CHAPTER 9

Energy Sector

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Highlights

- The energy sector contributes significantly to Russia's economy, supports its competitiveness, and shapes the country's internal political economy and foreign relations.
- Russia's high energy and emission intensities reflect the country's advantage as owner of vast fossil fuel endowments and high energy consumption needs as well as its legacy of Soviet-forced industrialisation and post-Soviet economic policies, which tend to support energy production and keep domestic energy prices at relatively low levels.
- Management of the energy sector is still dominated by the government, particularly in the natural gas sector, although the country has introduced reforms aimed at increasing efficiency and the role of market-based principles.

The chapter is based on the work completed during the author's sabbatical from the OECD. The views expressed in this chapter are solely those of the author and do not implicate the OECD or its Member States.

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- In the period leading up to Russia's invasion of Ukraine in February 2022, the implications of an imminent global energy transition for Russia could arguably be seen as both a cause of concern and an opportunity.
- Following the invasion, it is hard to see how Russia will be able to maintain its position as a key energy exporter, let alone become a key shaper of the global debate on combating climate change.

9.1 Introduction

This chapter starts with analysing the trends in energy consumption and CO2 emissions in Russia (Sect. 9.2). Next, it sketches the contours of Russia's policies in the energy sector (Sect. 9.3) before presenting the trends in Russia's production, consumption, and external trade of different fuels and outlining the key economic and institutional features of Russia's principal energy subsectors (natural gas, oil, coal, and electricity generation) (Sect. 9.4). Section 9.5 discusses the implications of a global transition to a low emissions economy for the Russian energy sector and, in this context, discusses Russia's opportunities and challenges as well as its strategic approach to tackling climate change, and Sect. 9.6 consequences of Russia's aggression onUkraine. Section 9.7 presents conclusions.

9.2 Energy Consumption and CO_2 Emissions

In 2019, the generation of USD 1000 worth of global gross domestic product (GDP) was on average associated with the consumption of about 1 billion calories of primary energy (equivalent to 0.7 barrels of oil) (see Box 9.1) and with about 255 kilogrammes of CO2 emissions.[1] This was approximately four to five times less than four decades earlier, illustrating significant reductions in energy and emission intensity of output (Fig. 9.1).

In the same period, global per capita energy consumption has actually increased (Fig. 9.2). The corresponding figures for Russia show even steeper reductions—albeit from much higher initial levels—but also that the country's energy and emission intensities are currently still 64% and 48% higher, respectively, than the world averages. Per capita consumption of primary energy in Russia is almost triple the world average.[2]

[1] This calculation is based on BP (2021), which shows the world economy consumes daily 380,779 trillion calories of primary energy, which is equivalent to some 260 million of barrels of crude oil, and that it emits 94 million tonnes of CO2. The world GDP data used for the calculation is in international dollars at purchasing power parities.

[2] Note that the category 'consumption' is not restricted to final consumption by individuals but also includes demand from downstream sectors such as industry, residential, services, transport, and agriculture.

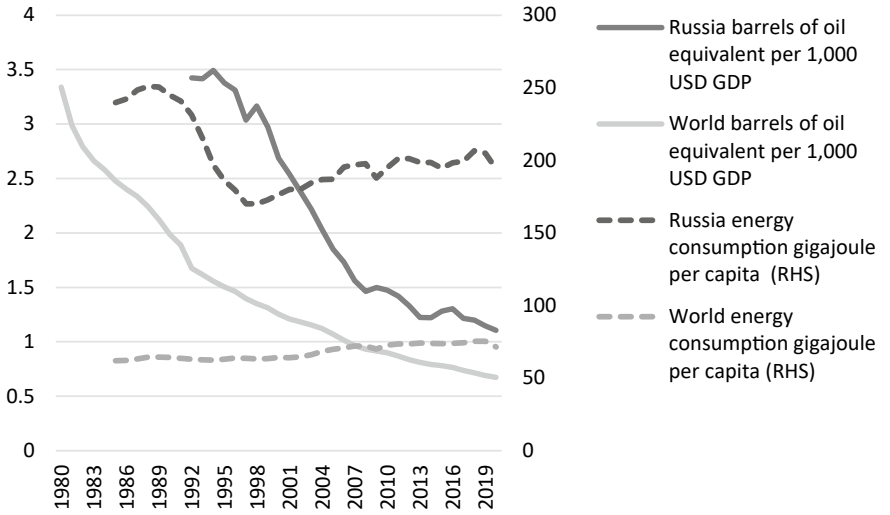

Fig. 9.1 Primary energy consumption per unit of GDP and per capita, world economy and Russia, 1980–2020 (*Source* Author's calculations based on IMF's World Economic Outlook, October 2021 for world GDP in purchasing power parity international dollars and BP [2021] for world's primary energy consumption)

In Russia, the relatively high energy and emission intensity reflect several unique factors, such as Russia's advantage as owner of vast fossil fuel endowments, its high energy consumption needs due to its large territory and harsh climatic conditions, its legacy of Soviet-forced industrialisation (see Chapter 4), and the post-Soviet economic policies which tended to support energy production and kept domestic energy prices at relatively low levels. The production, distribution, domestic use, and export of energy resources have indeed played an important role in the Russian economy and society for a long time, and energy still contributes significantly to the country's GDP, budget revenues, and export receipts (Fig. 9.3).

Note that the contribution of the energy sector to GDP, employment, and other economic aggregates depends on how the sector is defined. For example, while the estimate of the GDP contribution of the energy sector (mining, quarrying, electricity and gas, steam, and air conditioning supply systems) from the Federal State Statistics Service (Rosstat) was 14% in 2019, some estimates posit contributions of around 20–23% (Mitrova & Yermakov, 2019).

Access to relatively inexpensive energy is supporting the competitiveness of Russia's non-energy sectors, such as, for example, metallurgy or chemicals (European Commission, 2020). Proceeds from energy extraction and their concentrated distribution play an instrumental role in Russia's internal political economy (Kolesnikov & Volkov, 2021). The country's leading position

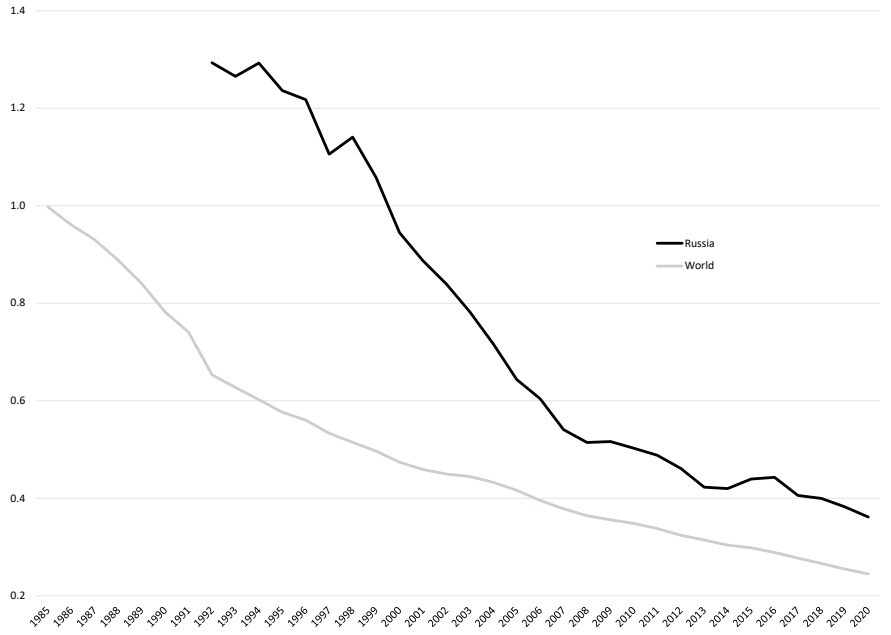

Fig. 9.2 CO2 emissions, per USD 1000 of GDP, world economy and Russia, 1985–2020 (*Source* Author's calculations based on IMF's World Economic Outlook, October 2021 for world GDP in purchasing power parity international dollars and BP [2021] for CO2 emissions)

as a top energy exporter, particularly to Europe and the former Soviet Union (FSU), has also been often used as a leverage in its foreign relations.

These realities might continue for some time but there are two major factors that are likely to cause reductions in demand for Russian fossil fuels, perhaps even in the most immediate future. These are the international policy responses to climate change (Sect. 9.5) and Russia's large-scale military aggression of Ukraine in February 2022 (Sect. 9.6).

Box 9.1 Definition of Primary Energy

Primary energy is defined in this chapter after BP (2021) as energy comprising commercially traded fuels, including modern renewables used to generate electricity. It includes oil, natural gas, coal, nuclear energy, and hydroelectric energy as well as renewables used to generate electricity such as solar and wind power. More generally, primary energy is defined as the energy which is extracted or captured and separated from other materials (e.g., coal from rocks), but not further processed. To avoid double counting, it is distinguished from secondary

energy which comprises all sources of energy that result from the transformation of primary and secondary sources (e.g., electricity generated from natural gas).

9.3 Overview of Russia's Policy Framework Relevant to the Energy Sector

Economic efficiency is an important consideration in energy policies across the world because, under conducive conditions, market-based interactions between suppliers and consumers of energy help determine its true economic and social value and thus the socially optimal levels of its production and use. However, energy is also a strategic resource, and energy markets are subject to market failures. The extent of state intervention in energy markets across the world is considerable, including through state ownership or control of key energy companies, subsidies, and regulations, which affect the costs and prices of different fuels across local and international energy markets.

Three decades after the breakup of the Soviet Union, Russia still presents a state-dominated approach to the management of its energy sectors, although it has also introduced several reforms aimed at increasing efficiency and the

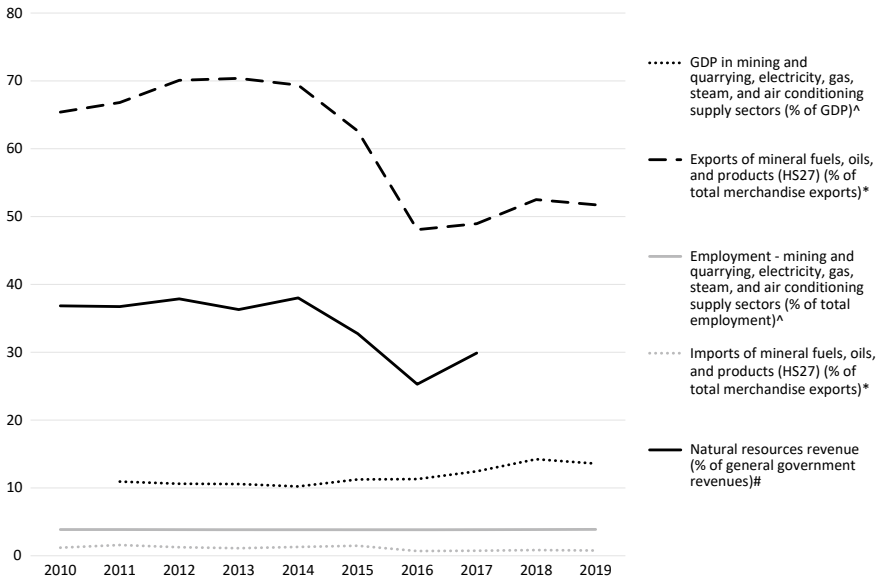

Fig. 9.3 The energy and related sectors and the Russian economy—selected indicators (*Sources* ^Federal State Statistics Service [Rosstat [2020]; *WITS [2021]; #NRGI [2021])

role of market-based principles. Market-oriented initiatives emerged in the 1990s and intensified in the 2010s, with gradual deregulation and the expansion of the share of producers independent from the state in the total volume of domestic sales of natural gas as well as reforms of the taxation of extraction and exports of energy products. However, a host of monopoly rights, the taxation of exports, and regulated prices, particularly in the natural gas sector, remain an important mechanism influencing the production and consumption of energy and continue to exercise a downward pressure on domestic energy prices. This likely leads to its suboptimal use by households and industry and introduces distortions in downstream economic sectors.

Similar to other countries, the range of policies used in Russia to shape the economic performance and social contribution of its energy sectors is wide and includes the statutory rights (and obligations) of natural monopolies, competition regulations, the tax regime, and government support.

Systemic aspects of the energy sector, such as the transmission of oil and gas products via trunk pipelines as well as natural gas transportation using pipelines, services on the transmission of electric power and heat energy, and natural monopolies are strictly regulated and many key players in this sector are state-owned or otherwise state-influenced. At the time of writing of this chapter, the following companies fall into the category of natural monopolies[3]: Transneft (transportation of oil through pipelines), Transnefteprodukt (transportation of oil products through pipelines), Gazprom (production and transportation through pipelines of natural gas), and Inter RAO (electricity). Natural monopolisation is most prominent in the gas subsector due to Gazprom's leading position in the production and export of natural gas and its statutory ownership and control of the Unified Gas Supply System (UGSS)—the world's largest gas transmission system (see also Sect. 9.5.1).

The implementation of laws related to natural monopolies, the regulation of prices for certain energy goods and services (e.g., gas and electricity tariffs), and foreign investments in business entities deemed strategically important in terms of national defence and state security are entrusted with the Federal Antimonopoly Service (FAS). The FAS ensures compliance with antimonopoly regulations at all levels of economic activity, including in the energy sector, and it also plays an active role in the process of developing policies in which it promotes competitive behaviour in the sector. Past cases investigated by the FAS concerning the energy sector include, for instance, incidents in which Gazprom was found to have violated competition law through its stock exchange activities, through its indexing of tariffs on gas transportation for independent producers, or by creating a competition-restricting environment (European Commission, 2020).

[3] Federal Law of 19 July 1995 '*On Natural Monopolies*', as amended, available at: http://pravo.gov.ru/proxy/ips/?docbody=&nd=102037075&intelsearch=%CE+%E5%F1%F2%E5%F1%F2%E2%E5%ED%ED%FB%F5+%EC%EE%ED%EE%EF%EE%EB%E8%FF%F5, accessed on 16 March 2020.

Accounting for about one-third of the federal budget revenue, energy taxation is an important source of public revenues, but it is also an instrument used to shape the sector's development and the domestic prices faced by consumers. Taxes applying to the energy sector include royalties (such as the mineral extraction tax [MET], with different tax rates applicable to different resources and a complex range of coefficients and parameters), an additional income tax on hydrocarbon extraction (introduced to support the exploitation of low-margin areas yielding oil, gas, and liquefied natural gas [LNG]), corporate profit tax, value added tax (VAT), excise duties, and export taxes.

Being a large net exporter of energy and a country which has relied on energy for its economic and social development, it is not surprising that the taxation of energy in Russia has traditionally focused on exports. The reforms proposed in the late 2010s[4] and known informally as the 'tax manoeuvre' with a view of improving Russia's budgetary situation have however aimed to gradually equalise the tax treatment of domestically consumed and export-oriented oil products by decreasing export taxes and increasing the MET (Khrennikova, 2018). Before the COVID-19 pandemic, major elements of this reform were still to be implemented and the current policies related to the taxation of energy exports seemed to continue to exercise a downward pressure on domestic energy prices across the different energy sectors (European Commission, 2020). The pandemic, which caused a temporary collapse of world oil prices and led to a significant budget deficit in Russia, triggered the largest tax reform in the oil and gas industry since the early 2000s, which resulted in abolishing a number of MET benefits and a more rapid transition to a sales-revenue-based system.

The energy sector is also receiving state support promoting the development of the sector, in particular, in the form of budgetary grants and allocations specified in the national Energy Development Programme. In the most recent version of this programme, which covers the period 2013–2024, budgetary allocations amounted to the equivalent of USD 2.2 billion and included project funding in areas such as energy savings and increasing energy efficiency, the development and modernisation of the energy sector, the development of the hydrocarbon sector, the restructuring and development of the Russian coal sector, and the development of renewable energy.

Adding together the direct budgetary support measures and tax benefits, the OECD (2021) estimated that the amount of annual Russian fossil fuel subsidies increased from USD 4.6 billion in 2015 to USD 17.3 billion in 2017, before decreasing to USD 9.3 billion in 2020. The bulk of these subsidies was in the form of reduced extraction taxes for oil depending on

[4] The reforms were part of a revival plan accepted by the State Duma in May 2018 which defined broad economic development goals up to the year 2024 inclusive (see: http://en.kremlin.ru/events/president/news/57425). The original announcement is available at: https://minenergo.gov.ru/view-pdf/11246/84473, accessed on 2 September 2019.

the specific properties of the subsoil deposit exploited or on the production properties, benefitting mainly large oil producers.

Defining state support more broadly as the amounts that energy producers benefit from being able to sell energy products at too high prices (producers' support) and the amounts consumers receive buying at too low prices (consumers' support), the IMF estimated the amount of the subsidies to fossil fuels in Russia at USD 551 billion in 2015, which made it the world's third largest subsidiser (after China with USD 1432 billion and the United States with USD 649 billion) and the world number one when it came to subsidies per capita (USD 3832 per capita) followed by Saudi Arabia (USD 3709) and the United Arab Emirates (USD 2452) (Coady et al., 2019).

9.4 Russia's Energy Mix

In 2019, Russia was the world's third largest primary energy producer, accounting for 11% of global energy production, after China (19%) and the United States (16%) (BP, 2021).

It was the second largest producer of both natural gas and oil (17.1% and 12.8% of global production, respectively, in both cases after the United States), the fifth largest coal producer (after China, Australia, India, and the United States) accounting for 5.5% of global production, the fourth largest producer of nuclear energy (after China, the United States, and France), and the fifth largest producer of hydroelectricity (after China, Brazil, Canada, and the United States). However, Russia was only the 61st largest producer of energy from renewable sources.

Russia's energy consumption and production mixes diverged in important ways from world averages (Fig. 9.4). Differences in production structures between Russia and the world, while still affected by consumer preferences and policies, are good indicators of differences in natural endowments (and thus of Russia's comparative advantages), while differences in consumption structures also reflect geographical conditions and policies that shape the domestic relative prices (and thus the use) of different fuels within the country. They reveal Russia's strong advantage and support policies in natural gas and oil, a steadily expanding advantage in coal, and negligible involvement in renewables other than nuclear and hydropower.[5]

9.4.1 Natural Gas

Russia harbours the world's largest proven reserves of natural gas (estimated at 37.4 trillion cubic metres in 2020, i.e., 20% of the global stock), which are located in West Siberia, mainly in the Yamal-Nenets Autonomous Okrug

[5] Whether nuclear energy and hydropower are renewable energy sources is a subject to debate.

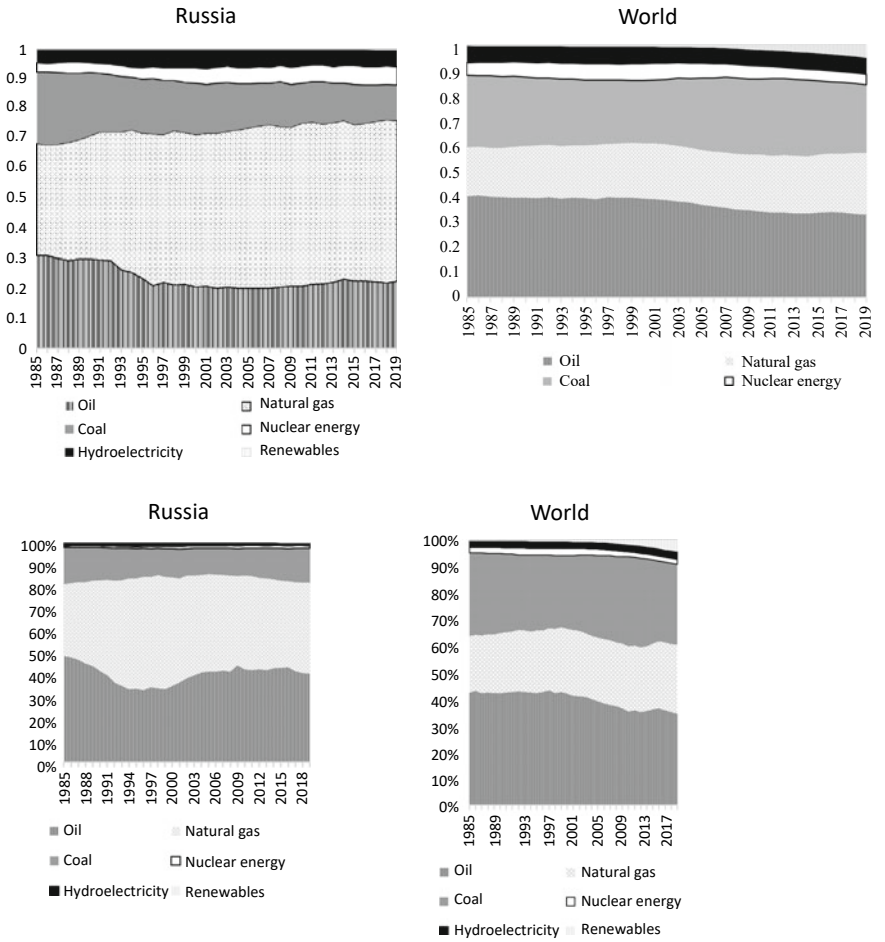

Fig. 9.4 Primary energy consumption and production by fuel: Russia and the world economy (*Note* shares calculated on the basis of calorific values. *Source* BP [2021]; author's calculations)

(District). The country's reserve-to-production ratio[6] of 58.6 years is above the world average (48.8 years). This suggests a relatively long time to the potential exhaustion of Russian gas reserves at the current rate of extraction.

In 2019, natural gas accounted for 53% of the energy consumed in Russia, which was more than twice the world average (24%). The growth in reliance on natural gas for consumption has also been more rapid than on average across the world, and it is one of the most prominent characteristics of the transformation of Russia's energy sector since the mid-1980s. The production

[6] The reserves-to-production ratio is the outcome of dividing the end-of-year reserves by the production achieved that year.

share of natural gas, at 41% in 2019, was also much higher than the world average (26%).

In 2019, Russia was the world's largest exporter of pipeline gas (44% of global exports) and the fourth largest exporter of LNG, accounting for 8.1% of the world's total. Exports of natural gas started picking up after a period of stagnation between the early 1990s and the mid-2010s, mainly due to institutional reforms in the Russian gas sector and the growing role of independent producers and LNG technology (see below).

At the beginning of the 2020s, there were more than 250 gas and associated petroleum gas mining companies registered in Russia; however, gas production has long been dominated by the majority state-owned Gazprom Group (Gazprom thereafter), which has the status of a natural monopolist in the natural gas sector. Despite a gradual deregulation and the opening of the gas market to independent companies, Gazprom accounted still for close to three-quarters of the national natural gas production. Another state-owned—but considered independent—company, Rosneft,[7] accounted for some 10% of Russia's gas production, while Novatek and Lukoil, which are both fully privately owned companies, accounted for a further 10% and 4%, respectively, of production.

Gazprom is an undisputed leader in the domestic gas market. It has been estimated that it directly satisfies almost one-half of domestic consumption while a further 30% is satisfied by other producers through the Gas Transmission System—the transportation part of Russia's UGSS—over which Gazprom maintains statutory ownership and control granted to it by the government.

The UGSS is the main part of Russia's Federal Gas Supply system. It is the world's largest gas transmission system comprising some 158,200 kms of gas trunklines and branches and 218 compressor stations, covering the European part of Russia, but excluding eastern Siberia and the Far East where gas is supplied via the regional gas supply systems.

As the statutory owner of the UGSS, Gazprom is obliged to provide access to UGSS' gas pipelines to independent gas suppliers. The latter, unlike Gazprom, which has to follow government-determined gas tariffs (see below), can supply gas to consumers at unregulated prices but are still subject to regulated gas transportation tariffs, in the setting of which Gazprom takes part[8] and which also depend on the transport routes allocated to these companies by Gazprom. In allocating routes, Gazprom is supposed to take into account the parameters and balance of the whole system and is not legally obliged to offer transport by the shortest routes to independent companies. This allegedly gives Gazprom information advantages and ultimately the ability to obstruct independent gas producers' access to the transmission and distribution facilities and influence their prices to their own advantage (Yafimava, 2015). Thus,

[7] Rosneft is referred to as 'independent', because it is not a part of the Gazprom Group.

[8] These tariffs are themselves set by the government on the basis of unique information possessed and reported by Gazprom.

in practice, Russia's gas prices and supplies are determined by Gazprom and its dominant owner—the government.

Gazprom is also by far the largest gas producer internationally, outdistancing by a factor of four or more such international players as the Royal Dutch Shell, Petro China, Exxon Mobil, or British Petroleum (BP). This leading position is clearly linked to Russia's natural gas endowments combined with Gazprom's statutory monopoly over exports of Russian gas via pipelines.

In 2020, Russia exported some 35% of its natural gas production. Europe, including Turkey and Ukraine, was a chief destination accounting for 85% of Russia's pipeline gas exports. The bulk of exports to Europe was destined for Germany (28% of Russia's total exports) and Italy (10%). Other FSU countries accounted for 13% of Russian exports, with Belarus alone accounting for 9%. Russian gas constituted 38% of total pipelined gas imports by Europe and 66% of imports by the FSU region.

9.4.2 LNG

The production and international trade of LNG are not regulated as heavily by the government as pipeline gas. Independent companies play more important roles in LNG production and exports since the 2013 amendment of Russia's Law on Gas Exports, when Gazprom no longer had a monopoly over exporting LNG and other companies fulfilling specific criteria could also do so. This has been estimated to have benefitted Novatek and Rosneft with their respective LNG projects in Sakhalin and in the Arctic but, at least for some time since the liberalisation, entry to the export market was still not possible for other market participants as they did not meet the export criteria (European Commission, 2020; Mitrova, 2013). Gazprom's share of LNG exports, estimated by the European Commission (2020) at above 20% in 2018, was already much smaller than the share in pipelined gas exports and has been gradually falling.

At least partially as a result of these reforms, Russia's LNG market developed rapidly in the 2010s. In 2020, exporting 40.4 billion cubic metres of LNG, Russia accounted for 8.3% of global LNG exports, almost triple the share in 2009 (2.7%). LNG exports accounted for 6.3% of Russia's total natural gas production—43% of Russia's LNG exports were destined for Europe; Japan and China accounted for 21% and 17%, respectively; and the Asia Pacific region as a whole accounted for 56%.

Russia's LNG exports were therefore more regionally diversified than its exports via pipelines and encompassed new dynamic centres of economic growth in Asia Pacific. The dependencies of the LNG importing countries on imports from Russia were also weaker than in the case of pipelined gas. These figures reflect both Russia's more liberal approach to the LNG segment and

stronger international competition in LNG markets as compared to pipeline gas.

9.4.3 Gas Pricing

The production, domestic consumption, and export of Russian natural gas are strongly shaped by the government through its regulation of gas prices. Price regulation reflects the role natural gas has played in Russia's economic and social development, including its impact on inflation.

Since the beginning of the 1990s, the regulation of gas prices has been a tool used by the government to limit increases in the prices paid by domestic non-industrial consumers and to shape the competitiveness of Russian downstream industries. Accounting for large shares of pipeline gas imports in Europe and the FSU, Russia also has considerable market power in these markets, and it has been using it to its advantage. Since the early 1990s—albeit to different degrees in different periods—the regulated prices paid for gas by residential consumers (household prices) have tended to be lower than those paid by industrial users (wholesale prices), and the latter have tended to be lower than export prices (e.g., European Commission, 2020; Henderson, 2011).

Russia's approach to gas price regulation has evolved significantly over the last three decades. In the 1990s, gas prices were indexed to inflation and, with the galloping inflation at the time, reached very high levels, contributing to non-payment problems.[9] The early 2000s saw a departure from the inflation-indexation and a move—at least officially—towards the conditioning of wholesale gas pricing on the costs of production and a regulated mark-up.[10] In reality, however, it is difficult to gauge whether and how economic costs were taken into account because the data and methodology used for these calculations were not public and several analyses argue that the cost-plus principle was generally not followed and that prices were set discretionally at the top political level (see, e.g., European Commission, 2020; Idrisov & Gordeev, 2017).

The late 2000s saw a further shift towards the market-based pricing principle based on the 'European netback parity', where the domestic wholesale price is calculated on the basis of the prices of exports to Europe with some discounts,[11] which were supposed to diminish over time so as to achieve equal pricing of domestic supplies and exports. The deadlines for achieving such

[9] Non-payments peaked in 1997 when Gazprom reported being paid for only 29% of its domestic sales (Henderson, 2011).

[10] Government Decree No. 1021 of 29 December 2000 on State Regulation of Gas Prices, Tariffs for Transportation Services and Fees for Technological Connection of Gas-using Equipment to Gas Distribution Networks in the Russian Federation ('Decree on State Regulation of Gas Prices').

[11] Government Resolution No. 333 of 28 May 2007 on Improvement of State regulation of Gas Prices.

parity were first set for 2011 and then for 2014 and 2017; however, these deadlines were not met and it has been estimated that, throughout the period 2010–2018, Russian export prices were over three times higher than their domestic counterparts (European Commission, 2020).

In the early 2020s, wholesale gas prices are still set according to the regulations and formula from the mid-2010s[12] based on the netback parity approach. The domestic wholesale gas price is thus calculated by first deducting the customs duties from the export price at the Russian border, the value of the costs of the transportation and storage of the gas when it is sold outside the FSU, and the difference between the average cost of transport from production sites to the border of Russia and the average cost of transporting gas from production sites to consumers within Russia. This price is scaled down further using a 'reduction coefficient'—also called a netback discount coefficient—which is supposed to ensure the downward correspondence of gas price changes with past consumer gas price changes and a price zone differentiation coefficient. This further lowers prices in individual regions, taking into account a range of factors such as different levels of socio-economic development and distance from gas production sites as well as the routing of gas flows, the costs and degree of use of alternative fuels, and the presence of independent gas suppliers (European Commission, 2020).

Since 2008, the Saint-Petersburg International Mercantile Exchange (SPIMEX) has provided additional opportunities for the organised trade of, among others, crude oil and oil products and of gas that is not covered by the government regulation of wholesale gas prices. However, the ability of this exchange to compete with the regulated market and significantly influence Russia's domestic gas prices is limited by relatively shallow competition, rigid price-setting mechanisms, the low liquidity and depth of the market, and the inadequacy of the trading infrastructure (European Commission, 2020). For example, it has been estimated that, in the late 2010s, Gazprom itself played a major role in trading gas on SPIMEX. Access of gas traded on SPIMEX to the pipeline network must be agreed upon with Gazprom at its discretion in advance of any trade being completed, thus raising questions about conflict of interests. Overall, in the late 2010s, transactions on SPIMEX constituted less than 10% of the entire domestic natural gas trade, and the prices of gas traded there usually remained some 3–5% below the administratively regulated level (European Commission, 2020).

Overall, market forces play a much larger role in gas pricing in the early 2020s than in the 1990s, but price formation is still very much influenced by the government. The wholesale gas pricing formula, which links the domestic price to the export price rather than to the actual cost of production in Russia, does not clearly factor in domestic market conditions or the commercial considerations of gas suppliers. Instead, by its construction, it creates a wedge between domestic and export prices. Importantly, the key parameters of

[12] FTS Order No. 1142-e of 9 July 2014 (as amended on 24 March 2015).

this pricing formula are determined by state-owned entities such as Gazprom based on criteria and information which do not appear transparent. Furthermore, price regulation seems conducive to non-transparent cross-subsidisation and price distortions across regions and industrial sectors and between the domestic and export sales. This is concerning both from the point of view of domestic environmental and welfare effects and the efficiency of the allocation of productive resources within Russia as well as in the context of international gas and product market distortions.

The pricing of gas used by other industries has indeed been identified as an issue when Russia was acceding to the WTO as well as in a number of trade remedy cases (Furculita, 2017).

9.4.4 Oil

Russia's 108 billion barrels of proven crude oil reserves accounted for 6.2% of the world's total reserves in 2020, making Russia the world's sixth largest oil reserve holder. Russia's production of oil in that year accounted for 13% of global production, which was the second largest share after the United States (17%) (BP, 2021).

Oil was also the second most important fuel consumed and produced in Russia, and its shares in overall energy consumption and production have been growing steadily in the last two decades. At 22%, the share of oil in Russia's energy consumption was however significantly lower than the world average (33%), while its production share was higher (41%, with 34% for the world average), revealing the export orientation of the sector.

Russia's net exports of oil have seen a significant expansion since the 1990s. The value of Russian hydrocarbon exports, and thus the overall value of merchandise exports, are strongly influenced by the international price of oil and so thus is the exchange rate of the national currency (see Chapters 12 and 16). Russia is not a member of the Organization of the Petroleum Exporting Countries (OPEC), but it has co-ordinated its oil output strategy with the organisation in order to influence international prices of oil on some—but not all—occasions. Since 2019 it has been part of the larger 'OPEC+' group and central to its many vital decisions.

In 2020, 53% of Russian oil exports were destined for Europe, 32% for China, an additional 7% for other countries in Asia Pacific, and 6% for FSU countries. As far as dependence on imports of Russian oil is concerned, shipments from Russia accounted for 98% of oil imports of the FSU, 29% of imports of Europe, and 15% of imports of China.

At the beginning of the 2020s, there were close to 300 entities licensed to produce oil and gas condensate (oil liquids) from subsoil resources, although about 83% of Russia's production was delivered by 100 entities included in

the structure of 11 vertically integrated companies.[13] In 2018, the largest shares were contributed by Rosneft (35%), Lukoil (15%), Surgutneftegas (11%), Gazprom Neft (7%), Tatneft (5%), Bashneft (3%), Slavneft (2%), Novatek (2%), and Russneft (1%). The largest oil companies that accounted for more than one-half of production were state-owned. There was also a fair amount of cross-ownership between the different state companies (European Commission, 2020).

At the beginning of the 2020s, Rosneft's major shareholder was Rosneftegaz, fully owned by the government. Gazprom Neft is a subsidiary of the majority state-owned Gazprom. Tatneft is partially owned by the Republic of Tatarstan, while Bashneft is majority-owned by Rosneft. Slavneft is a formerly state-owned company of the government of Belarus and it is currently jointly controlled by two Russian state-owned companies: Rosneft and Gazprom. Lukoil is a former state-owned enterprise which was privatised in 1993 and is currently the largest private Russian oil-producing company. Surgutneftegas, created in 1993 by merging previously state-owned companies, is a fully privately owned company. Russneft and Novatek are also privately owned (European Commission, 2020).

9.4.5 Oil Pricing

The domestic prices of oil and oil products are generally subject to supply and demand forces, although discretionary government interventions have happened fairly often. These included instances of price fixing agreements with market players, for example, in November 2018, to tame the growth of retail prices for petroleum products (European Commission, 2020).

As discussed in Sect. 9.3, and similar to other energy and mineral products, the prices of oil and oil products are also shaped by the taxes applied on the extraction or sales of these resources. They influence the competitiveness of different segments of the oil and oil products industry, for example, by setting higher tax rates on exports of crude oil than on exports of processed products. In addition, the government has the right to deploy specific fiscal instruments if the prevailing market conditions push the Urals Crude oil prices in directions that endanger the financial security of the national economy.[14] Informally, the so-called tax manoeuvre aimed to push companies to invest in refineries and reduce the amount of low-value heavy fuel oil exports while expanding high-quality diesel production to target the European market.

[13] Ministry of Energy of the Russian Federation (2018), *Extraction of crude oil*, available at: https://minenergo.gov.ru/node/1209, accessed on 1 September 2019.

[14] Urals Crude oil prices are the official benchmark for the pricing of the Russian crude oil earmarked for international markets and are used in planning budgetary expenditures and other macroeconomic indicators.

SPIMEX maintains indices for regional producers' prices for the most significant oil sites (i.e., Timan-Pechora, Volga-Ural, and West Siberia) and provides information on the prices of some oil derivatives.

9.4.6 Coal

As of 2020, Russia held the world's second largest proved coal[15] reserves, after the United States (15% of the world's total), and its reserve-to-production ratio of 407 years was almost three times higher than the world average (139).

The share of coal in Russia's domestic primary energy consumption has decreased from 24% in the mid-1980s to 11% at the beginning of the 2020s, while the world average has been hovering around 25–30%. The share of coal in Russia's total energy production has been increasing since the mid-2000s, which coincided with world trends and followed an increase in crude oil prices. Growing external demand for coal was a primary driver, as testified by a significant expansion in net exports.

In 2020, Russia was the world's third largest exporter of coal (18% of global exports), after Australia (29%) and Indonesia (27%). Asia and Asia Pacific accounted for 56% of Russia's coal exports, with China itself accounting for 18%, South Korea for 13%, and Japan for 10%. European destinations accounted together for 35% of Russian coal exports while the FSU accounted for 2%.

Several countries and regions depend strongly on coal imports from Russia. In 2020, Russia accounted for 50% of coal imports by Europe, 47% of imports by all African countries, 30% of imports by the Middle East, 22% of imports by South Korea, and 15% and 13% of imports by China and Japan, respectively (BP, 2021).

At the beginning of 2021, close to 180 coal mines were active in Russia.[16] Accounting for close to 60% of total production, the largest centre is the Kuznetsk Coal Basin (Kuzbass). Other significant coal-producing regions include Kansk-Achinsk (9% of production), South Yakutia (4%), and Pechora (2%). The industry has been almost completely privatised, with state and municipal enterprises accounting for less than 0.5% of production (Rosstat, 2018). The market is however relatively concentrated, with the largest three coal producers accounting for over 40% of total production. These are SUEK (26% market share), the Ural Mining Metallurgical Company, incorporating Kuzbassrazrezugol (11%), and SDS Ugol (6%) (Central Dispatch Management of Fuel & Energy Complex, 2018). According to estimates of the Analytical

[15] The BP (2019, p. 40) definition used in this chapter includes commercial solid fuels, i.e., bituminous coal and anthracite (hard coal), lignite and brown (sub-bituminous) coal, and other commercial solid fuels. It also includes coal produced for coal-to-liquids and coal-to-gas transformations.

[16] Ministry of Energy of the Russian Federation (2018), *Gas: About the industry*, available at: https://minenergo.gov.ru/node/433.

Center for the Government of the Russian Federation (2017), about 39% of the coal consumed in Russia was destined for coking plants and 35% for large industrial sectors such as metallurgy, cement production, and railways.

9.4.7 Coal Pricing

Similar to oil, the domestic prices of coal and derivative products, while influenced by applicable taxes, are shaped to a large extent by market forces. One additional channel of potential governmental influence is through the regulation of railway transportation tariffs. The main coal mining regions are located long distances from the nearest seaports and railways serve as the most important means of the delivery. For example, delivering coal to one of the Pacific coast ports from the Kuznetsk Coal Basin requires transportation by some 4000 kms. On average, coal and coke have average hauls of around 1500 kms, a distance on which railways are an economically preferred mode of transport (Pittman, 2011).

Railway tariffs are set by Russian authorities and coal belongs to a privileged class of commodities which enjoy relatively low transport tariffs, deemed in the literature as priced below cost and being cross-subsidised by higher tariffs for the transport of other goods (European Commission, 2020).

9.4.8 Renewables

The share of energy generated from renewable sources (nuclear, hydroelectric, wind, and solar) in consumption has increased from 8% in the mid-1980s to 12% at the beginning of the 2020s, which was quicker than across the world on average. Nevertheless, at the beginning of the 2020s, the share was still lower than the world average of 16%, indicating the potential for further expansion. Nuclear and hydroelectric energy were the principal sources of Russia's renewable energy, while wind and solar power have not increased markedly and accounted for less than 0.1% of Russia's energy consumption in 2019.

The production shares of renewable energy are even smaller. While Russia is a relatively significant producer of both hydroelectric and nuclear energy, it is actually still a net importer. The relatively low production of wind and solar energy suggests unrealised potential, especially given that Russia occupies 11% of the world's land mass (see Chapter 1 and Sect. 9.5).

9.4.9 Electricity

In 2020, Russia was the world's fourth largest producer of electricity, after China, the United States, and India, accounting for 4% of global production. The share of electricity in Russia's total energy consumption has been increasing since the 1980s, following world trends. However, it flattened in the 2010s and remains below the world average. In 2019, it accounted for 13% in Russia, as compared to 17% globally.

Russia's electric power generation sector has undergone extensive reforms since the late 1990s when the United Energy System of Russia (RAO UES; the Russian language abbreviation RAO EES), the incumbent state-controlled monopoly dominating at that time, with over two-thirds of generation capacity and almost the entire transmission and distribution network, was gradually unbundled. It was separated into regulated entities, including an independent system operator, trading and transmission systems administrators at the federal level, several distribution companies at the regional level, and market-based competitors in the generation and retail segments. The aim of the reforms was the creation of competitive wholesale and retail markets for both electricity and capacity governed by a set of market rules and procedures.

The unified national electric grid is owned by the state-owned Federal Grid Company (FGC). However, the FGC and its affiliates are prohibited from selling and purchasing electric energy, which makes them different from Gazprom, who is the main producer and trader of gas while also being the manager of the UGSS and the main implementing body of regulated gas price policies (see Sects. 9.4.1 and 9.4.2).

In the generation segment, the unbundling of RAO UES resulted in the separation and privatisation of several wholesale and territorial power-generating companies, with several of the privatised companies being purchased by foreign energy firms. These reforms are deemed to have resulted in the significant deregulation of certain market segments and in new capacity investments. However, in 2018, over 80% of power generation was concentrated among the top 10 players, several of whom were majority state-owned. These were RusHydro, in which more than 60% of shares belong to the state, Inter RAO (where the state-owned Rosneftegaz Group owns approximately 28% of shares and FGC—an additional 9%), Gazpromenergoholding (owned by Gazprom), and the state-owned Rosenergoatom, an electric power division of Rosatom (Khokhlov, 2018).

State control over the retail segment is considered less significant than in the generation segment but market concentration, due to the strong positions held by legacy companies in their historic territories, is still deemed high (Khokhlov, 2018).

In 2020, 46% of electricity was generated in Russia from natural gas (compared to 23% across the world on average), and only 16% from coal (36% across the world) and 1% from oil (3%). Nuclear energy and hydro-electric power also had relatively high shares in electricity generation, but the contribution of other renewables was minimal.

The dominance of gas as the principal fuel in the electricity sector makes Russian electricity greener than it would be if it was generated in oil or coal-fuelled power plants. At the same time, companies that generate electricity from gas and which pay relatively low regulated prices for it de facto compete for gas with more lucrative export markets. This provides an incentive

to Russian policymakers and the electric power-generating companies themselves to gradually diversify away from gas towards other, preferably renewable, energy sources.

9.4.10 Electricity Pricing

Russia has a two-tier electricity market—wholesale and retail. In the wholesale market, electricity generating companies or electricity importers supply electric power on the day-ahead market or under unregulated bilateral agreements within the same geographic zone. The wholesale power and capacity market is divided into three independent geographic zones: (1) the first price zone (Russia's European area and the Urals); (2) the second price zone (Siberia); and (3) the non-price zone (remote regions isolated from the unified energy system of Russia).

In price zones, the day-ahead wholesale market price is derived through the clearing of price bids submitted by suppliers and buyers, and thus it reflects the interaction of demand and supply as well as the structure of the given market. There are also additional regulated components which are added to the equilibrium price of the wholesale market, such as, for example, allowances for capacity or renewable energy generation. In the non-price zone, electricity is supplied at prices regulated by the FAS.

Thus, the wholesale market prices are a combination of both regulated tariffs and market forces, with market forces playing a larger role in the price zones and regulated tariffs dominating in non-price zones. In the retail market, power is supplied to industrial consumers and households at tariffs regulated by the FAS, which partially reflect the costs of system services and market conditions in the wholesale markets, but which are also differentiated by the categories of end users (European Commission, 2020).

9.5 Russia's Approach to the Challenges of Climate Change

Russia's specialisation in natural gas is a structural characteristic which, on the one hand, poses a challenge and, on the other, could turn into an opportunity. Natural gas, and particularly pipeline gas, while not as 'green' as renewables, has the lowest emissions per unit of energy obtained among the conventional fossil fuels (U.S. Environmental Protection Agency, 2021). It is envisaged as a non-negligible share of energy consumed even in scenarios with low or zero emissions. In addition, subsoil cavities, which remain after gas extraction, can be used as 'natural sinks' for the storage of captured carbon. The relatively low reliance on oil and coal sources for domestic energy consumption can also be conducive to such a transition because the direct impact on Russian consumers would be relatively small. However, the significant export orientation of these industries—and their contribution to the value of the country's overall merchandise exports—makes Russia vulnerable to climate change and

other policies adopted by major importers of its oil and coal. The relatively low levels of production of renewable energy other than nuclear and hydropower (see Sect. 9.4.8) are a definite challenge.

9.5.1 A Green Economy Transition

The global challenge of reducing CO2 and other greenhouse gas emissions is a formidable one not just for Russia. The energy sector—the source of an estimated three-quarters of global greenhouse gas emissions—is at its centre. The International Energy Agency (IEA, 2021) sets out a trajectory for the global energy sector to achieve net zero CO2 emissions by 2050 to allow limiting the long-term increase in the average global temperature to 1.5 °C.

The implications of the IEA's scenario in terms of the level and structure of the global primary energy supply in the lead-up to 2050 are shown in Fig. 9.5. The global economy transforms from one dominated by fossil fuels to one progressively led by known renewable energy technologies. In 2050, wind and solar account together for 37% of energy supplies while fossil fuels account for only slightly more than one-fifth. Some fossil fuels such as natural gas and oil, which either cannot be substituted for renewable energy sources or are not combusted when used in production, are still used at the end of this timeline. Notably, natural gas, which has relatively low emissions relative to its calorific content and has versatile applications, will account for 11% of the total energy supply in that year, while oil for 8%.

Electrification and the substitution of the direct combustion of fossil fuels for indirect use via electricity generation are two additional important elements of a green transition. Electricity generation and electrification allow reducing greenhouse gas emissions not only when electricity comes from renewable sources but also when it is generated from fossil fuels, because the transformation of fossil fuels into electric energy in specialised power plants allows for a better control of emissions.

While this is not the only trajectory to reach a low emission economy—and certainly it is very ambitious—it is in the view of the IEA the most technically feasible, cost-effective, and socially acceptable one, and it also allows continued economic growth, further improvements to energy efficiency,[17] and maintaining the security of energy supplies. In terms of technology requirements, the scenario assumes the increased use of existing renewable and emission capture technologies as well as improvements in their cost-effectiveness and the investments in infrastructure these will need. It also assumes considerable investments in further innovation focusing on the commercialisation of

[17] According to this scenario, in 2050 the world economy is more than twice as big but uses 8% less energy than in 2021.

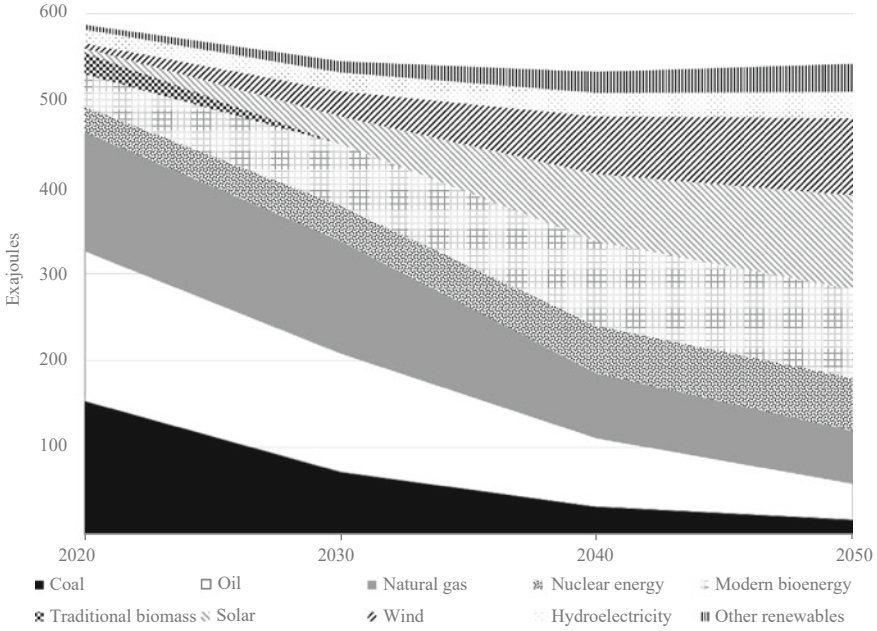

Fig. 9.5 IEA's Net Zero CO2 emissions by 2050 scenario: total global energy supply by source (*Source* IEA [2021] and author's calculations)

technologies which are not yet on the market,[18] such as advanced batteries, hydrogen electrolysers, and direct air capture and storage (IEA, 2021).

9.5.2 *Russia's Energy Strategy and Its Challenges and Opportunities Associated with a Green Transition*

As communicated in a number of presidential and governmental decrees issued during 2019–2021, Russia's official energy strategy and its position on climate change and the green transition seem to have recently undergone a radical change.

The Energy Security Doctrine decreed by the President in 2019[19] is a strategic planning document which focused on ensuring Russia's energy security and set out the key directions of the country's energy strategy for the period up to 2030. It was followed by the government's executive orders, which adopted concrete implementation measures.[20] Energy security was

[18] In this scenario, half of the cumulative emission cuts in 2050 come from technologies that are at the demonstration or prototype phase.

[19] Decree of the President of the Russian Federation of 13 May 2019 N 216 'On Approval of the Energy Security Doctrine of the Russian Federation'.

[20] These are the Decree of the Government of the Russian Federation of 06 September 2021 No. 1523-r 'On approval of the Energy Strategy of the Russian Federation for the

defined in these documents not only in terms of the ability to supply energy to citizens and national businesses but also as the ability of doing so based on domestic energy production.

Climate change and the transition to a green economy were referred to explicitly in the challenges section of the Doctrine, as belonging to a '*set of conditions and factors that create new incentives for the development of world energy […] but also can lead to a threat to energy security*'. While supporting '*…international efforts aimed at combating climate change*' and declaring readiness '*…to cooperate in this area with all states*', the Doctrine considered the idea of the green transition an unacceptable infringement of '*the interests of energy producing states and deliberately ignoring such aspects of sustainable development as ensuring universal access to energy and developing clean hydrocarbon energy technologies*'.

The Doctrine also described a number of other external threats and challenges to Russian energy security, which made it clear that the country sees itself as discriminated in global energy markets and energy development projects.

A more progressive view—albeit also revealing Russia's strategic interests—was expressed in Russia's 2021 'Strategy for the Socioeconomic Development of the Russian Federation with Low Greenhouse Gas Emissions Until 2050'.[21] Prepared just before the United Nations (UN) Climate Change Conference (COP26) in Glasgow in November 2021—and announced unexpectedly on the first day of COP26 talks—the strategy explicitly acknowledged negative anthropogenic impacts on climate and the associated dangers for Russia, and it reiterated Russia's international commitments[22] to fighting climate change. To illustrate the need to overhaul the Russian energy sector and Russia's economy as a whole in this context, the document portrayed two alternative socio-economic development scenarios.

The 'inertial' scenario, in which Russia's energy mix and energy efficiency would not change significantly, would be a threat to its socio-economic development which would materialise as a reduction in its medium-term rate of GDP growth to 1%, mainly due to negative growth in Russia's raw energy exports caused by the global transition towards greener energy sources. In

period up to 2035', and the Decree of the Government of the Russian Federation of 06 January 2021 No. 1447-r (as amended on 14 September 2021) 'On approval of the Action Plan for the implementation of the Energy Strategy of the Russian Federation for the period up to 2035'.

[21] See the Presidential Decree No. 666 from 4 November 2020 'On the reduction of greenhouse gas emissions' and the associated Governmental Decree N 3052-r from 29 October 2021 'On Approval of the Strategy for the Socioeconomic Development of the Russian Federation with Low Greenhouse Gas Emissions Until 2050'.

[22] Russia is a party to the Framework Convention, the Kyoto Protocol, and the Paris Agreement.

contrast, in the preferred 'target (intensive) scenario', Russia would cut its greenhouse gas emissions by up to 70% by 2030, as compared to the 1990 level, and become completely carbon neutral by 2060. Among others, the intensive scenario featured the development and application of low and zero carbon technologies, the increased use of secondary energy sources, changes in tax and customs policies, new financing for green initiatives, more than doubling the greenhouse gas absorption capacities of Russia's forests and other ecosystems, and the promotion of carbon capture, storage, and utilisation. In addition, hydrogen was seen in this context as a way for Russia to use its extensive pipeline export network into Europe amidst its worries that European Carbon Border Adjustment Mechanism would eventually apply to its fossil fuel exports. In the intensive scenario, Russia would gradually diversify away from raw energy production and exports towards more modern economic activities which are less energy intensive and which rely on greener energy sources. This scenario was portrayed as allowing the economy to achieve a medium-term growth rate of 3%.

At face value, these policy statements may have been be interpreted as showing the Russian authorities' increasing appreciation of the stakes involved in a transition to a greener global economy for a country like Russia. These statements were also likely part of a strategy to lay the groundwork for defending Russia's strategic interests in this debate (as illustrated by an emphasis on increasing the greenhouse gas absorption capacities of forests rather than on cutting emissions, technology neutrality in order to accept nuclear energy as a source of green energy, and developing international standards and mechanisms for accounting for carbon emissions in different countries (Likhacheva, 2021; Sharushkina, 2021; Trenin, 2021).

9.6 Consequences of Russia's Military Aggression on Ukraine

The illegal large-scale military aggression of Russia on Ukraine, which commenced on 24 February 2022, shocked the world. Many countries, including some of the main importers of Russian oil, gas, and coal, demanded an immediate cessation of the aggression and, in its absence, imposed on Russia a suite of economic sanctions (see Chapter 14). Russia responded with threats of energy supply cuts and imposed new payment conditions, which were in breach of current contracts.

These events have become a major incentive for consumers of Russian energy (represented by both governments and private firms) to diversify away as quickly as possible towards other sources. By the end of March 2022, some countries have already announced bans on imports of Russian oil and coal or have presented emergency plans for gradually introducing such bans on all Russian fuels, and others may follow in the near future. It has also been reported that major oil importing firms have already reduced purchases of Russian oil, not wanting to be seen as financing the aggression. Shifting to

other suppliers is costly and takes time but, if enough actors decide to pursue this path—or if Russia itself decides to cut supplies with a view of inflicting economic costs on its political adversaries—this could well mean the end of dominance of the Russian energy sector and the Russian economy the way we have known it in the last three decades.

9.7 Conclusion

In the period leading up to Russia's invasion of Ukraine in 2022, the implications of a global energy transition for Russia could be arguably seen as both a cause of concern and an opportunity. More than in countries which do not produce as much energy from fossil fuels, in Russia, the transition to an economy based primarily on renewable energy would require not only very significant economic changes, but social and political ones as well (Kolesnikov & Volkov, 2021). This explains why, for a long time, Russian political elites viewed the policy responses to climate change deliberated by the international community mainly as a threat.

At the same time, a global transition to a low emission economy would have to build on existing sectoral expertise and would require large investments in innovation, technology deployment, and infrastructure development. It could thus, in principle, also arguably be an opportunity for Russia, and this seems to have been reflected in its strategy on tackling climate change prepared in Autumn 2021 in the context of the COP26. Participating in international discussions and having the ability to shape the global debate on climate change and energy transition would make good sense from Russia's point of view. Furthermore, having Russia on board would also be in the interest of the international community.

Unfortunately, following Russia's invasion of Ukraine and the threats of energy supply cuts subsequently made by Russia to some of its main energy trading partners, it is hard to see how Russia will be able to maintain its position as a key energy exporter, let alone become a key shaper of the global debate on combating climate change.

Questions for Students

1. Why does energy play such an important role in Russia's economy and economic policies?
2. What roles do government and market forces play in the management of Russia's energy sector?
3. What are the main implications of international climate change policies for Russia's energy sector?

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