to have mixed implications for Russia's role in the global energy system. On one hand, Russian officials might be right, or closer to right than many climate policy advocates, in expecting the shift away from fossil fuels to continue to move slowly. STEPS forecasts a decline in the share of fossil fuels in global primary energy demand from about 80% today to 73% in 2030²¹³—a significant change, but not transformative. If global energy consumption does not meet these expectations (because governments do not fully succeed in implementing their stated policies), the fossil fuel share in the global energy system could decrease more slowly. Russia could also benefit from increased demand for nuclear reactors, nuclear fuel, and key minerals and metals.

On the other hand, financial and technological sanctions may constrain Russia's energy technology, which could limit both its traditional energy industries and attempts to develop new technologies and export products. The latter impacts will become more visible beyond the 5- to 10-year time frame, as global trade in those goods and technologies expands.

Nuclear Energy

The United States and Western governments have been very selective in applying sanctions to Rosatom and Russia's civil nuclear exports. If this approach continues, and especially if the United

States (and/or China) fails in delivering competitive products, Rosatom will likely remain in its leading position in global nuclear reactor and nuclear fuel markets well beyond the next 5–10 years. Despite some setbacks, Rosatom's exports appeared to grow following Russia's invasion of Ukraine; in December 2022, Rosatom CEO Alexei Likhachev said that exports rose 15% that year, with Rosatom's foreign order book stable at \$200 billion.²¹⁴ In 2023, Russia's nuclear fuel exports to EU countries appeared to double from 2022 levels, though this likely reflected stockpiling in the Czech Republic and Slovakia as firms operating Soviet/Russian-origin reactors worked to change fuel suppliers.²¹⁵

So far, sanctions have focused primarily on Rosatom's capability to develop future nuclear projects rather than on stopping ongoing reactor construction, such as that at the Paks II nuclear power plant in Hungary, or banning Rosatom's uranium enrichment services. The United States has also targeted Rosatom entities working outside the company's nuclear energy business, such as those working on nuclear weapons and naval nuclear propulsion systems, or working outside the nuclear sector altogether, such as subsidiaries involved in developing Russia's Northern Sea Route and other Arctic projects.²¹⁶ Nevertheless, Rosatom reported signing "an agreement on strategic cooperation" with the UAE logistics company DP World in December 2023; the agreement—not announced by DP World—is to focus on "logistic integration amongst BRICS members and partner countries."²¹⁷

Over the next 5–10 years, the United States and Western governments may improve their ability to impose sanctions on Rosatom's nuclear construction projects as well as its uranium enrichment business. Rosatom will eventually complete projects in allied countries, like Hungary and Turkey, as well as projects that involve allied contractors, like its reactors in Egypt.²¹⁸ As this occurs, allied resistance to such sanctions will likely ebb.

Yet even with limited sanctions, most Western governments interested in building nuclear power plants appear quite unlikely to contract for new Russian reactors during the next 5–10 years. As a result, once Paks II connects to Hungary's power grid in the early 2030s,²¹⁹ Rosatom will have few opportunities for new nuclear sales in the United States or Europe. That said, these markets have relatively low electricity demand growth, despite recent upward revisions to account for data centers powering artificial intelligence, and are not easy places to build new reactors (especially for Russia after 2014); Rosatom's 2020 strategy noted business opportunities resulting from growth in population, GDP, and electricity demand²²⁰—trends most evident outside the West. From this perspective, new domestically oriented US or Western reactor bans would have little impact. Russia's nuclear fuel is the greater issue.

The US executive and legislative branches are each giving growing attention to developing domestic nuclear fuel supply, including both LEU (low-enriched uranium) and HALEU. In the European Union, which has 19 operating Soviet/Russian-designed reactors in former Soviet bloc countries and Finland, Westinghouse has been working to manufacture compatible fuel assemblies since Russia's invasion of Ukraine.²²¹ (This began with efforts to supply Ukraine with fuel for its Soviet-era reactors.) However, the fuel assemblies still require enriched uranium, of which Russia is the world's leading supplier.

Rosatom will likely continue to depend heavily on exports to sustain the company, due to its limited domestic opportunities. Russia will probably experience relatively low economic growth and relatively small growth in electricity demand over the next 5–10 years as sanctions continue, which could limit domestic reactor construction as well as any increases in domestic nuclear fuel demand. Given its inability to secure new export markets that replace former markets in Europe, Russia is likely to have a large natural gas surplus during this period; thus abundant fossil fuels and high borrowing costs may further erode the competitiveness of the nuclear sector inside Russia.²²² Rosatom can replace lost Western fuel and enrichment customers only by building new reactors with supply contracts or, alternatively, taking existing supply business from other firms. Neither will be easy.

At the same time, Russia is positioned to benefit from greater global demand for low-carbon electricity. Because it offers services through the entire nuclear fuel cycle, Rosatom can be an attractive partner to newcomers and established nuclear countries requiring specific services alike.²²³ Rosatom can also be an easier partner than the United States and some Western firms, both because its nuclear energy exports face little opposition within Russia on nonproliferation or environmental grounds, and because Russia's parliament reliably supports government initiatives in this and other areas.

Rosatom also benefits from the full backing of the Russian state. Senior Russian officials and diplomats play a key role in marketing Rosatom's services abroad; deals with Rosatom often follow from bilateral framework agreements encompassing wider cooperation, both economic and military. And Rosatom has thus far been able to provide loans backed by Russia's sovereign wealth fund. In Bangladesh, for example, Russia is reportedly financing 90% of the costs of the \$12.65 billion Rooppur nuclear power plant.²²⁴

Rosatom may face some challenges, too. First, some governments might come to see Russia as an unreliable supplier, or alternatively to consider long-term nuclear fuel supplies as a source of dangerous leverage. Second, Rosatom may struggle to manufacture or obtain all the parts that it needs. Many nuclear plant systems—such as turbines, valves, and control systems—might suffer from the same import dependence seen in Russia's fossil fuel industry. Public reports on Rosatom's supply chain are scarce. Next, Russia's nuclear industry could confront increasing competition from the United States and others if firms succeed in selling new small modular reactors—and from China regardless of whether this is the case. Finally, it is unclear how generous Rosatom can be with its future financing.²²⁵

Minerals and Metals

The challenges to Russia's mining industry over the next 5–10 years will likely be similar to those confronting its leading extractive industry—fossil fuels.

Like Russian oil and gas, Russian mining is highly dependent on Western technology. In the coal industry, the average share of imported equipment at mines in Russia jumped from 54% in 2012 to 79.3% in 2019; analysts see broadly similar trends in other mining sectors.²²⁶ Since February 2022, Western firms like Caterpillar, General Electric, Hitachi, and Komatsu have stopped supplying production equipment and parts to the Russian market.²²⁷ Sourcing equipment domestically or from China will take time, and industry representatives expect Russian mining to become less efficient in the interim. Meanwhile, firms including Nornickel have reportedly hired larger equipment repair teams during a period of “explosive growth in demand for blue-collar workers.”²²⁸ In spring 2022, officials at Rusal indicated that equipment supplies could delay some investment projects.²²⁹

Transportation is a second problem for Russia's mineral and metal exports. Like coal, these bulk commodities compete for access to Russia's rail system. Some of Russia's metallurgy industry is geographically isolated, in some cases as a legacy of former Soviet leader Joseph Stalin's program to relocate and develop strategic industries during and after World War II. Norilsk—the home of Nornickel—was largely constructed by prewar political prisoners and enslaved postwar forced migrants. In addition to Soviet soldiers freed from German prison camps, these included deportees from new Soviet territories in the Baltic region and central Europe, among them, reportedly, all the students from a western Ukrainian girls' school.²³⁰

Though the share of metallurgical exports going to Asia rose from 10–20% before the war to over 50% by fall 2022, Russia's Ministry of Industry and Trade estimates it will take eight years for Russia's metallurgy industry to adapt to sanctions and reorient exports to Asian markets.²³¹ In addition to rail

congestion, Russia must also contend with a lack of sufficient capacity in its Far East ports, which has forced much more costly shipping to Asia from the Black Sea.²³² Worse for Russia, many developing countries have high tariffs on metals to protect domestic producers.²³³

Financing is another problem. Russia's domestic demand for some of the specific minerals and metals needed in renewable energy systems is too low to justify investments in new production. In Russia's wartime fiscal environment, the Kremlin and the Russian Finance Ministry may have higher priorities, so that Russia's capacity to exploit rising demand for clean energy systems could be limited. Tough financial conditions at leading mining and metallurgy firms will also limit investment.

In general, Russia is likely to see a growing gap between its resource sector ambitions and the financial resources needed to pursue them. Russia has been increasing its mineral extraction tax to recover federal budget revenue lost in other areas, both during the COVID-19 pandemic and after its invasion of Ukraine.²³⁴ In April 2022, metal producers' concern that Russia's invasion of Ukraine would harm exports prompted calls to reverse some taxes.²³⁵ Russia has instead imposed new taxes, including a new export duty that went into effect on October 1, 2023.²³⁶ This will presumably constrain Russian companies as they make new investment plans.

6. Implications for the United States

Russia's changing role in the global energy system, including its possible further evolution over the next 5–10 years, has important and wide-ranging implications for the United States and for US policy. The analysis below looks at four broad areas where Russia's changing global energy role will likely affect the United States and should inform US policy:

- Russia's economy, politics, and stability
- Russia's global relationships and influence
- US allies
- Sanctions

Russia's Economy, Politics, and Stability

The United States and its allies have sought to damage Russia's economy to impose consequences for its invasion of Ukraine and, if possible, to force Russia's leadership to abandon the war. Despite these efforts, Russia's economy contracted by only 1.2% in 2022 and grew 3.6% in 2023.²³⁷ The IMF forecasts 2.6% growth in 2024.²³⁸ Australia's Lowy Institute projects that Russia's 2030 GDP (purchasing power parity) will grow to \$5.951 trillion.²³⁹ Compared to the World Bank's figure of \$5.33 trillion in 2022,²⁴⁰ this implies an average annual growth rate of slightly more than 1.35%—stagnation, to be sure, but unlikely to compel Russia's president to reevaluate his decision, and unlikely to drive his removal by others who would do so.

In the nearer term, many warn that Russia's economy could see renewed inflation due to expansive government spending; in early 2024, the Bank of Russia (Russia's central bank) stated that "current inflationary pressures are gradually easing but remain high."²⁴¹ In December 2023, central bank governor Elvira Nabiullina more colorfully warned that "if you try to drive faster than the car's design allows and step on the gas as hard as you can, then the engine will overheat sooner or later and we won't get far. We might go fast," she added, "but not for long."²⁴² The Bank of Russia has also pointed to growing labor shortages.²⁴³

Even so, current inflation expectations also do not appear likely to threaten Russia's economic and political stability, especially if Russia's government is able to compensate important political and social groups while repressing its critics. As in the past, Russia's energy wealth will likely serve as an important source of revenue in managing any economic or social tensions that could emerge over the next 5–10 years. Russia will continue to "muddle through."²⁴⁴

From this perspective, global energy prices—especially oil prices—will be extremely important to the Russian government's success in managing the economic and financial pressures it faces. Sustained low oil prices during the 1980s contributed very significantly to the Soviet Union's eventual collapse.²⁴⁵ While Western officials have sought to impose similar costs (though milder) through the oil price cap, global

markets have largely adjusted to this effort.²⁴⁶ The United States government has only very limited tools available to influence oil prices continuously for several years, especially considering market feedback mechanisms and the interests and capabilities of other major oil producers, like Saudi Arabia (and other governments owning national oil companies), which typically seek higher rather than lower prices.

Indeed, if US leaders hoped to apply this broad-based market pressure without a global recession, it would require a major diplomatic effort to encourage other oil exporters to increase their output (and to accept lower prices). This in turn is unlikely to succeed without difficult domestic decisions to provide stronger incentives to those governments to accommodate US preferences. Support from other major oil consumers—including China, which imported over three times more crude oil from Saudi Arabia than the United States in 2022²⁴⁷—could also be quite important. Thus, the necessary components of such a strategy make it implausible, though not impossible.

The United States is in a somewhat stronger position in LNG markets, where the United States is a top exporter with additional export capacity. Expanded US production and exports could deny markets to Russia, especially in Europe, Japan, and South Korea. If natural gas demand peaks around 2030 as the IEA forecasts in STEPS,²⁴⁸ the rapid expansion of US exports (and continued efforts to block or delay Russian LNG projects) could weaken the commercial rationale for further Russian LNG development.

Russia's coal, mineral, and metal exports are as important in supporting domestic supply chains and maintaining employment as they are in generating economic activity and government revenue. In addition, these exports probably have disproportionate political impact due to their role in supporting monotowns. Nevertheless, like Russia's oil and natural gas exports, these products are important to global markets and establish complex interdependencies even when US and allied firms do not invest in or import them. For example, on top of their wider economic impacts, lower global steel and nickel supplies, and higher prices, could slow efforts to develop renewable power systems and electric vehicle batteries, potentially sustaining higher oil and natural gas consumption and prices for a longer period.

While Rosatom's \$200 billion in orders sounds impressive, the company's 2020 return on sales was 13% and its return on assets just 3.32%;²⁴⁹ its work is very capital-intensive. Spreading 3.32% of \$200 billion (\$6.64 billion) over many years or more makes clear that Rosatom's profits and tax-generating capacity are quite limited in comparison with Russia's oil giants. Yet Rosatom's geopolitical role could be quite significant in building deep and enduring relationships, especially in the Global South.

Absent signs of Russian plans to cut off enriched uranium supplies, an orderly US and Western transition away from Rosatom's nuclear fuel seems more important than targeting Russia's uranium enrichment business. Washington and allied capitals might be increasingly able to target Rosatom's reactor sales, yet doing so without offering competitive alternatives risks yielding these opportunities to China's burgeoning nuclear industry. Failing that, Chinese firms might build fossil fuel power systems instead; some Western-led international institutions and Western investors are unwilling to finance these, but Chinese competitors have no such concerns. Considering this, more determined US attempts to facilitate sales of US-manufactured nuclear reactors, fuel, and related services could serve multiple American objectives.

Russia's Global Relationships and Influence

Russia's invasion of Ukraine severely damaged its relationships with the United States and most US allies, especially America's NATO allies. This was most consequential in the EU, which had a much larger prewar trade relationship with Russia than America. Indeed, Russia's share in the EU's external trade has fallen by at least half since 2021.²⁵⁰ In 2020, the EU was Russia's largest trade partner and accounted for 37.3% of Russia's goods trade.²⁵¹ In 2021, roughly two-fifths of this trade, or €98.9 billion,

was in “mineral fuels”—oil, oil products, natural gas, and coal.²⁵² Prior to the war, this relationship provided Russia, the EU, and EU member governments with mutual leverage that has diminished sharply in parallel with their commerce.

Yet Russia’s foreign trade, in energy and in other products, has not stopped, notwithstanding various disruptions in volumes, prices, transportation, destination, and payment. This suggests that Russia is in the process of developing new economic relationships that could also provide mutual influence. Most notable are Russia’s relations with China and with India.

In China’s case, Beijing appears to have gained more from the growth of Russia-China ties than Moscow. This imbalance arises partly from Russia’s desperate search for new natural gas export markets and China’s considerable price-setting power. It also arises from wider dependencies, such as Russia’s reliance on China for imported consumer goods (to replace those previously imported from the EU),²⁵³ microchips and other high-tech products,²⁵⁴ and dual-use or military goods, like the small drones used in ever-increasing quantities on Ukraine’s battlefields, though Beijing has reportedly tightened controls over drone exports following US complaints.²⁵⁵

In India’s case, Russia’s oil-dominated exports to India totaled \$40.5 billion for April through November 2023, 54.8% above the same period in 2022. India’s exports to Russia grew 46.2% to \$2.7 billion.²⁵⁶ For reference, India’s total goods imports and exports in 2023 were \$668 billion and \$432 billion, respectively.²⁵⁷ Thus Russia’s oil remains a modest though strategically important share of India’s overall imports, as well as a value-generating one, given India’s refining and resale of Russian crude oil.

From a US perspective, a larger question is whether India’s booming trade with Russia will facilitate greater trade in arms or other items with military applications. India has reportedly issued guidelines restricting military-related exports to Russia,²⁵⁸ though some analysis suggests that Russia might be buying back some components previously sold to India.²⁵⁹ So far, India seems to have granted greater priority to accommodating US preferences than to commercially exploiting Russia’s military needs.²⁶⁰ India will decide its future approaches within the context of overall US-India relations at the time.

Russia’s energy industry, including its energy-related mining companies, may have greater influence in markets smaller than China’s and India’s, where Russia’s proportionate contribution is greater. Russia has been especially active in Africa’s mining sector and has also signed 20 civil nuclear cooperation agreements on the continent.²⁶¹ Fossil fuels comprise about 20% of Russia’s exports to Africa, with ores making up around 9% of Russia’s imports from Africa. (The largest share of imports and exports are food and other agricultural products.)²⁶² This suggests that Washington would do well to be attentive to Russia’s efforts at outreach to the Global South, including its energy outreach and to unintended consequences of US and Western policies toward Russia for countries in the Global South, including energy-related price inflation. US officials and the Congress should similarly consider what alternatives America can offer these countries—or at least some of them—to deepening economic engagement with Russia (and, of course, with China).

US Allies

Russia’s reliance on energy-related revenue may be a source of vulnerability, but energy-related exports are at best a point of mutual vulnerability, in that removing them from global markets reduces supply, increases prices, and possibly deprives some importers of expected shipments. Thus, US and Western economic sanctions and Russia’s resulting restructuring of its fossil fuel exports have had unavoidable consequences for Western economies, particularly European economies, including spikes in natural gas prices²⁶³ and electricity prices,²⁶⁴ shuttered factories,²⁶⁵ and massive government spending to mitigate the effects of these consequences on households and businesses.²⁶⁶ US and Western reliance on Russia for uranium, enrichment services, and nuclear fuel poses similar dilemmas.²⁶⁷

Despite the tendency to see Russia and US policy toward it within a European frame, it is important to recognize that US allies in Asia are also experiencing significant economic effects from Russia's invasion of Ukraine. LNG prices in Asia soared in 2022 and spiked during August that year at over \$54 per million metric BTUs—or 10 times (relatively low) pre-pandemic prices.²⁶⁸ Among other consequences, the price spike created a financial crisis at Korea's government-owned utility, KEPCO, which had amassed \$154 billion in debt by fall 2023, in part due to efforts to shield consumers from vastly higher fuel costs. The company is selling various assets, including real estate, to cover some costs.²⁶⁹ Japan also confronted problems related to LNG availability and prices in 2022, including over 30 bankrupt electricity retailers and blackout fears.²⁷⁰

Japan and South Korea are extraordinarily dependent on imported energy; Japan imported 89.8% of its total energy supply in 2022,²⁷¹ while South Korea imported 85.1% that year.²⁷² Japanese companies have invested heavily in Russian oil and gas projects to diversify away from their considerable dependence on imports from the Middle East.²⁷³ Japan's government has resisted divestment from Russian fuel, on both energy security and economic grounds.²⁷⁴ It is thus unsurprising that Japanese officials have expressed concern over the Biden administration's recent suspension of US LNG export permits, which could affect Japan's mid- to long-term energy security.²⁷⁵

These realities have encouraged American and other policymakers to be cautious in their efforts to use energy-related sanctions to inflict economic pain on Russia. Sensitivity to mutual dependence was one motive behind the G7–European Union oil price cap, a policy intended to permit continued Russian oil exports but to force a lower price.²⁷⁶ Given the relative inelasticity of uranium and nuclear fuel supplies, policymakers have been even more careful in targeting Russia's nuclear exports; the United States and some European countries continue to import Russian enriched uranium.

Amid US efforts to delay Russia's new Arctic LNG projects by blocking financing and technology exports, and with the IEA projecting peak global natural gas demand sometime in the early 2030s, LNG exporters in the United States and Qatar are striving to develop new projects to meet rising global demand. US LNG projects could help America's allies in Europe and Asia replace existing Russian LNG supplies with US LNG, and could further complicate Russia's efforts by raising questions about the marketability of planned Russian LNG production. Under the circumstances, constraining US LNG exports appears to work against America's strategic interests in applying continued pressure to Russia's economy.

Similar logic applies to US oil exports. While investors and energy companies will ultimately decide how much oil to produce and refine in the United States, supporting additional US oil exports encourages other oil exporters, including Russia, either to accept lower prices or to reduce export volumes to sustain prices. Conversely, constraining US oil exports reduces this pressure on Russia's government while also allowing Moscow greater scope to exploit its oil exports as an instrument of geopolitical influence.

Perhaps most important, maintaining unity among US allies in Europe and Asia is more important to continued pressure on Russia (and to dealing with China) than any specific additional penalty that the United States might plausibly impose on Moscow. One of Russia's most promising pathways to victory in Ukraine is to encourage and exploit divisions within the countervailing Western coalition. Considering what is politically and economically sustainable in America and in allied countries should thus be a core task in this enduring confrontation.

Sanctions

On February 24, 2022, President Biden spoke following initial US and Western economic sanctions on Russia, including Russia's ban from the SWIFT international banking network. "The sanctions we imposed exceed anything that's ever been done," he said, and later told reporters, "let's have a

conversation in another month or so to see if they're working."²⁷⁷ Approximately three weeks later, Biden described these and further economic sanctions on Russia, coordinated among the G7, NATO, and the EU, as a "crushing blow" to the Russian economy.²⁷⁸ While Russia's economy contracted slightly in 2022, there is little evidence to suggest that economic sanctions crushed, will crush, or indeed can crush Russia's economy, especially without costs to Western economies.

This is not to say that sanctions have not damaged Russia's economy. Russia's energy sector has suffered in many ways, including short- to medium-term disruption of its trading relationships, decreased investment, higher taxes to compensate for Russian federal budget shortfalls, and reduced access to Western technology. Notably, President Putin has suggested that Russia could abandon its flat tax in favor of a progressive tax that would impose a greater burden upon "legal entities and individuals who earn more" while reducing costs for "large families."²⁷⁹ But Russia's energy sector and wider economy continue to function; Russia is accepting higher costs and greater inefficiencies and, where possible, pursuing ways to mitigate them. Russia may not have access to the best technologies or approaches, but it has been finding solutions that are good enough, at least for now.

Over time, Russia might succeed in managing these problems in some or even many areas. Other problems could compound. One critical question is whether Russia and its remaining trading partners can develop viable substitutes for Western technologies; as time passes, it becomes increasingly probable that they can. If Russia can develop these substitutes indigenously, its economy will be stronger for it. If not, the potential consequences could be those described by Vladimir Putin in a 2018 address to Russia's parliament:

The speed of technological progress is accelerating sharply. It is rising dramatically. Those who manage to ride this technological wave will surge far ahead. Those who fail to do this will be submerged and drown in this wave.

Technological lag and dependence translate into reduced security and economic opportunities of the country and, ultimately, the loss of its sovereignty. This is the way things stand now. The lag inevitably weakens and erodes the human potential. Because new jobs, modern companies and an attractive life will develop in other, more successful countries where educated and talented young people will go, thereby draining the society's vital powers and development energy.²⁸⁰

After Vladimir Putin's decision to invade Ukraine, Russia is less likely to escape the "technological lag and dependence" that existed 2018, when Putin made this statement, and in 2022, when he started the war. The flight of scientists²⁸¹ and technology workers²⁸² since Russia's invasion of Ukraine further exacerbates this. Recognizing the continued leakage of some Western technology into the country, Moscow seems to be partially exchanging the Russian economy's reliance on Western technology for reliance on Chinese technology, while simultaneously accepting and enduring conditions that will complicate Russian efforts to develop home-grown technologies in energy and other fields.

This situation could have decidedly mixed consequences for the United States. Many Russian technologies will lag their Western counterparts, contributing to continued relative weakness in Russia's economy and society. Yet in a period of escalating US-China competition, deeper Russian dependence on China—not only for technology but also for consumer goods, energy export earnings, and other imports and exports—does not serve US interests. On the contrary, in managing its parallel competition with China, Washington could probably find more opportunities in greater Russian strategic independence, especially as Russia's current president approaches and eventually reaches the end of his career.

7. Conclusion

Russia has and is likely to retain a major role in the global energy system for some time. The United States and its allies have succeeded in imposing significant costs on Russia's energy sector, and on Russia's economy, but have been unwilling to prevent the country's exporters from selling their energy resources—including not only its oil and gas, but also enriched uranium—because Russia's energy is necessary to maintain supply/demand balances at acceptable prices. Efforts to limit Russia's revenue without constraining its exports have had only mixed success.

The United States has additional options in seeking to damage Russia's energy sector and to raise the costs for Russia's economy. Nevertheless, pursuing these approaches—especially as they become increasingly impactful—forces policymakers to confront the same dilemma that America faces in its military support to Ukraine: the more damaging the policy, the more likely that Moscow will seek to respond, even at potentially high costs to Russia's interests. Vladimir Putin is unlikely to see existential economic threats as fundamentally different from existential military threats—what is existential is existential, regardless of the means involved. In such circumstances, because Russia's economy is far smaller than America's, or the EU's, and this limits Russia's leverage, Kremlin decisionmakers are unlikely to act strictly symmetrically.

Putin's decision to invade Ukraine has been quite costly for Russia and is certain to be more costly before it concludes. In addition to economic damage and high casualties for Russia's military, Russia's wartime imperatives are forcing deepening dependence on China, which has already extracted considerable concessions from Moscow in providing a market for Russian gas. How deep this dependence becomes, and with what consequences, could have profound consequences for the United States and its allies and deserves close and continuing attention.

America's theory of victory in the Western-Russian confrontation over Ukraine also deserves serious scrutiny. Today, US strategy appears to rely upon using economic pressure to create political pressure for Russian capitulation or at least significant Russian concessions. Implicit in this approach is the assumption that economic pressure will become political pressure and that the United States can impose sufficient economic pressure to push Russian society across an invisible threshold beyond which Russia's citizens are no longer willing to accept continuing sacrifices.

This logic has a serious flaw, however, in that Russians' willingness to endure the war's costs does not depend on the costs alone; Russia's citizens will view those costs inside the wider context of the war's purpose. Vladimir Putin has so far largely succeeded in defining his war of choice as a war of necessity—an essential struggle to preserve Russia as an independent major power in the international system. Regardless of which new energy sanctions the United States and its allies impose, successfully translating the war's costs into substantial political opposition will be quite difficult without undermining this narrative.

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