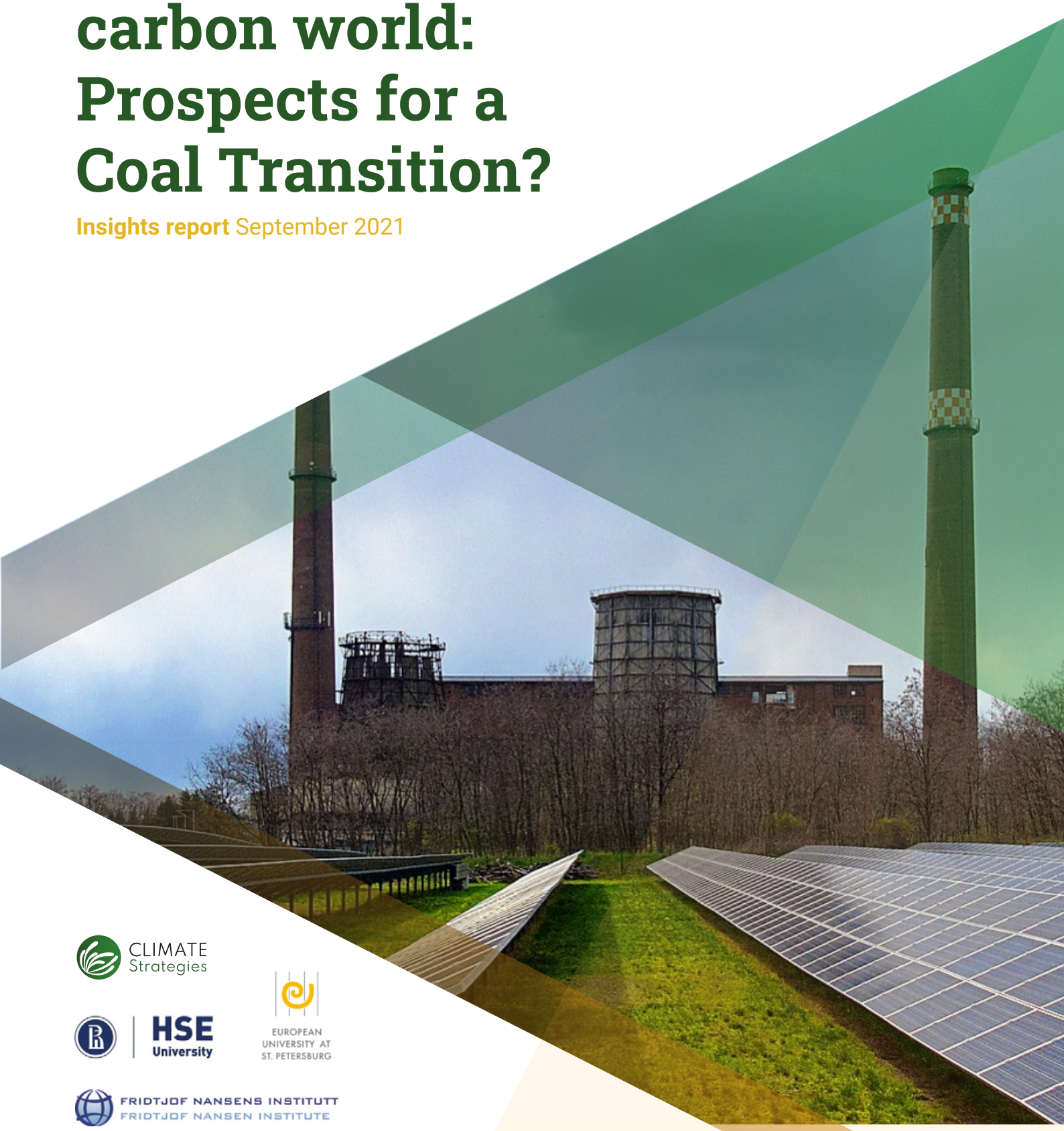
The Russian coal sector in a low-carbon world: Prospects for a Coal Transition?

Insights report September 2021



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About

This report forms part of the project 'The Russian Coal Sector. Challenges and Transition Opportunities'. Convened by Climate Strategies, the project builds and enables knowledge exchange on the current and future status of coal in Russia. Focusing on progress towards low-carbon developments in Russia, the project provides insights into the macroeconomic and social stability of coal regions, and delineates future pathways in the ongoing global low-carbon energy transition.

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The Russian coal sector has social significance because of the employment it provides, its contribution to regional budget revenues, and the mono-towns it has created. **The political leadership is keenly interested in the survival of the sector, not least because strikes in the coal sector contributed to the collapse of the Soviet Union in 1991.** Domestic demand for coal has been declining since then, with the recent growth of the sector stemming from increased export. The Russian coal industry expects demand for coal export to continue for another 10–20 years, especially in Asia. However, official estimates of significant growth appear unrealistic, as they reflect previous plans for expanding coal capacity. Most coal-importing counties – including those in Southeast Asia which were seen as a potential new market area for Russian coal – have now downgraded their plans for building new coal capacity. Several markets, including the European Union (EU), South Korea and China, have set a target of carbon neutrality; in others, among them India, Turkey and China, renewable energy is limiting potential growth for coal demand. Moreover, concerns about air pollution are turning previous importers away from coal.

In fact, **the coal sector makes only a negligible contribution to the Russian economy.** In 2019, the coal rent (revenues above the cost of extracting coal) stood for only 0.4% of the Russian Gross Domestic Product (GDP); in 2020, the share of coal sector in Russia's GDP was estimated at 1%. However, the sector has greater regional significance, especially in Kemerovo (Kuzbass) region, which produces more than half of Russia's coal. All the same, the size of indirect subsidies to the sector dwarfs the revenues. Fiscal support to coal exploration and mining includes various region-specific tax incentives, reduced tariffs for rail transport, cross-subsidies from higher tariffs for other industrial products, and federally financed infrastructure projects to enhance coal-transport capacity for Asia-Pacific markets.

By contrast, **the climate impacts of the coal sector are proportionally much greater than its contribution to the Russian economy**: in 2018, coal mining and combustion accounted for 21.6% of domestic greenhouse gas (GHG) emissions. Moreover, due to exports, the sector's contribution to climate change outside Russia has been roughly estimated as equivalent to Australia's annual gross GHG emissions – or one third of Russia's own annual gross emissions.

Russia's ageing coal fleet is already economically strained. The average age of Russian coal-fired power plants with capacity of more than 25 megawatts (MW) is 53 years. The design life of a steam turbine is usually up to 35 years; this can be extended to 50–55 years, but the costs and risks increase at an accelerated rate. There have been few investments in new coal capacity to replace obsolete plants; over the past two decades, only three large new power plants with coal as the main fuel (capacity > 25 MW) have been commissioned in Russia. Moreover, **coal mining causes significant health risks for local populations, largely as a result of air pollution.** In the past, public protests against coal mining were rare. Since 2015, however, over 50 protests have taken place in Kuzbass, mostly involving villagers living near the coal mines.

The conservative approach espoused by the Russian leadership and the coal sector does not foresee an end to coal mining, and encourages expanding coal exports. From this perspective, the Paris Agreement is a disaster for the coal sector. In contrast, a more liberal domestic group of stakeholders favours adjusting to external low-carbon triggers, in order to remain competitive in the decarbonizing global economy. Further, the Ministry of Economic Development and Presidential Climate Advisor Ruslan Edelgeriev expect Russian coal production to decline, although not as a result of any active phase-out strategies. A coal transition – in the European sense – does not feature on the current Russian political agenda or in the domestic debate.

Russia has no official decarbonization scenario. Expert scenarios have been developed, involving various measures for cutting coal consumption and improving energy-efficiency measures and retrofitting, fuel switching, carbon regulation and Carbon Capture and Storage (CCS). So far, conservative voices have dominated policymaking related to climate in Russia, as seen in unambitious

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climate policies and opposition to carbon-regulation measures such as a domestic emissions trading scheme or carbon pricing. The industry and other proponents argue that, as Russia is already set to achieve its nationally determined contribution (NDC) under the Paris Agreement target with the current measures, discussions on carbon regulation are premature. EU carbon border adjustment measures are not welcomed by either the conservative or the liberal group.

Nevertheless, the global low-carbon trend is apparent in the Russian coal sector. External pressures are increasing as the low-carbon policies of importing countries result in declining demand for Russian coal. The possibility of fiscal measures such as the EU Carbon Border Adjustment Mechanism (CBAM) are also likely to affect domestic coal consumption in Russia, as exports of carbon-intensive products, including iron and steel, aluminium and electricity, will be charged for their GHG emissions. **Thus, it would make sense from an economic as well as a social perspective for Russia to prepare for a coal transition.** Both domestic and international experiences of previous coal transitions can provide guidance here.

Coal regions require proactive planning, to enable them to diversify their economies before the decline of coal demand begins to affect their socio-economic well-being. There are many alternatives that entail various social and environmental burdens, including tourism, agriculture, food production, equipment manufacturing, renewable energy sources (RES) and coal-bed methane. Our research shows that **a just (i.e. fair and equitable) coal transition in Russia** should consist of three elements: 1) **social programmes to subsidize and re-employ the redundant labour force;** 2) **regional programmes to plan and support the diversification of regional economies**, especially in Kuzbass, which is the most coal-dependent region; and 3) **economic mechanisms to reflect the real costs of the coal sector**, such as a domestic carbon price to kick-start the declining use of coal. Objective national assessment of these three elements and their interlinkages will be needed to manage such a major transition.

The success and failures of earlier coal transitions provide valuable experience. **Lessons learnt from the previous transition of the Russian coal sector could be applied to a low-carbon transition in the sector.** The Russian government has experience with social programmes established to ease the impacts of mine closures during the 1990s reform. Social support for laid-off employees included payments of entrance allowances and support for relocation, assistance to industry employees in purchasing housing, support for generating new jobs and SME businesses. More recent coal transitions in other countries can also provide lessons: it has become clear that long-term planning is essential.

The Russian political leadership may disagree on the CBAM but is doing itself a disfavour by focusing on directly opposing it rather than preparing for it. **Recognizing it as a tool for the inevitable low-carbon and coal transition could help those employed in the coal industry as well as the political leadership itself**, cushioning against sudden and abrupt changes likely to entail high social and economic, and perhaps also political, costs.

Acronyms

CalPERS	California Public Employees' Retirement System
CBAM	Carbon Border Adjustment Mechanism
CCS	Carbon Capture and Storage
CENEf	Center for Energy Efficiency
CO_2	Carbon Dioxide
CSA	Capacity Supply Agreements
ERI RAS	Energy Research Institute of the Russian Academy of Sciences
ES-2035	Energy Strategy until 2035
ETS	Emissions Trading System
EU	European Union
FOB	Free On Board
GDP	gross domestic product
GHG	greenhouse gas
HSE	Higher School of Economics
IEA	International Energy Agency
IEF RAS	Institute for Economic Forecasting of the Russians Academy of Sciences
IPCC	Intergovernmental Panel on Climate Change
LCOE	Levelized Cost of Energy
LNG	Liquefied Natural Gas
LULUCF	Land use, land-use change, and forestry
Mtce	Million Tonnes of Carbon Equivalent
$MtCO_2e$	Metric tons of carbon dioxide equivalent
MW	Megawatts
NDC	(Intended) Nationally Determined Contributions
OECD	Organisation for Economic Co-operation and Development
RANEPA	Russian Presidential Academy of National Economy and Public Administration
RES	Renewable Energy Sources
TES	Total Energy Supply
UNFCCC	United Nations Framework Convention on Climate Change
WTO	World Trade Organization

Introduction: Anticipated demand for coal exports vs a low-carbon world

Key messages

- **Russia's political leadership anticipates that coal production and exports will grow.**
- **The coal sector has a high climate impact, but contributes little to the Russian economy.**
- **A coal phase-out is not on the political agenda: even the liberal wing is not directly advocating for it in the domestic debate.**
- **Preparing for the coal transition fuelled by the global low-carbon trend could soften economic and social impacts.**

1.1 Political anticipations

As Russia is among the world's main coal producers, its coal sector is of great socio-economic and political importance. In 2019, coal mining directly employed 133,300 people in Russia[1], and the coal mono-towns provided a living for a many more. The responsibilities of coal companies go beyond mining, and include social development, budget revenues and fuel balance[2]. The Russian political leadership has a vested interest in the survival of the sector, as coal miner strikes contributed to the fall of the Soviet Union. Domestic use of coal accounted for 15.7% of Russia's total energy supply (TES) in 2018[3]; the share of coal in the power and heat sector is declining, but remains significant. Due to the high costs of transport, the main domestic users of coal are located close to the mining areas in Siberia and the Far East (Box 1.1). Domestic consumption of coal has not changed dramatically since 2000, but coal exports have increased six-fold. In 2018, 60% of coal production was exported[4], making Russia the world's third-largest exporter of coal. According to Deputy Prime Minister Alexander Novak (former Minister of Energy):

> *[according to] the consensus forecasts of all analysts, [coal] will take a fairly high share in the energy balance for a long time… If today in the global energy balance it is 25% ... this share will decrease only to 20% by 2040, and those niches that we see today… in the Asian markets, allow us to ensure the development of our industries. That's why we're looking at 10, 20 years ahead*[5].

In 2020, Russia produced 402.1 million tons of coal, down from 439 million tons in 2019[6]. The Energy Strategy Until 2035 (ES-2035) has set the target of increasing the volumes of coal mining to 485–668 million tons by 2035 (21%–66% increase). Similarly, the Programme for the Development of the Coal Industry in Russia for the Period up to 2035[7] foresees an increase to 429–588 million tons by 2035 (7%–46% increase). These high expectations reflect the past rather than the current plans of the largest importers of Russia coal (see section 3) as the impacts of the global low-carbon transition will soon start to impact the Russian coal sector. The 2020s decline in the coal market is acknowledged in the 'The Socio-economic Prognosis of Russia for 2021 and Plan for 2022 and 2023' by the Ministry of Economic Development[8], which now expects coal extraction figures to decline by 10% in 2020 and remain in a gradual decline until 2023 due to the low world market price and contraction of the European market[i]. Moreover, ES-2035 indicates significant uncertainty as to Russia's share in the global coal market, which may decrease to 12% or increase to 25% by 2035.

i. In the aftermath of the pandemic year 2020, 2021 saw a significant rise in commodity prices, including coal, supported by global economic recovery. Coal price, and commodity prices in general, are forecast to decline towards the end of 2021 and during 2022 (Trading Economics 2021; FXStreet 2021).

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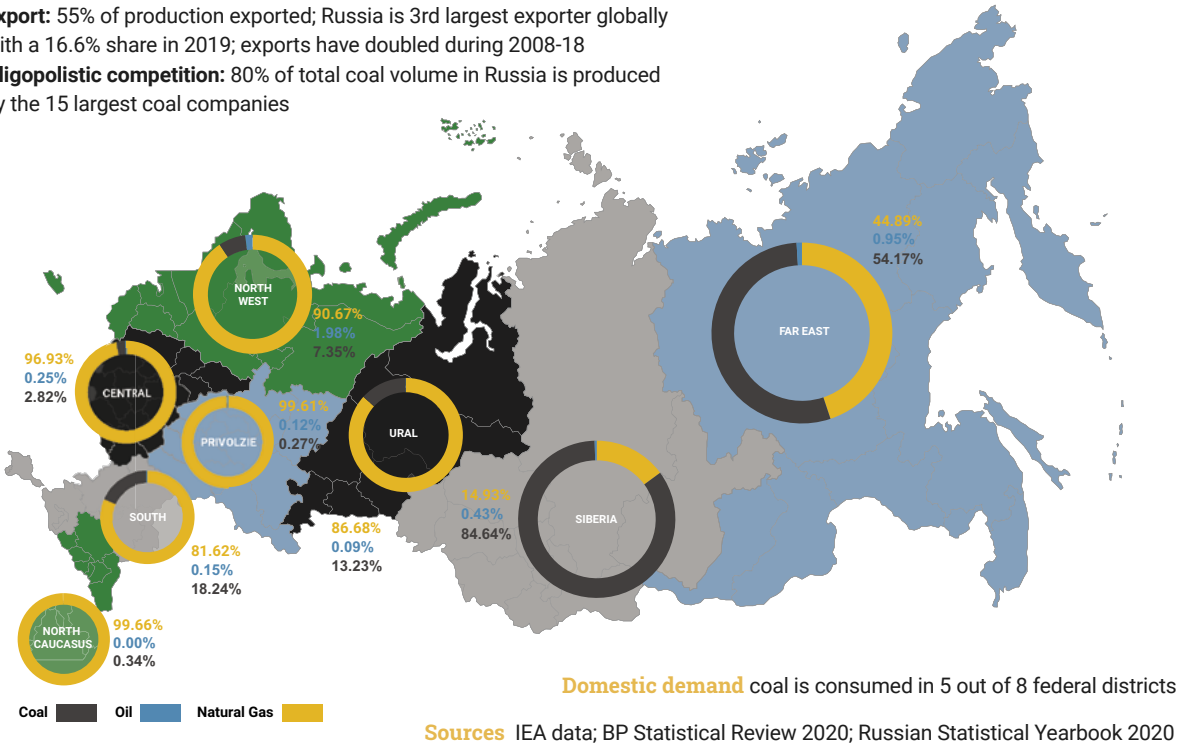
Box 1 The Russian Coal Sector Today[i]

- **Production:** 439 million t; 5.5% of global total in 2019
- **Domestic demand:** 15.7% of total final consumption; coal accounted for 16% of power generation and 20.7% of heat production in 2018
- **Export:** 55% of production exported; Russia is 3rd largest exporter globally with a 16.6% share in 2019; exports have doubled during 2008-18
- **Oligopolistic competition:** 80% of total coal volume in Russia is produced by the 15 largest coal companies



Domestic demand coal is consumed in 5 out of 8 federal districts

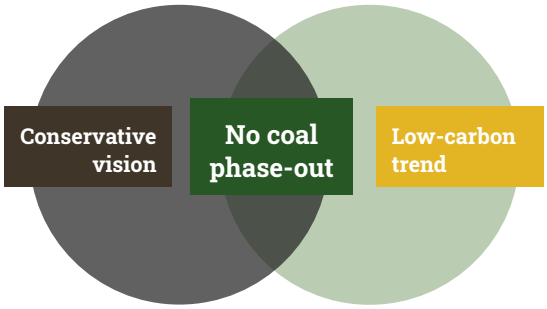
Sources IEA data; BP Statistical Review 2020; Russian Statistical Yearbook 2020

1.2 High climate impact but low contribution to the Russian economy

The Russian coal sector contributes significantly to global warming, especially in view of its low net contribution to the Russian economy. Some 21.6% of Russia's domestic Greenhouse Gas (GHG) emissions originate from coal mining and combustion. In addition, due to exports, the contribution to climate change outside Russia has been estimated as roughly equal to Australia's annual gross GHG emissions – or a third of Russia's own annual gross emissions (see section 3). If the Russian economy were dependent on the coal sector, such an environmental impact might be easier to justify. However, in 2019 the coal rent (revenues above the cost of extracting coal) comprised only 0.4% of Russia's Gross Domestic Product (GDP), compared to 9.2% for oil and 2.8% for natural gas rents[9]; in 2020, the share of coal sector in Russia's GDP was estimated at a mere 1%[10]. However, in some regions, coal plays a substantial role – for instance, accounting for 27.2% of the gross regional product of Kuzbass[11], which produces more than a half of Russia's coal. However, the value of mostly indirect federal subsidies to the sector dwarfs the coal revenues (see section 5).

1.3 Coal phase-out not on the political agenda

Figure 1. The two main discourses on the coal sector in Russia do not foresee a coal phase-out



Two main views on how the collision course between coal mining and the global low-carbon trend is viewed and understood characterize the Russian domestic debate on a coal transition. Despite declining demand and financial losses, the conservative vision held by the Russian coal sector[12] does not foresee an end to coal mining: instead, it encourages expanding coal exports[13,14]. Such views have also been voiced by the political leadership, including President Putin[13], the Ministry of Energy, some members of the State Duma, the Duma Energy Committee, and the administrations of the coal-producing regions dependent on coal revenues (see, for instance, Lavrenkov[15]). Because growing demand is expected, especially from India, China, Southeast Asia and Africa, the declining demand in the developed economies, until the period 2035–40, is less of little concern[16]. Future alternatives, such as high value-added products[17,18,19], are actively sought to keep the coal sector in business, and coal demand is expected to recover after the COVID-19[14,20]. From this perspective, the Paris Agreement is seen as a disaster for the coal sector[21,22] and as an attempt to limit the development of the Russian economy[23]. The official Energy Security Doctrine takes a sceptical view of trade barriers set to achieve environmental goals if they affect important sectors such as the coal industry[24].

In contrast, a set of more liberal stakeholders proposes that external low-carbon triggers be adjusted, for Russia to remain competitive in a global low-carbon economy. This group includes the Ministry of Economic Development; Presidential Climate Advisor Ruslan Edelgeriev, and many analysts and experts[25,26,27,28]; certain companies and individuals, for instance Anatoly Chubais of Rosnano[29]; and environmental NGOs. These stakeholders expect Russian coal production to decline[19], with the impact of the global low-carbon transition and domestic carbon tax making itself felt already in the short term. Divestment from Russian coal[30] and the competitiveness of renewable energy in contrast to coal and nuclear[31] are recognized. The global carbon trend is mostly seen as an external factor that Russia must adjust to in order to avoid economic problems, not environmental ones. The response of the private sector has been pragmatic, as exporters are obliged to adjust to external pressures like the low-carbon trend to compete internationally. The risks to carbon-intensive exports to the European Union (EU) and beyond are well recognized[32,33,34,35]. However, this group does not foresee an active phase-out of coal either. Whereas declining demand for coal exports is expected, increasing demand is forecast beyond the member-states of the Organisation for Economic Co-operation and Development (OECD)[19]. Thus, a coal transition – in the European sense – is not part of the Russian political agenda or even the domestic debate.

1.4 Preparing for coal transition: softening economic and social impacts

In fact, the global low-carbon trend is already affecting the Russian coal sector. External pressures are increasing as the low-carbon policies of importing countries result in a declining demand for Russian coal. Moreover, upcoming fiscal measures such as the EU's Carbon Border Adjustment Mechanism (CBAM) are likely to affect domestic coal consumption in Russia, as exporters of carbon-intensive products will have a motive to switch to less carbon intensive sources of energy. Instead of voicing political opposition to the climate policies of other countries, it would make sense from an economic as well as a social standpoint for Russia to prepare for a coal transition. Domestic and international experience of previous coal transitions can provide guidance here. The fossil-fuel industry has managed to reject domestic carbon regulation – but the tide may turn, especially as the policies of countries

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that import Russian raw materials and products begin to internalize the previously externalized environmental costs, thereby affecting Russian economic activity and opportunities in the international market.

Russia has no clear vision for its coal sector, beyond its (outdated) expectations of increasing coal exports. Are expectations of demand for coal in international markets likely to be correct, in light of the policies and the latest demand forecasts regarding (potential) importer countries? Further: how could Russian regions currently dependent on coal production diversify their economies, so as to minimize the negative impacts of a global coal phase-out? Which other options could be developed? This report outlines the issues relevant to the Russian coal transition and discusses the elements of a transition strategy. This report thereby contributes to the Russian debate on coal influenced by Russian policymakers in Moscow as well as by coal regions and the coal sector. The further aim is to provide up-to-date information on the current status of the Russian coal sector to the international audience in order to facilitate collaborations and dialogue.

Coal sector dependent on indirect government subsidies

Key messages

- **The historically crucial coal sector retains its social and political importance in Russia.**
- **The importance of coal is declining in the domestic markets.**
- **Russia's obsolete coal fleet is nearing the end of its lifetime.**
- **Federal coal subsidies are significant, but indirect.**
- **The conventional alternatives for coal are limited.**

2.1 Coal sector: still socially and politically important

After the demise of the USSR, there was a need for structural changes to create competitive enterprises that could supply coal products with less financial burden on the national budget. The centrally set coal price was replaced by a market-based price; subsidies to inefficient coal enterprises were gradually phased out; unprofitable mines were closed. Further, the government initiated mass privatization of state-owned enterprises within the coal industry, and established the state enterprise 'Rosugol' for commercial management of the parts that remained federally owned. Finally, the government committed to restricting the industry when accepting loans from the World Bank in the 1990s[35]. In 1994, the Russian coal sector had 294 enterprises; by 1998 there were 97 production units, and total production had declined from 337 to 232 tons. Although the total industrial workforce declined from about 900,000 in 1992 to 328,000 by the end of 2001[37], labour productivity almost doubled between 1992 and 2002[38]. The government allocated the equivalent of more than USD
10 billion of budget funds for implementation of the restructuring programme, and World Bank adjustment loans for industry restructuring amounted to more than USD 1.1 billion. Under the new economic conditions, a profitable and competitive private industry began to emerge by the early 2000s.

In 2019, coal mining directly employed 133,300 people in Russia[1] – down from 151,600 in 2017[136]. In mono-towns based on coal mining, the social and economic importance of the sector is greater; for instance, in Kuzbass, 20% of jobs are in the coal mines[39]. Some 11 million people live in Russia's five coal-mining regions; the jobs and incomes of hundreds of thousands of people are estimated to be dependent on the coal sector[40]. Thus, the social and political importance of the sector remains significant, albeit reduced from the days of the Soviet Union.

Coal sector dependent on indirect government subsidies

The share of coal of total energy supply
(TES)

22%
in 1990

15.7%
in 2018

The decline of domestic demand for coal
In million tonnes

179.4 million
in 2010

163 million
in 2020

The share of coal in power generation

20%
in 2000

15.8%
in 2019

Social significance declining:
employed by the coal sector

900,000
people in 1992

133,300
people in 2019

2.2 Importance of coal declining in the domestic markets

The share of coal has been declining in the Russian energy mix – from some 22% of total energy supply (TES) in 1990 to 15.7% in 2018. The decline in absolute terms has been even more significant, with an 18% decrease in TES during this period[41]. In 2020, 163 million tonnes were supplied to the domestic market[42], in comparison to 179.4 million tonnes in 2010[43]. The main consumers of coal in Russia are the power and heat sector and the industrial sectors (iron and steel industries). The share of coal in power generation was 15.8% in 2019, down from 20% in 2000, and 20.7% in heat generation in 2019, down from 27.6% in 2000[xxxix]. Overall domestic demand for coal has declined by 10% in the past decade, due to competition with natural gas and Gazprom's gasification of regions. Still, the new Programme for the Development of the Coal Industry in Russia for the period up to 2035 foresees an increase in domestic shipments in both its scenarios. According to the conservative scenario, by 2035, this will increase up to 170 million tonnes; according to its optimistic scenario, up to 196 million tonnes: increases of 4% and 20% respectively12. ES-2035[14] recognizes these uncertainties by leaving it an open question as to whether coal demand may decline (−6%) or increase (+8%) by 2035 in comparison to 2018 levels.

Coal sector dependent on indirect government subsidies

2.3 Russia's obsolete coal fleet nearing the end of its lifetime

Thermal coal capacity has been estimated[ii] to account for 44.8 GW[45] of Russia's total power generation capacity. The condition of the combustion capacity is an important factor in the decline of coal demand. According to our estimates, the average age of Russian coal-fired power plants with a capacity of more than 25 megawatts (MW) is 53 years[iii]. The design life of a steam turbine is usually up to 35 years, and may be extended to 50–55 years but the costs and risks increase at an accelerated rate. According to expert estimates, continued operation of steam thermal power plants can be problematic after they reach the age of 35–40 years[46]. Thus, from an economic perspective, Russia's coal fleet is already strained to the limit.

In the past two decades, only three large, new power plants with coal as the main fuel (capacity < 25 MW) have been commissioned in Russia: Primorskaya thermal power plant in the Kaliningrad Region, Sovgavanskaya cogeneration plant in the Khabarovsk Territory, and Sakhalin Regional Power Plant-2 in the Sakhalin Region., with total installed electric capacity of 441 MW. Prior to this, new coal-fired power plants had not been commissioned in Russia since 1997. Some older coal-fired power plants have been converted to natural gas, but the obsolete status of a large share of the coal fleet reduces the economic potentials for fuel switching.

2.4 Federal coal subsidies significant, but indirect

The Russian coal industry is significantly subsidized; however, this is done indirectly. Lack of transparency makes it difficult to assess government support for the industry, and publicly available assessments remain incomplete. Coal exploration and mining receive governmental support in the form of budgetary transfers and tax exemptions; for 2016–2017, the annual average fiscal support for coal exploration and mining was estimated at ₽1.775 billion (USD 28 million)[47]. Examples of such subsidies include the tax incentives. In Russia's Far East and certain other regions, income tax transferred to the federal budget has been set at 0% for ten tax periods[48]; it is also possible to establish a reduced tax rate for the income tax transferred to the regional budgets. In South Yakutia's 'Territory of advanced social and economic development' scheme, the main investment projects in this sphere are the construction of the Vostochnaya Denisovskaya mine, the construction of an enrichment plant to produce coal concentrate, the construction of the Inaglinsky ore mining and processing plant for the extraction of coal, and the production of coal concentrate. Territory residents are granted zero federal income tax rate for the first five profitable tax periods. Regional income tax cannot exceed 5% for the first five profitable tax periods and 10% for the next five profitable tax periods. Moreover, residents are accorded reduced rates for insurance payments[49].

The Russian coal mining industry also benefits from 'hidden' support through reduced tariffs for rail transport. Coal accounted for 43.5% of the total loading of all export cargo of JSC Russian Railways in 2019, but the coal industry has constant disputes with them, as coal transport is unprofitable at the current tariffs and discounts, and must compete with higher-yield cargo[50,51,iv]. As coal miners demand discounts and expansion of quotas for exports to the East, JSC Russian Railways appealed to the government for subsidies to partially cover the losses from transporting coal[52]. In practice, the high tariffs for other transport uses, such as oil/petroleum products and metallurgic products, cross-subsidize the coal sector, without officially counting as a state subsidy. This enables coal mining companies to earn income by exporting their products. In total, coal miners have underpaid about 200 billion rubles a year relative to the average network tariff (within 20%–30% of the revenues of JSC Russian Railways)[53]. In March 2021, the Russian government set the goal of enhancing the transport capacity of the eastern part of Russian railroads by 25% by 2024 by upgrading the Baikal–Amur railroad and Trans-Siberian railways[54]. Infrastructure projects aimed at improving transport capacity for coal for Asia-Pacific markets represent a further de facto subsidy for coal exports.

ii. Official data do not differentiate among the various fuels used for thermal generation.

iii. A database of coal-fired power plants was collected based on open sources (Regional long-term development schemes and programmes for electric power industry, for instance https://pnzreg.ru/project-office/New%20Folder/177-%D1%80%20%D0%A1%D0%98%D0%9F%D0%A0%202019-2023%20%D0%98%D0%A2%D0%9E%D0%93.pdf). Calculations were conducted for power plants that use coal as the main fuel (plants using coal and natural gas as main fuels were excluded). The age of the power plants was weighted by their installed capacity.

iv. 1 ton of coal transported per 1 km, on average, brings Russian Railways 4–4.2 times less income than 1 ton of oil, metals or chemical cargo; for scrap metal, this gap increases sixfold.

Coal sector dependent on indirect government subsidies

Coal consumption is openly subsidized via regulated tariffs for electric power and heat, support for purchase of coal for heating (provided from the federal budget to remote regions), and subsidies for thermal coal for vulnerable consumers. As an example of the latter, pensioners who have worked for at least 10 years in coal mines and open-pit mines or in paramilitary rescue units, or their widows, are entitled to free rations of coal for home heating. In Kuzbass, this currently applies to 12,300 people[55].

In 2009, Russia pledged to phase out inefficient fossil-fuel subsidies that encourage wasteful consumption within the G20, but this commitment remains to be implemented[56]. The government's fiscal support for the coal sector[57,58] may be grounded in fears of possible social unrest in coal-mining regions[59].

2.5 Limited conventional alternatives to coal

Parts of the Russian coal-power fleet has switched to natural gas, for economic and environmental reasons. Gasification – i.e. the extension of gas distribution networks – is an ongoing long-term 'national project' implemented by Gazprom[60] that enables more consumers to receive gas. There are social benefits, as gasification can reduce local pollution and thus improve the standard of living of the population. In 2018, 68.1%of the population lived in the proximity of gas distribution networks, as against only 53.3% in 2005; the chairman of the Duma Energy Committee has mentioned 85% as a goal[61]. The Ministry of Economic Development and Trade has recognized the theoretical possibility of reducing 17% of Russia's GHG emissions by replacing coal with gas in the energy sector[62]. However, it should be borne in mind that investments in new natural gas capacities to cut GHG emissions serve to crowd out investments in renewable energy capacities[63]; moreover, even if natural gas emits only half as much GHGs during combustion (directly) that coal does[64], the lifecycle emissions – taking into account mining and transport – may be even greater than those of coal[65] depending on the gas field.

Nuclear energy is another alternative to coal However, nuclear reactors are located mostly in the European part of Russia; no civilian-use nuclear plants are operated in Siberia, where coal predominates and the demand for thermal power is too great to be covered by nuclear reactors. As construction time for nuclear plants is 10–50 times longer than for solar and wind power facilities, renewables are competitive against nuclear. The lifecycle of GHG emissions from nuclear reactors, which occur predominantly during upstream and downstream processes, is significantly higher than for renewable energy facilities[66].[v] The economic viability of nuclear energy is low in comparison to other energy sources[67];[vi] moreover, nuclear technologies entail environmental risks, including the absence of long-term storage solutions for radioactive waste[vii] and the risk of nuclear accident.

v. The most popular reactor types, LWR and HWR, emit between 10 and 130 g CO_2e/kWh (65 g CO_2e/kWh on average), That is lower than fossil-fuel power plants (typically 600–1200 g CO_2e/kWh), but significantly higher than for many renewable energy facilities, especially wind power plants (15–25 g CO_2e/kWh).

vi. It costs between 129 and198 USD /MWh to produce power at new nuclear reactors, compared to 65–159 USD /MWh for new coal power plants, 26–54 USD /MWh for new wind power facilities and 29–42 USD /MWh for new utility-scale solar PV plants.

vii. Finland is the only country, which has built a deep geological repository for spent nuclear fuel (IAEA 2020).

Russia's climate policy plans do not address polluting coal

Key messages

- **The Russian coal sector has a significant impact on the global climate.**
- **Russian expert scenarios outline various ambitious climate policies options for Russia but conservative voices dominate climate policymaking.**

3.1 Significant impact on the global climate

Russia is the world's fourth-largest emitter of GHGs, with a 4.6% share of global emissions[68]. In November 2020, Russia announced its NDC as part of the implementation of the Paris Agreement. The target is to limit emissions to 70-75% of 1990 levels by 2030, taking into account the absorptive capacity of land use, land-use change and forestry (LULUCF)[69,70]. However, this can be considered as business-as-usual as it allows room for emissions growth[viii] until 2030[24,71]; and it has been deemed critically insufficient[72]. In April 2021, in his annual state-of-the-nation speech, President Putin stated that Russia's total net GHG emissions should be less than those of the EU over the next 30 years; it remains uncertain if such a target would add ambition to the NDC target.

Coal combustion was responsible for 25.9% of Russia's total CO_2 emissions in 2018, with 411 metric tonnes of carbon dioxide equivalent ($MtCO_2e$) emissions. Of Russia's total GHG emissions, including gases other than CO_2, 68.5 $MtCO_2e$ of methane emissions stemmed from coal mining. Thus, the coal sector's share in Russia's total GHG emissions accounts for 21.6% (down from 25% in 1990). Reduced emissions from coal combustion and mining contributed to reducing Russia's emissions by a third of the total (32.6%) during 1990–2018[ix], helping Russia to achieve its target under the Paris Agreement.

However, Russia's coal exports also generate significant GHG emissions outside the country. In 2020, some 181 Mt of coal were exported, accounting for 553 $MtCO_2e$ emitted outside Russia[73]. This is equivalent to a third of Russia's total emissions, or equal to the total GHG emissions of Australia in 2018[74]. Russian coal exports have increased almost six-fold during the period 2000–2019, from 38 Mt to 217 Mt[75]. Emissions from coal mining, 3.1% of Russia's total GHG emissions, have grown by some 35% as a result of the rise in extraction since 2000. However, the carbon intensity of coal mining has declined by some 22.3% during this period,[x] probably a result of closures of the least economically viable mines during the restructuring of the sector.

Target is to limit emissions to **70-75%** of 1990 levels

Coal combustion was responsible for **25.9%** of Russia's total CO_2 emissions in 2018

GHG emissions of Russian coal exports are equivalent to Australia's yearly emissions

Coal exported **181 Mt** in 2020

viii. In 2018, Russia's emissions had reached 52.4% of the 1990 level, including LULUCF.
ix. CO_2 emissions from coal combustion declined by 36.6% during 1990–2018; Russia's total GHG emissions (no including LULUCF) declined by 33%.
x. Calculations based on IEA and UNFCCC data. https://www.iea.org/reports/coal-information-overview

Table 2.1. Summary of recent decarbonisation scenarios for Russia

Scenario	Years	Greenest scenario	Role of coal
Ministry of Natural Resources and Ecology: Reporting to the United Nations Framework Convention on Climate Change (UNFCCC)[lxxii]	1990–2030	With LULUCF and additional measures −49%	Decline in demand for power and heat reduces the absolute amount of fossil fuels as a result of energy-efficiency improvements, while the fuel balance remains unchanged
Ministry of Economic Development and Trade (2020): Draft low-carbon strategy until 2050[62]	1990–2050	Intense scenario −52%	Reduction of the carbon intensity of energy sector, introducing CCS and domestic carbon regulation; energy-efficiency improvements and technological renewal of energy sector
IEF RAS[xxv]	1990–2050	Aggressive scenario −83% (in line with the 1.5C target)	Hydrocarbons expected to account for 15% of power and heat production, in comparison to the current 72%
HSE/RANEPA[xxiv]	1990-2050	Decarbonization scenario −88%	Coal use declines by 70% of the 2010 level by 2050, use of CCS for remaining fossil fuels
CENEf[78]	1990-2050	1.5C scenario (−69%/−78%)	Carbon tax increases the price for coal; carbon-free power sources cover 62% of demand
ERIRAS / Skolkovo[79]	2015–2040	Energy transition scenario +1.6% (of 2015 by 2040)	Consumption of coal declines by 2.1%

3.2 Russian expert scenarios: various ambitious climate policies options

Russia has no official decarbonisation scenario; the ES-2035 assumes that emissions will follow Russia's NDC, reaching 70–75% of the 1990 level by 2035[xlii]. Recently, however, two Russian ministries have included low-carbon scenarios in their reporting. In 2020, the Ministry of Economic Development and Trade published a draft low-carbon strategy which foresees Russia emitting around 52% of 1990 level in 2050. This 'intensive' scenario would introduce domestic carbon regulation and CCS, energy-efficiency improvements and renewal of energy-sector technology. Commissioning 30 GW of modern highly efficient heat and electricity capacities and decommissioning more than 17 GW of obsolete capacities is foreseen to cut 110 $MtCO_2e$ during 2017–2024. In addition, a ban on the construction of new coal-fired power stations is recognized as a potential low-carbon policy. The lowest projection of the Ministry of Natural Resources and Ecology[76] is even more ambitious: 49% below the 1990 level by 2030. This 'with additional measures' prognosis expects demand for power and heat to decline as a result of energy-efficiency measures while the shares of energy sources remain unchanged.

Table 2.1 outlines the latest decarbonization scenarios for Russia, including those by the Institute for Economic Forecasting of the Russians Academy of Sciences (IEF RAS), a joint scenario by the Moscow Higher School of Economics (HSE) and the Russian Presidential Academy of National Economy and Public Administration (RANEPA), Center for Energy Efficiency (CENEf) and a joint scenario by the Energy Research Institute of the Russian Academy of Sciences (ERI RAS) and Skolkovo

Box 2.1: Policy options to reduce domestic coal use in Russia

Energy efficiency and capacity renewal policies: power and heat sectors

Energy efficiency could be improved both by retrofitting existing installations and replacing them with new. That the Russian coal fleet is ageing provides a natural push for closure of the least efficient capacity, but has less retrofitting potential.

Fuel switching: power and heat sectors

Because of to the ageing infrastructure of Russia's coal sector and the national gasification 'project', switching from coal to gas, which cuts emissions, is already underway. IEF RAS has calculated that a coal phase-out in the power sector would cut emissions by 306 $MtCO_2e$ by 2050[26].

Carbon taxes, regulation and domestic emissions trading schemes

These target the coal sector by increasing costs. ERIRAS/Skolkovo[75] (2019) has estimated that, in the absence of climate policies, global energy transitions will reduce Russia's GDP by ca. 0.6% per annum, whereas climate policies (carbon price of 20 USD per tonne, competitive domestic gas price and reducing cost of capital to 6–7%) could yield 2.7% annual GDP growth.

No new coal-fired generation capacity

A ban on building new coal-generation capacity is recognized as an option in the draft low-carbon strategy until 2050. A domestic carbon tax may have a disincentivizing effect, also without an explicit ban.

CCS technologies

The use of CCS could retain some coal capacity by capturing the GHG emissions generated; this possibility is included in many mitigation scenarios. However, the current costs of CCS remain much higher than those of other policy options.

Energy Centre, and summarizes the details of policies relevant to coal consumption.

There is evident expertise in Russia to model a range of policy paths to decarbonisation; however, the current scenarios, especially the most 'official' one based on Russia's NDC, show that the decarbonisation scenarios have remained academic. However, any of these scenarios would influence domestic use of coal over time; a range of policy options relevant to coal combustion, fairly similar across scenarios, is shown in Box 2.1.

3.3 Conservative voices dominant in climate policy-making

The main argument in the domestic debate against decarbonisation has been the high costs: a GDP decline of as much as 18% by 2030 has been quoted[80,81]. The more conservative wing tends to interpret the low-carbon policies of other countries as a 'high-profile campaign against coal'[15,42]. Doubts have been cast as tor the realism of the EU's low-carbon policies – for instance, the CBAM (the EU Carbon Border Adjustment Mechanism) and carbon neutrality – as well as the ongoing debate on the phase-out of coal in EU countries[16,77]. The merits of alternative energy forms are questioned – the argument being that all forms of energy pollute more or less equally[15,11] and that 'clean coal' remains significantly cheaper than renewable energy sources (RES)[15].

The more liberal wing argues that the Paris Agreement does not dictate phasing out coal,

as Russia's target does not require this, and recognizes the regional and peak load roles of coal[82]. It has been argued that Russia should join the carbon-tax countries for reasons of competitiveness[83,84]. For instance, Presidential Climate Advisor Ruslan Edelgeriev, Anatoly Chubais of Rusnano, and Mikhail Rasstrigin, Deputy Head of the Ministry of Economy, argue that, to avoid adverse economic consequences, businesses should start getting prepared for the CBAM, which is set to be launched in the near future[28,85,86,87]. The risks to carbon-intensive exports are well known, as are those related to the effects of a carbon pricing system on Russian exports to the EU and beyond[31,32,33,88]. A domestic carbon price has been held to reduce Russia's risks stemming from the EU's CBAM[89]. However, the liberal wing has questioned the motivations behind the EU's carbon border adjustment measures[90].

Thus far, the conservative wing has dominated Russian policymaking. This is evident in Russia's unambitious climate policies, and its opposition to such carbon-regulation measure as a domestic emissions trading scheme or a carbon price. This stance has been heavily influenced by industry and other proponents arguing that, as Russia is already set to achieve its Paris Agreement target with the current measures, discussions on carbon regulation are 'premature'[83]. Carbon border adjustment measures by the EU are not welcomed by any group in Russia. For instance, the Ministry of Economic Development, which tends to hold more liberal views on the low-carbon trend, has expressed caution concerning attempts to 'use the climate agenda to create new barriers' under World Trade Organization (WTO) rules[91]. Russia's Foreign Policy Concept[23] outlines Russia's opposition to politicizing environment protection and its use for encouraging unfair competition.

Declining international demand for coal; also Southeast Asia downgrading its coal plans

Key messages

- **The competitiveness of coal is declining in international markets.**
- **There's no long-term future for coal exports to the EU.**
- **Coal demand in China and India is peaking and declining.**
- **Regardless of carbon neutrality commitments, Korea and Japan continue to import some coal.**
- **Turkey replaces Russian coal imports for political reasons.**
- **Southeast Asia is cancelling new coal capacity.**

4.1 Competitiveness of coal declining in international market

Coal has been under significant pressure for several years as economies try to shift to cleaner sources of energy, with global coal consumption peaking in 2013 at 5,591 Mtce[92]. In 2020, global demand for coal fell by 4% due to COVID-19 restrictions to its lowest since World War II. In 2021, the IEA[93] expects the global coal demand to experience a short-term rebound.

In the coming years, the declining competitiveness of coal in power generation, stricter emission standards and national carbon-neutrality plans will cut demand for coal. Bodnar et al.[94] forecast the share of uncompetitive coal power plants to reach 73% worldwide by 2025. In times of excessive capacity, as during the COVID pandemic, it is cheaper to load renewable energy power plants than the coal fleet, which has higher operating expenses. Low coal prices provide only minor support to the economic attractiveness of coal generation due to its low cost-sensitivity[xi]. Coal prices are volatile; for instance, the price of thermal coal[xii] dropped by some 50% between July 2018 and July 2020, recovering (more than USD 100 per ton) by July 2021[95]. The spread in coal prices between Europe and Asia is increasing: the anticipated coal phase-out is cutting demand for coal in the EU, but in Asia the price is supported by strong demand in China, India, and other emerging economies. Tariffs for rail transport of coal products have the greatest impact on competitiveness, accounting for an average of 46–56% of costs of exports[96,97].

4.2 No long-term future for coal exports to the EU

Among Russia's current coal importers (see Graph 4.1), in the largest market – the EU – coal demand has been declining for some time as a result of the EU's strong climate policies, including carbon neutrality by 2050. This has mainly influenced the EU's domestic coal production since 1990; only recently have imports started to decrease. The remaining EU coal production could account for the current coal demand by industry and potential coal-fired power capacity equipped with CCS in the future. The EU's coal fleet is fairly old, and is being decommissioned. Coal mines have been closing due to their lack of competitiveness; the EU seeks to deal with the ensuing social issues, especially unemployment, with its Just Transition Mechanism[98,99]. The IEA[100] has forecast that coal plant retirements and the growing renewables sector combined will reduce coal generation by more than 5% annually through 2024. It is clear that there is no long-term future for coal imports to the EU, although the post-COVID-19 economic recovery and the closures of German nuclear power plants may generate some demand in the short term.

4.3 Coal demand of the Asian giants: peaking, declining

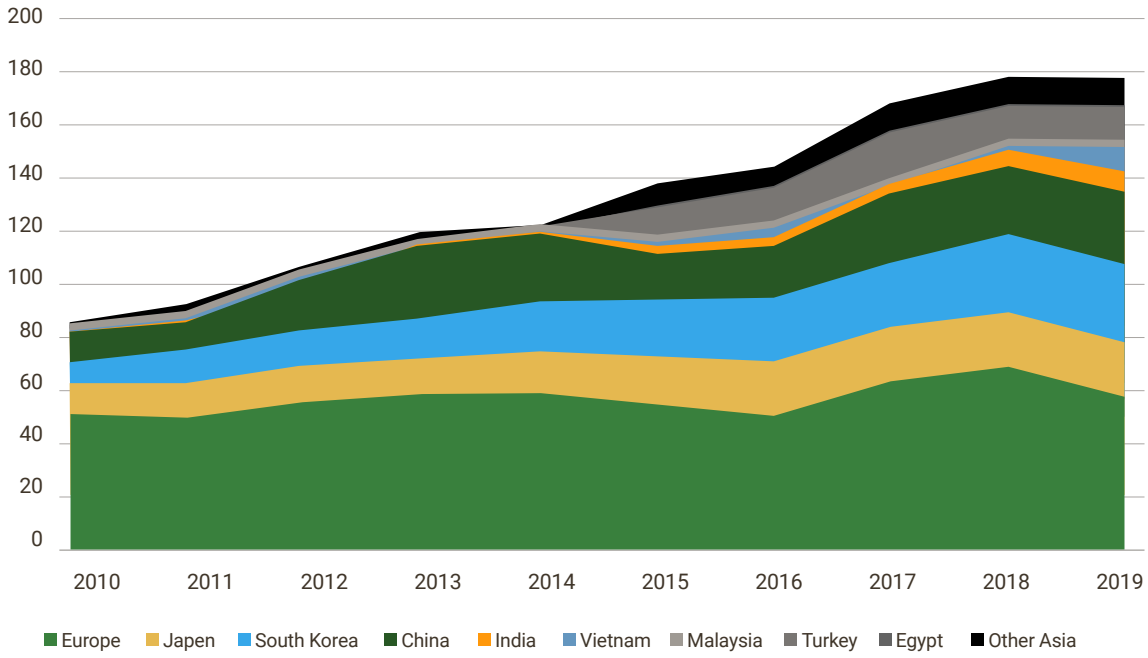
China is the largest consumer of coal: its coal fleet accounts for about one-third of total global coal capacity[101]. Domestic production accounts for over 90% of China's coal supply. The country is building significant amounts of new coal-fired capacity, although domestic criticism

xi. If coal prices go down by 25%, the costs of generating 1 MWh of electric power decrease by 6%; if coal prices go up by 25%, the costs of generating 1 MWh of electric power increase by only 3%

xii. Free on Board (FOB) price, calorific value of 6,300 kcal/kg

Declining international demand for coal; also Southeast Asia downgrading its coal plans

Graph 4.1 Russia's coal export's structure, Mt
Source : United Nations Comtrade Database: International Trade Statistics



has recently emerged, based on the existing environmental regulations. China's carbon-neutrality ambitions by 2060 are likely to mean reduced use of coal soon, even though the 14th Five-Year Plan (2021–2025) mostly focused on announcing the matter. There are also previously established policies aimed at decarbonising the nation's energy balance; China is the world leader in RES development, and various provinces as well as major companies are aiming for carbon neutrality following the 2060 goal[102,103]. Air pollution concerns are driving the phase-out of coal; however, that would lead to economic and social challenges such as unemployment, the collapse of local tax revenues and problems of stranded assets[104]. In 2019, the IEA forecast that the share of coal in China's power generation mix would fall from 67% in 2018 to 59% in 2024, and that coal demand would plateau by 2022, followed by a slow decline. Demand for coal has been flat, while the import trend has been growing. Due to disputes with its previous main supplier Australia, China may seek new suppliers.

India has added some 13.5 GW of new coal-fired capacity annually during 2010-2019[105]. Coal as well as energy consumption are growing; India's demand for coal is expected to grow in absolute terms more than that of any other country[96]. Some 70% of the coal consumed is domestic; efforts are being made to increase this share, as imports have remained below the 2014 peak[106]. In addition, the renewables (RES) sector has been developing strongly. The price of RES, especially solar PV, has become highly competitive as regards new capacities, while also outdoing some of the existing coal-fired capacity. Parts of this capacity have ended up as stranded assets; that is also feared to be the case with some of the new coal-fired capacity under construction. Further, the declining price of battery technology to store solar power is expected to compete with coal generation already by the 2030s[101,107,108]. The IEA96 forecast India's coal power generation to increase by 4.6% per annum during 2018–2024, with the peak of demand coming by the mid-2020s[101,109]. India argues that, as a developing country, it has not been responsible for causing climate change (it is the developed countries that should act first); and that the decline in its coal imports is due to economics and politics beyond climate policy.

Declining international demand for coal; also Southeast Asia downgrading its coal plans

4.4 Korea and Japan: continued coal imports, despite carbon-neutrality commitments

Korea is a major coal importer with only minor domestic production; coal accounted for more than a quarter of Korea's TES in 2019. A significant amount of old coal capacity is to be decommissioned, and some capacity is being retrofitted for Liquefied Natural Gas (LNG); however, this is to balance out the newly built coal capacity. Seoul's 2050 carbon-neutrality plans[110] are yet to be translated into action. A domestic Emissions Trading System (ETS) is in place, and the government is committed to phasing out coal and supporting a switch to LNG with fiscal measures, but more concrete actions are necessary[111]. For instance, the RES sector can be developed significantly; this is addressed under the Green New Deal post-COVID-19 recovery package[112]. Local air pollution concerns have temporarily limited the use of coal-fired capacity, but coal is expected to play an important role in Korea's energy balance until the 2040s[88]. Thus, there will be demand for coal in Korea, even though it will be declining. Moreover, plans for introducing CCS may extend the coal era in Korea.

Japan is dependent on coal imports, for the same reasons as Korea. The closure of its nuclear fleet in the aftermath of the Fukushima nuclear accident led to a peak in coal demand in the mid-2010s; coal now accounts for more than a quarter of Japan's TES[113]. Japan has pledged to achieve carbon neutrality by 2050, and plans to reopen its nuclear fleet and reduce the use of coal. Technology lock-in is a concern: between 2016 and 2019, Japan built 3 GW of new coal capacity; the IEA[114] reported 8.4 GW under construction, with a further 2.6 GW planned – but there have also been some recent cancellations[115]. This is balanced out with the decommissioning of the outdated coal capacity, which will apply to 114 of Japan's 140 coal plants by 2030[116]. As the government has not committed to phasing out coal, and CCS is expected to play an important role in future coal combustion, there will probably be demand for coal in Japan in the coming decades. Here it should be noted that Japan owns and finances coal mining operations overseas to ensure security of supply; for industrial reasons, the quality of coal is a key issue.

4.5 Turkey replaces Russian coal imports for political reasons

Turkey's energy balance is highly dependent on coal: almost 30%. The country has domestic coal (lignite) production, which it aims to use for security of energy supplies. Turkey's policy of reducing dependence on Russian gas and coal imports has triggered the commissioning 10 GW of RES as well as gas-to-coal switch in the power sector[117,118]. Turkey has not ratified the Paris Agreement, and its climate policy allows for emissions growth regardless of energy-efficiency improvements and the introduction of 4.8 GW nuclear capacity. However, plans for commissioning 7.5 GW of new coal generation capacity have experienced financial difficulties[64]. Air quality and pollution are major concerns[64]. Given the geopolitical tensions involving Russia in the 2010s, which boosted diversification of coal supply by increasing imports from Colombia and active promotion of the use of domestic coal reserves, it may be unlikely that Turkey became a major importer of Russian coal at least in the near future.

Table 4.1 outlines the structure of the coal sector and consumption as well as climate policy in the six main importers of Russian coal.

Declining international demand for coal; also Southeast Asia downgrading its coal plans

Table 4.1 Importance of coal in countries importing Russian coal

	China	India	Japan	Korea	Turkey	EU
TES trend	Growth	Growth	Decline	Flat	Growth	Flat
Total coal consumption, of global total	Large	Large	Small	Small	Small	Mid
Share of own coal production 2018	Large	Large	Small	Small	Mid	Large
Share of coal import in 2019/2020, of global flows*	Large	Large	Large	Mid	Small	Mid
Share of coal import from Russia 2019**	Mid	Small	Mid	Mid	Large	Large
Coal consumption (supply) trend 2015-2019, % of 2015	Flat	Growing	Flat	Flat	Growing	Declining
Coal import trend 2015–2019, % of 2015	Growing	Growing	Flat	Flat	Growing	Declining
Share of coal of power production, 2018/9	High	High	Mid	Mid	Mid	Low
Share of coal of TES 2018/9	High	Mid	Mid	Mid	Mid	Low
Net coal capacity increase***	Yes	Unclear	No	No	Yes	No
Carbon neutrality plan	Yes	No	Yes	Yes	No	Yes
Share: RES of TES	Low	High	Low	Low	Mid	Mid

Source: IEA (2021)[3] except * BP (2021)[119], ** BP (2020)[120] and IEA (2021)[116], ***data presented in the case studies

4.6 Southeast Asia cancelling new coal capacity

Southeast Asia has shown interest as a potential importer of Russian coal: Indonesia (itself a coal exporter) and Vietnam, as well as Malaysia and the Philippines are forecast to increase their coal use beyond 2025, and new coal-fired capacity is being built[88]. The IEA expects coal demand in Southeast Asia to grow by more than 5% annually through 2024. A closer look reveals recent revision of plans to build additional coal capacity. Vietnam's dependence on coal has increased from 15% in 2000 to 44% in 2018,[xiii] and coal imports from Russia have increased five-fold since 2015 (Graph 4.1). However, the era of commissioning new coal-fired capacity seems to be over, as Vietnam's latest energy strategy sets goals for increasing renewable energy capacity and building LNG infrastructure in order to reduce the reliance on coal[121]. Malaysia, which has increased the share of coal in recent decades,[xiv] is now planning to reduce some 30% of its coal-fired capacity by 2039[122]. Many other Asian countries that had commissioned new coal capacity have downgraded their coal plans as of 2020, due to the lower costs of gas and renewables[88]; 45 GW of anticipated new capacity in Asia, including Pakistan and Bangladesh, is now planned to be cancelled[123,124]. There may well be some additional regional demand for coal in the coming decade, but not as much as previously expected.

xiii. IEA data: TES by source.
xiv. IEA data: TES by source.

Foreign climate policies reduce demand for Russian coal

Key messages

- **EU's CBAM reduces the competitiveness of many carbon-intensive export products.**
- **Renewable energy is gaining competitiveness over coal in Russia and abroad.**
- **Divestment cuts the Russian coal sector's access to international credit markets.**

5.1 Carbon border adjustments reduce competitiveness of many export products

Carbon border adjustments aim at charging importers for the carbon content of their products at the border, in order to equalize the carbon costs of imported products with domestic products under local carbon regulations, such as a carbon price or an ETS. The aim is to avoid carbon leakage: industrial enterprises moving production to countries with less stringent carbon regulations. The EU is probably the first to introduce charges for imported products according to their carbon content. The CBAM is still under discussion; it is expected to become operational in 2023 and fully deployed by 2026.

Importers will have to register with the CBAM and submit an annual declaration of the product's carbon footprint, and the availability of the required number of CBAM certificates, which is envisaged to be adjusted to take into account domestic carbon price in the country of origin. The cost of such certificates is proposed to be linked to the average quota price under the EU ETS. It remains unclear how exactly the price of CBAM certificates will be determined: various approaches have been proposed85. The current first draft law proposes a list of products that could be included: electricity, aluminium, cement, chemical fertilizers, iron and steel[125]. Although fossil fuels per se are unlikely to be included, the CBAM will have an impact on the Russian coal sector, as domestic coal use by industry will be taken into account.

5.2 RES gaining competitiveness over coal in Russia and abroad

In recent decades, renewable energy has been supported by policy measures by many governments, enabling these technologies to develop and reach maturity. According to a range of authoritative sources[126,127,128], solar PV and onshore wind energy are now the cheapest power sources globally. Moreover, competitiveness of utility-scale solar PV and wind power continues to improve as prices of solar PV modules and wind turbines fall[xv] and as capacity factors increase. These forms of energy are now cheaper than any new fossil fuel or nuclear plants, and often cheaper than currently operational coal capacity (41 USD/MWh on average). According to Bondar et al[90], it has become cheaper to build a new RES unit than to continue operating 39% of the global coal power fleet.

Russia has abundant renewable energy resources; Carbon Tracker[129] has estimated that generating all Russian electric power from solar would require less than 5% of the Russian territory. Due to a late start (from 2013) for modern utility-scale solar PV and onshore wind, the small size of the market (the Russian wind power market reached 1 GW only in early 2021) and localization requirements, costs of wind power generation in Russia in 2020 were about twice as high as costs globally[107,130,63.xvi] Still, newly commissioned wind power plants in Russia already generate cheaper electric power than new coal-powered plants.[xvii] Bondar et al[90] estimates that by 2030 all existing coal power generation in Russia will cost more than commissioning new renewable power generation with storage.

xv. Lazard (2020) estimates that in 2020, the global costs of newly commissioned utility-scale solar PV power generation started from 29 USD /MWh, the costs of newly commissioned onshore windpower generation – from 26 USD /MWh.

xvi. The estimates of the Russian prices include 67.35–72.29 USD /MWh (IEA 2020c) and average 88 USD /MWh (Lanshina 2021b) compared to the global average of 40 USD /MWh (Lazard 2020).

xvii. RREDA and Vygon Consulting (2020) have estimated the costs of solar PV power generation (2020) at 127 USD /MWh, compared to the global average of 37 USD /MWh by Lazard (2020).

Coal sector dependent on indirect government subsidies

5.3 Divestment cuts Russian coal sector's access to international credit

As of early 2021, there were approximately 4,500 institutional investors in the coal industry globally, including pension funds, insurance companies, banks, etc., with total holdings of USD 1 trillion. The largest coal financiers are two US asset managers Vanguard (coal assets of almost USD 86 billion), followed by BlackRock (coal assets of over USD 84 billion). Together they account for 17% of the global institutional investment in coal[131]. However, in recent years there has been a growing divestment movement. Over 1,300 institutions with assets of around USD 14.5 trillion have pledged to divest from coal, partially or fully[132]. Among these institutions are the Rockefeller Brothers Fund, the City of Oslo, New York City, the California Public Employees' Retirement System (CalPERS). China has announced that it will stop building coal plants abroad[133].

Russian state-owned banks are among the largest investors in the coal industry; however, they have not yet incorporated any coal divestment policies. The major coal funders in Russia are Sberbank, VTB and Gazprombank. Between 1 October 2018 and 31 October 2020, these funders allocated at least USD 2.5 billion, USD 0.9 billion and USD 0.5 billion, respectively, to the coal industry. Sberbank provided funding mostly through loans, whereas VTB and Gazprombank contributed by underwriting. Other important funders of the coal sector in Russia are Otkritie, Russian Regional Development Bank, Credit Bank of Moscow and Alfa-Bank. Additionally, VTB owned coal-company shares worth USD 1.9 bln as of January 2021[134]. In September 2021, JSC SUEK, Russia's largest coal producer whose credit rating has been declining[135] mandated nine banks[xviii] for a Eurobond issuance[136]. While the involvement of international banks flagging green policies has been criticised[137], apparently some European and US investors were among the buyers[138].

However, banks and financial institutions are not the only relevant stakeholders: several foreign companies have been selling their coal plants in Russia in order to achieve their climate commitments. The Russian subsidiary of Finnish Fortum has sold one of its coal-fired plants in Chelyabinsk region (to a Russian state nuclear corporation subsidiary 'Rosatom') and announced it will have divested itself of coal totally by the end of 2022 in Russia, due to the company's commitment to carbon neutrality by 2050[139]. Enel Russia, a subsidiary of the Italian state energy company, sold its coal-fired power plants in 2019[140]. The German energy company Uniper, which currently operates 11.2GW of lignite, hard coal and gas-fired power plants in Russia, is considering divesting its Russian power facilities due to its carbon- neutrality plans[141]. According to the Russian bank VTB Capital, several energy-generating companies, including subsidiaries of Gazprom and other state-owned entities, have become 'uninvestable' for some European funds, due to divestment policies124. Swedebank's exclusion list includes the Russian Irkutskenergo as well as four other companies – KTK, Mechel, Raspadskaya, and SKC – involved in coal mining in Kuzbass[142]. Also Gazprom has tried to sell its coal capacities, holding them to be unprofitable, but potential sales have been blocked by the Russian government due to their strategic importance[124].

xviii. Bank of America and Citi from the US; Germany's Commerzbank; Bank of China; and five Russian banks: Alfa Bank, Gazprombank, Renaissance Capital, SberCIB and VTB Capital.

Regional coal transitions: risks vs. opportunities

Key messages

- **Local environmental and health protests are emerging in coal-producing regions in Russia.**
- **Coal regions have several diversification options but their environmental impacts vary.**

6.1 Emerging local environmental and health protests

Coal mining causes significant health risks for local populations, largely because of air pollution. The total mortality rate of the working-age population in Kuzbass was the second highest in Russia, 46% higher than the Russian average in 2018[143,144] and the cancer mortality rate 17% higher than the Russian average[145]. The annual respiratory disease mortality remains significantly above the national average.[xix] In Kuzbass, 1990–2018, life expectancy at birth was on average 3.14 years less than in Russia as a whole[146,147]. Some open-pit coal mines are located right in the middle of local towns, which are severely affected by the mining operations. Ash waste from coal combustion includes hazardous mineral substances and polycyclic aromatic hydrocarbons that enter underground waters, soil and atmospheric air. The concentrations of many dangerous substances may be extremely high in locations where there are waste deposits.

Public protests against coal mining used to be rare. However, more than 50 protests, mostly by residents of villages located next to coal mines, have taken place in Kuzbass since 2015[148]. Although the local government often responds to protests with administrative and criminal charges against organizers, activists have achieved significant successes. For the first time, in 2019 a Kuzbass court recalled a licence for the construction of a new coal mine as demanded by a group of national and local activists. In summer 2020, a group of local activists set up a protest camp near Cheremza village in Kuzbass. After two months of protests, the construction of coal mining infrastructure was halted. There have been protests against the expansion of coal production and the construction of new open-pit mines and open-air coal transhipment in some regions. Local activism against coal mining in Russia is triggered by environmental and health issues, not by climate change.

6.2 Coal-producing regions: various diversification alternatives

Coal regions require proactive planning to diversify their economies before the socio-economic impacts of declining coal demand become severe. There is a range of alternatives that are socially and environmentally preferable to mining coal for fuel. Table 6.1 outlines the potential options for economic diversification identified by the Ministry of Economic Development for Kuzbass and the Komi Republic as of July 2021[149].

Kuzbass:

- mining of metal ores and other minerals
- metallurgical production
- agriculture and food production
- construction
- tourism (including the Sheregesh ski resort and other ski complexes)
- wood processing and production of wood products
- production of paper and paper products
- coke and petroleum products
- chemicals and chemical products
- rubber and plastic products
- finished metal products
- machinery and equipment
- electrical equipment

Komi:

- mining of metal ores and other minerals
- wood processing and production of wood products
- production of paper and paper products
- finished metal products
- agriculture
- construction

xix. 75.95 deaths in Kuzbass per 100,000 population since 1990, as against 58.98 in Russia as a whole

Regional coal transitions: risks vs. opportunities

Diversifying to the extraction of other minerals would not deliver improvements to the local environment and public health, which have already been significantly affected by coal mining. Furthermore, the oil and gas sectors are already important for the Komi Republic and Sakhalin oblast. There are also diversification options that are less environmentally and socially burdensome, such as tourism, agriculture, food production, equipment manufacturing, RES and coal-bed methane extraction.

Former flooded coal mines could be converted into sources of cheap geothermal energy to heat buildings and greenhouses. This could facilitate greenhouse farming; abandoned coal mines also provide opportunities for underground mushroom farms. Some coal regions with existing wood and paper industries could use their waste streams to produce fuel pellets and biogas.

Solar PV is another option for several coal-producing regions, which have higher irradiation[xx] than in Germany where solar PV power plants produced 10.5% of all electric power in 2020[xxi]. Comparing the costs of generating solar PV electric power (Levelized cost of energy, LCOE) to the grid prices in three coal producing regions illustrates the economic viability of PV generation[150], at least for small businesses and individual entrepreneurs (see Table 6.1). The development of geothermal energy and solar PV sectors would require local manufacturing and assembly facilities for these sectors. Kuzbass is centrally located in Siberia, possesses a developed rail and road network, and thus has logistical advantages for developing a Siberian renewable energy cluster.

The potential for replacing coal with coal-bed methane, a non- conventional form of natural gas found in coal deposits or coal seams[153], can be considered a bridging solution for the coal mining regions. For instance, it could be used for power and heat generation as well as a vehicle fuel, in both compressed and liquefied formats. The total reserve of coal bed methane in Kuzbass is estimated at some 13 trillion m^3 [154]. After launching methane extraction in Kuzbass in 2003, Gazprom has since explored and started developing several sites.

Coal chemistry offers a potential for revenue generation compatible with the current revenues from coal supplies in Kuzbass. Coal as a raw material can be utilized to produce 130 types of chemical semi-products and over 5000 products (carbon fibre, molecular sieves, nanotubes, nanocomponents, carbon sorbents, etc.). Development of the coal chemistry cluster in Kuzbass could generate 75,000 new jobs, and over USD 10 billion in annual revenues[155], however, its climate impacts remain unclear and dependent on the products chosen.

Table 6.1 Comparison of solar PV generation costs and grid electricity prices in three regions in 2021[151,152]

Region	LCEO, RUB/kWh	Electricity price for small and individual entrepreneurs, RUB/kWh
Kuzbass	4.9	<6
Rostov	4.7	<7
Zabaikalsky Krai	3.6	<5

xx. Direct normal irradiation in Kuzbass is 1128.4 kWh/m2 per year; in Rostov region, 1297.8 kWh/m2; in Zabaykalsky krai – 1788.8 kWh/m. Global Solar Atlas (2021). Map data. URL: https://globalsolaratlas.info/map.

xxi. 1030.1 kWh/m2 per year in Bavaria, in southern Germany (Fraunhofer ISE, 2021). Public Net Electricity Generation in Germany 2020: Share from Renewables Exceeds 50 percent. URL: https://www.ise.fraunhofer.de/en/press-media/news/2020/public-net-electricity-generation-in-germany-2020-share-from-renewables-exceeds-50-percent.html.

Previous experience of coal transitions: guidance for the upcoming transition

Key messages

- **Russia successfully restructured its coal sector in the 1990s and 2000s.**
- **Recent coal transitions in other countries can provide lessons for Russia.**
- **International experiences illustrate the importance of proactive planning.**

7.1 Previous successful restructuring of the Russian coal sector

Towards the end of the Soviet Union, coal mining was characterized by a drop in production volumes and labour productivity, the presence of many unprofitable enterprises, and high physical depreciation of mining assets[2]. This crisis also involved the non-payment of coal workers' salaries[156], which resulted in large-scale miners' strikes throughout the country; indeed, it is largely because of this experience that the Russian government has continued to support the coal sector, despite it not yielding major profits for the federal budget. That being said, experience gained from the previous transition of the Russian coal sector could be applied to approaching a low-carbon transition: it will be similarly triggered by economic factors (declining demand for coal exports, competition from other forms of energy in the domestic market) and social problems (unemployment, changes in regional budgets), as was the case with the post-Soviet reform of the sector.

The Russian government has experience with the social programmes[157,158,159] established to ease the impacts of mine closures during the 1990s reform. Social support for laid-off employees included payment of entry allowances and support for relocation, assistance to industry employees in purchasing housing, support for generating new jobs and SME businesses, repair and construction of social infrastructure facilities, creation of safe working conditions, and support for research and development works covered by the allocated budget financing. These programmes provided a relatively long period of consistent and well-financed support: the local development programmes launched in 1996 were still receiving financing in the early 2000s[36]. This experience could guide a future coal transition as well.

7.2 Importance of proactive planning: international experiences

In recent decades Australia, Poland, the Netherlands, South Africa, and Germany have embarked on coal transitions. Their success and failures can provide valuable lessons that can inform and guide Russia's coal transition.

The first and perhaps most valuable lesson is the need for long-term planning. Anticipation of the impact of a coal transition enables the government to be ahead of and not behind any potential fallouts. Therefore: *plan proactively rather than reactively*. In Australia, the lack of anticipatory, long-term planning limited the impact of government financial support for the Latrobe Valley region and former coal workers[160]. In contrast, policymakers in the Netherlands were pro-active; as a result, they were able to better manage the consequences and impact of the country's coal transition on the economy and on local communities[161]. Anticipation and long-term planning is also necessary to *prevent the stranding of assets and additional energy generation costs*. In South Africa, recently built coal plants are already considered stranded assets, and analysis shows that money can be saved through the early retirement of currently operational plants[162]. If Russia does not account for the continued decrease in LCOE produced by renewables in comparison to coal, it risks being left with stranded coal assets such as plants and mines.

Equally important is the nature and shape of the policies designed to facilitate a smooth transition. In Germany, two successful sets of policies aimed at *re-training and early retirement*. The early retirement scheme was intended for older workers. It facilitated a staggered decrease in jobs in the coal sector without resulting

Previous experience of coal transitions: guidance for the upcoming transition

in negative economic and socio-economic outcomes. The second scheme, re-training of workers in the coal sector, enabled them to re-enter the labour market[163]. In contrast, in Poland the re-training of workers has been lacking; as a result, many former workers from the coal sector have not re-entered the labour market. Baran et al.[164] argue that incentivizing skills development and continued participation in the labour force facilitate employment better than conditional payments.

Conclusions: Elements of a coal transition

Key messages

- **A fair and equitable coal transition in Russia must consist of:**
  - **social programmes to subsidize and re-employ redundant workers.**
  - **national and regional programmes to plan and support the diversification of the regional economies, especially in the most coal-dependent region, Kuzbass; and**
  - **economic mechanisms to reflect the real costs of the coal sector such as a domestic carbon price.**
- **The Russian government should launch an objective national assessment to manage such a major transition and maximize the benefits it can deliver.**

The Russian government and the coal lobby expect demand for coal to continue, both internationally and domestically. This out-of-date stance reflects neither the recent re-evaluation of coal investments and policies by the expected importers of Russian coal, especially in Asia, nor domestic trends. Domestically, the coal fleet is on average well past its technically planned lifetime, and its continued use increases risks as well as costs. Internationally, the competitiveness of renewable energy and gas is leaving coal plants as stranded assets, and the planned and ongoing climate policies serve to curb the demand for coal. According to the Russian government and coal sector, it will still take time before global coal demand starts to decrease. This may be correct in the short term, as demand and capacity will not disappear permanently overnight. The post-COVID-19 economic upturn is likely to result in a short-term boost in coal demand. Beyond that, however, it is difficult to forecast the pace of the decline of coal; the IEA[88,101] expects coal consumption to peak during the 2020s in many countries.

What may appear odd to foreign observers is the short-term planning that Russian companies as well as the government are clearly applying. In Russian terms it still makes economic sense to invest for instance in Eastern railroad capacity, even though the coal markets are likely to start drying up during the next decade. Also, to European eyes, the layers of subsidies to the otherwise loss-making coal exporters seem ill-advised: why allocate further budget money to new transport capacity when also its use will have to be cross-subsidized? Such decisions are obviously politically driven, and keep the budget constraints soft for some businesses in Russia, including coal. The social importance of the Russian coal sector has declined due to restructuring in the 1990s and 2000s, which cut the labour force to a fraction of what it was in the final days of the Soviet Union. This consideration has remained relevant and influential, justifying subsidies.

However, change is indeed underway. The Russian coal sector may survive in its current format, perhaps for a decade or two longer, depending on the federal government. Thus, the key question for the Russian coal industry is *not if* there will be demand for coal exports – but *for how long*? The unforeseen circumstances in the global economy in the pandemic year 2020 explain the decline of coal demand for the first time since World War II. Recovering economic growth will boost coal demand to some extent – but green recovery packages, divestment away from coal, and the momentum of renewable energy technologies are the focal points for a global energy transition.

Russia cannot escape the global low-carbon trend indefinitely, and a coal transition will take place sooner or later. At the same time, such a transition also provides the Russian government with a major opportunity to put its economic diversification policy into practice.

Conclusions: Elements of a coal transition

Guiding the coal producing regions to diversify their economies sufficiently to enable the economic forces to kick-start a manageable coal transition will require consistent, well-planned government policy – federal as well as regional. Our research has shown that a fair and equitable coal transition in Russia must consist of three elements: 1) social programmes to subsidize and re-employ the redundant labour force; 2) national and regional programmes to plan and support the diversification of the regional economies, especially in the most coal-dependent region, Kuzbass; and 3) economic mechanism to reflect the real costs of the coal sector such as a domestic carbon price, to kick-start the transition. *An objective national assessment of these three elements and their interlinkages is needed in order to manage such a major transition and maximize the benefits it can deliver.* This also makes economic sense for the coal sector itself, because the businesses involved could diversify their operations – as many of them are already doing. This time, perhaps they can get government support for the operations they must undertake regardless, given international green market trends and divestment.

Russia has prior experience of a major coal sector restructuring from the 1990s and 2000s. That was a much larger operation, in social as well as economic terms, than the transition that is now needed. Moreover, Russia can learn from the successes and failures of countries which have already undertaken coal transitions, or are poised to do so.
Perhaps the most vital lesson concerns the need for long-term planning. Further, it is important to facilitate the entry of workers from the coal sector into the broader labour market. In both cases, the role of the state, at national and regional levels, is critical: both long-term planning and policymaking are required, to set a clear vision and incentives, and to steer investment decisions.

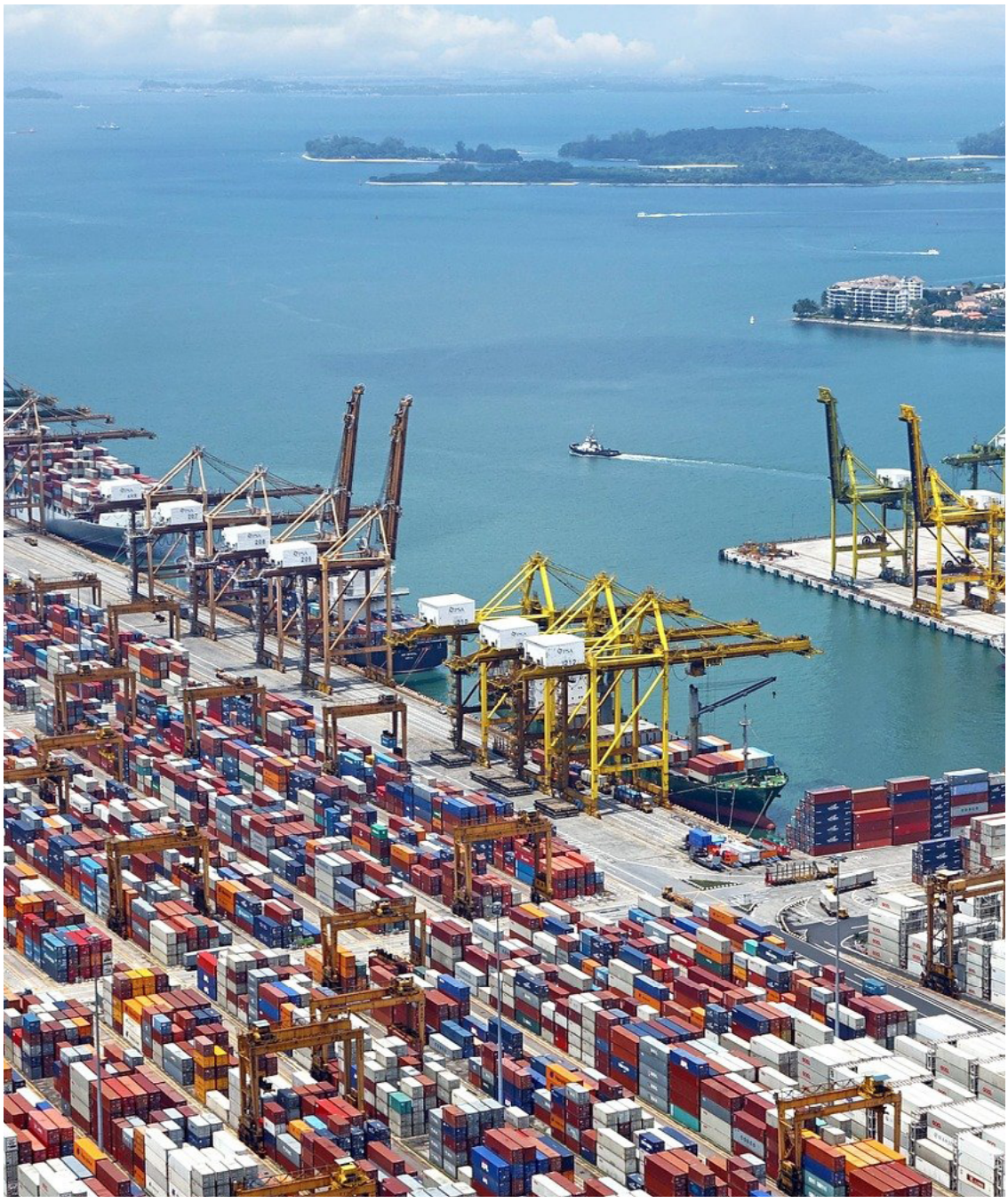
A well-planned transition away from coal could enable the mining regions to develop into environmentally and socially sustainable, as well as economically viable, sectors of the economy. For instance, renewable energy clusters and modern agriculture could give coal regions reason to accelerate their transition towards more sustainable practices and to attract investments, which have already begun to shift away from coal. Green special economic zones could provide investors with tax and other economic incentives previously accorded to the coal sector – but also with access to green electric power and heating, green infrastructure and opportunities to implement greener production processes. In turn, this could support the future exports of regions as well as of Russia as a whole to the EU, at a minimal carbon border adjustment cost.

However, a coal transition for Russia will necessarily encounter political obstacles. This is reflected in the absence of European-style 'coal phase-out' discourses in the Russian domestic debate. The short-term economic thinking – which makes sense in an unpredictable short-term economy like that of Russia – on the part of the coal sector as well as the Russian government ignores the environmental costs of coal use, which remain externalized. Even most of the liberal wing in the domestic debate is driven not by environmental concerns, but by economic ones, and often shares the scepticism of the more conservative voices over the CBAM, for instance. Here we should note more general foreign policy approach of Russia, a former superpower: it is politically uncomfortable for Moscow to find itself on the receiving end of the environmental policies of others – as also stated in Russia's Foreign Policy Concept.

Introducing domestic climate policies has been recognized as one mechanism that can enable economic forces to do their work by internalizing the hitherto externalized environmental costs. With the upcoming CBAM, exporting products to the EU will require measures by Russia in any case. In Russia, there is considerable expertise that could be applied to achieving a functional and just domestic carbon regulation scheme – which could also contribute to a better economic balance of the budget by indirectly phasing out coal. Renewable energy and coal-bed methane extraction as diversification options could further increase Russia's trade possibilities with the EU in future.

Concerning international climate policy, Russia's critically insufficient growth target under the Paris Agreement invites foreign

policy approaches by other countries that go beyond negotiations, such as carbon border adjustments. The importance of proceeding with low-carbon policies, even if not all countries (e.g. Russia) cooperate, is highlighted by the Intergovernmental Panel on Climate Change (IPCC) report issued as this report was being prepared. Time is running out fast for mankind to control the climate crisis. The Russian political leadership may disagree on the CBAM, but is doing itself a disfavour by focusing on directly opposing it. Acknowledging the CBAM as a tool for the inevitable low-carbon and coal transition could help to protect all those working for the coal industry as well as the political leadership itself from sudden shocks likely to entail high social and economic, perhaps also political, costs.



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