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Russian Coal in the National and International Context: The Coal Industry in Post-Soviet Russia

Russia, as the beneficiary of one of the world’s largest coal reserves, is poised to produce coal. Historically, it is the fossil fuel most responsible for Russia’s growth and development, and remains one of Russia’s most indispensable resources. Coal is Russia’s most stable energy carrier, and for this reason, the coal industry prescribes heavy coal investment and coal utilization to offset energy use. It seeks to become a larger part of Russia’s energy-balance dialogue. This paper argues that since coal is critical for industrial development and is a tool for maintaining influence abroad, Russia will not only bolster the development of its coal industry, but will increase coal production at levels beyond what is forecasted. However, it is also worth discussing whether there are valid reasons, beyond national and international emission regulations, for Russia to continue to invest so heavily in coal.

The socio-economic development of Russia reflected by its energy strategy suggests that Russia will increase coal production from 315 million tons in 2010 to about 415 million tons in 2020. Russia’s total coal reserves are estimated at 3.9 to 4.5 trillion tons, 95 percent of which lies east of the Urals. Other appreciable but less significant deposits lie west of the Ural Mountains. Russia’s explored reserves are estimated at 200 billion tons (second after the United States). Russia currently holds nearly 16 percent of the world’s total coal reserves and if Russian reserves were combined with that of the former Soviet republics, the conglomerate would

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4 Nekrasov and Sinyak.
possess almost 23 percent of the world’s total reserves.\(^5\) Central Siberia is the main coal-producing region of the Russian Federation. It represents 66 percent of the nation’s probable reserves, 78 percent of its high-grade explored reserves, 80 percent of coking coal, and 81 percent of low-grade coal. Surface mines constitute about 87 percent of all explored reserves. Russia’s most productive reserves are found in the Kuznetskiy and Kansko-Achinskiy regions of Siberia. Siberia’s basins are currently home to the largest state and private coal-producing centers, and the combined basins account for nearly 60 percent of all saleable coal output.\(^6\) Regions west of the Urals account for about 10 percent of steam coal (low-grade or non-coking\(^7\)) and less than 10 percent of coking (medium to high-grade) coal.

The coal industry’s historical trajectory, along with recent energy policies, suggests that Russia’s coal industry is evolving and that sustaining the coal industry is critical to the success of many regions, especially coal mining towns. Prior to the dissolution of the Soviet Union, coal towns, generally rural, depended almost exclusively on coal revenue.

The environmental impact of the Russian coal industry is also of serious concern. The future of Russian coal depends heavily on the steps taken by the state to perpetuate the industry while satisfying international demands—be it the production of coal or Russian compliance with international energy-related regulations such as the Kyoto protocol.\(^8\)

\(^5\) Miller.
\(^6\) Nekrasov and Sinyak.
\(^7\) Low-grade or non-coking coal is also referred to as brown or soft coal. Higher grade bituminous or anthracite is also referred to as black or hard coal. Coking is a process by which coal softens and forms an encrusting product during carbonization in a heating chamber. Coking coal is primarily used in steel foundries as coking coal produces relatively low ash content and higher fixed carbon proportions during combustion. Non-Coking coal is generally required for steam production in thermal power plants.
\(^8\) Buchner and Dall’Olio.
Russian Coal and Non-coal Fossil Fuels in the Domestic and International Spheres

The Russian power industry, with a capacity of 215 gigawatts (GW) is the world’s fourth largest, after the United States, China and Japan. Its electric power industry is comprised of more than 700 electric power plants with a total capacity of 225 GW. Of all of Russia’s electric plants, 25 of these are thermal coal-fired plants that carry a combined total energy capacity of about 30,000 MW. Coal-fired power plants provide nearly 23 percent of Russian electricity. Russia possesses about 10 percent of all known oil reserves and 26.6 percent of the world’s natural gas reserves. Approximately 80 percent of power-producing facilities in western Russia, including those in the Ural region, operate on gas and oil, while more than 80 percent of thermal power generating facilities in eastern Russia operate on coal. This division in regional methods of energy acquisition should be no surprise: coal is far more abundant in the eastern parts of Russia. In 2005, 24 percent of the European Union coal, 42 percent of its gas, and 32 percent of its oil imports came from Russia. European utility companies and steel refineries are perhaps Russia's most important foreign investors as the EU is Russia’s most important export market for overall energy sales.

Centralization of Russian Fossil Fuels and Implications for European Union and Central European Energy and Foreign Policy

Russia’s coal will continue to be a European commodity for years to come. Coal is the second most important source of energy in Europe, just behind oil. The combined export of

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9 Kakaras, et al.
10 Volkov, et al.
11 Kakaras, et al.
12 US Energy Information.
13 Barysch, et al.
14 Volkov, et al.
15 Barysch, et al.
16 Paillard.
energy suppliers to the European Union generates over $60 billion annually for Russia.\textsuperscript{17} The relationship between Russia’s energy providers and European energy consumers is mutually beneficial, given Russia’s substantial energy reserves and the reliable and growing market in the EU for imported energy.\textsuperscript{18} The European Union’s newest members (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia) are more dependent on Russian fuels than the original 15 members.\textsuperscript{19}

Orban (2008) and Smith (2004, 2010) suggest that Russia has in the past relied on its energy resource as a foreign policy tool. However, Barysch et al (2008) argue that Russia does not use energy as a political tool and that Russia can be trusted as a supplier whose primary goal is to distribute energy resources to other countries, irrespective of special interests. Furthermore, they suggest that the energy interdependence between the European Union and Russia allows Russia’s energy sector to serve as a basis for the development of regional partnerships. Ukraine, for example, is for the most part self-sufficient in coal and electricity but produces only around one-fourth of its domestic consumption of crude petroleum and natural gas. It imports the rest primarily from Russia. In 2000, within the Baltics and Commonwealth of Independent States (CIS)\textsuperscript{20}, Ukraine was the largest buyer of Russian gas, the second-largest buyer of crude oil, behind Lithuania, and the third-largest buyer of refined products, behind Estonia and Latvia.\textsuperscript{21} Ukraine, like other former Soviet Socialist Republics, is expected to pursue a more diverse source of coal supply in order to alleviate Russian geopolitical influence. However, Russia will

\textsuperscript{17} Orban.
\textsuperscript{18} Barysch, et al.
\textsuperscript{19} Orban.
\textsuperscript{20} Commonwealth of Independent States include 12 of the 15 former Republics of the Soviet Union, namely Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldava, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.
\textsuperscript{21} Shiells.
continue to devise a series of stratagems to win the confidence of Ukraine, since it is a critical transport corridor for coal and other hydrocarbon fuel resources sold or traded in Eurasia.

A large part of Russia’s strategy for energy expansion during the Soviet era and beyond has been to use its energy resources to strengthen its foreign influence, especially in Eastern European countries like Poland, Slovakia, and Hungary, which have had historically rocky relationships with Russia.\(^\text{22}\) Russian energy companies have participated in privatization proposals for several Central and Eastern European country’s strategic energy assets, and have been proactive in finding opportunities to sway key pieces of energy policy.\(^\text{23}\)

It appears that one of the main strategies of Russian energy companies is the establishment of some level of hegemony over European, and to a lesser extent, Asian energy markets.\(^\text{24}\) This has been demonstrated through energy sales and trade deals in Europe and Asia, all which seek to craft a trade deal that asserts Russia’s national interest.\(^\text{25}\) To achieve greater influence in energy markets Russian energy enterprises must diminish foreign diversification of energy assets.\(^\text{26}\) For example, Russian energy companies often present special provisions for friendly international governments provided the governments open their respective countries to Russian energy trade and investment. These deals are said to characterize several major Russian international energy trade relationships, but are utilized by other countries’ energy companies as well.

\(^{22}\) Lucas; Orban.
\(^{23}\) Orban.
\(^{24}\) Alto; Smith, 2004; Smith, 2010.
\(^{25}\) Varol.
\(^{26}\) Orban; Smith, 2004; Smith 2010, Varol.
Centralization of Russian Fossil Fuels and Implication for Western Nations

Historically, the United States has traded with and has been a large import beneficiary of Russian coal. However, it is not clear exactly what influences Russian coal trade has had on the United States. Between 1926 and 1934, the New England states alone imported 44 percent of the USSR’s high-grade anthracite coal. As it does today, anthracitic coal commanded a high price because of its high heating value and low ash content. The shipments averaged 229,000 tons a year from 1931 to 1934, but accounted for less than one percent of total U.S. anthracite production and about four percent of total New England consumption.27

The United States and many European Union countries have strained relationships with Russia. Energy policy is one of the most contentious topics between these countries. It has been suggested that Russia is suspicious of Western pressures for the use of Western cleaner coal technology for emissions reduction. Like Poland, Russia believes that mounting Western pressures may not necessarily be an avenue to address pollution control, but to promote business and advance an American agenda.28 In contrast, one of the prevailing Western fears is the perpetually expansionist behavior of Russian energy policy, under which coal can be used as a tool of persuasion.29 Like its oil and natural gas, Russian coal resources can be used as a tool of leverage and in many cases rouses international attention. Smith calls Russia’s use of its energy companies as tools to influence other countries an “instrument of subversion and corruption.”30

While Smith’s description of Russia’s energy influence is not necessarily an accurate characterization of the national agenda, the 2006 shut-off of the gas pipeline to Ukraine reflects the significance of Russia’s sphere of influence in the world energy market, as well as European

27 Schley, et al.
28 Chandler.
29 Smith, 2004; Smith, 2010.
and former Soviet Republic dependence on Russian energy supplies.\(^{31}\) After the Russian government substantially reduced the volume of gas supplies in transit to the EU and former Soviet Republics through its Ukraine pipeline, Hungary lost nearly 40 percent of its supply; Austrian, Slovakian and Romanian supplies were cut down by one third; France lost 25–30 percent of its allocation, and Poland and Italy lost 14 and 25 percent of their share, respectively.\(^{32}\) With such systemic losses, the EU declared the conflict an ‘energy crisis.’ Today, critical coal basins such as the Donetskiy (Ukraine), formerly Russian, are a contentious topic in Russia-Ukrainian energy dialogues.

Even though the West is aware that Russia still focuses significantly on energy expansion and has had a rich history of energy proliferation long before the 1917 Bolshevik victory,\(^{33}\) Western nations, including the U.S. and EU, have called on Russian officials to accelerate reforms of Russia’s coal and hydrocarbon fuel monopolies in order to attract foreign investments and increase energy exports. For more than a decade, through partnerships and cooperation agreements such as “EU-Russia Energy Partnership,” the EU has encouraged Russia to make concrete commitments to improve the legal framework through which European energy firms operate in Russia’s energy sector and to favor the development of fast track settlement procedures in Russian law. One reason why U.S. investment in the Russian coal market is modest is that the U.S. does not have a ratified bilateral investment or free trade treaty with Russia. American investors usually invest in Russia’s energy sector through a European subsidiary that enjoys better legal protection.\(^{34}\)

\(^{33}\) Mersheimer.
\(^{34}\) Aslund and Kushins; Varol.
Figure 1. Major coal basins of Russia by volume of reserve. Sources: Goudkoff, 1923; Craig et al., 1994; International Energy Agency, 2009; Keith Philippe, 2011.
Figure 2. Major coal basins contiguous United States by volume of reserve. Sources: Goudkoff, 1923; Craig et al., 1994; Truly, 2006 (Truly, John, US Geological Survey); International Energy Agency, 2009; Keith Philippe, 2011.
Should the Russian Federation Continue to Invest in Coal?

In this section, the question is raised, whether Russia should so thoroughly invest in coal while markets are steadily shifting towards alternative fuels. This section argues that despite shifting energy markets Russia, is likely to continue to invest in coal energy up to 2050. Unlike other natural resources produced in the federation, the coal sector is more often closely linked to social and domestic issues. For example, in mining towns, coal is often the only real source of employment either directly or indirectly. The 1991 restructuring\textsuperscript{35} of the coal industry demonstrates how critical the industry is to mining towns. However, in recent years foreign and domestic investors have paid far less attention to the coal industry than to the oil industry because coal, although stable and profitable, has not produced as many oligarchs.\textsuperscript{36}

Russia is in effect a petro-state. However, although petroleum resource is a key driver of Russian energy markets, it is clear that petroleum alone cannot sustain economic growth or international demand for Russian energy over the next few decades. Therefore coal, as an alternative fuel, is considered a post hoc energy alternative for the state. Also, if the performance of the petroleum industry serves as a reliable measure of state power, then it will be in Russia’s energy security interest to secure non-petroleum fuel to diversify its fuel economy in order to balance diminishing petroleum wells. Russia is in a strong position to tap into its coal potential as a stable energy supplier.\textsuperscript{37}

\textsuperscript{35} Coal mines had provided tremendous resource to small towns and had been in many cases the catalyst of municipal development. Shortly after the dissolution of the former Soviet Union, the Russian coal industry faced the grim task of reform due to market privatization and shifting assets. The number of Russian coal workers was reduced from 900,000 in 1991 to a staggering 400,000 by 2001. “staggering” is usually used to modify a large number, not a small one – it might be better to say “reduced by a staggering 500,000 from 900,000 to 400,000 by 2001” or perhaps delete “staggering” altogether.

\textsuperscript{36} Cheskidov; Smirnovsky.

\textsuperscript{37} Orban; Barysch, et al.
Russia’s natural gas production is likely to become more costly as western Siberian gas fields deplete. Domestic and foreign gas consumption is also likely to increase with increasing consumer demand. Therefore, the geographical pattern of gas production is likely to change as production demands increase both domestically and abroad. To slow down the growth in gas demand, Russia would have to intensify its efforts to replace natural gas with other energy-yielding alternatives such as coal.

Since Russian power plants use about 40 percent of the state’s total domestic gas consumption, and electricity demand is growing fast, an increase in coal production may be one of the best energy investment decisions in order to supply new and existing power plants.

Russia continues to make progress in its utilization of coal for electric purposes. Barysch et al. suggest that many energy-producing processes, like those of compressor stations along Russia’s 155,000-kilometer pipeline system, will be electrified and powered by coal and nuclear energy.

More recently, the escalating mortality during heat waves and cold spells suggests that there is an increase in the demand for heating energy and that coal energy is a likely option to help curb energy-shortage-induced mortalities.

China’s growing economy has also been an incentive for growth of the Russian coal industry. Although China possesses large coal reserves of its own, they are supplemented with coal imports from Russia. On a visit to China in September 2010, Dmitry Medvedev signed several agreements supporting energy trade between Russia and China. In addition, the Russian Energy Minister, Sergei Shmatko, and the head of China’s State Energy Office, Zhang Goba,

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38 Aalto; Barysch, et al.
39 Barysch, et al.
40 Barysch, et al.
41 Revich and Shaposhnikov.
signed a memorandum of understanding on coal trade between the two counties.\textsuperscript{42} Furthermore, the number of supply contracts Russia has signed with consumers like the United States, China, India, and Japan suggests that Russia is determined to continue coal production. China, for example, plans to provide Russia with a credit of about $6 billion to develop new and existing Russian coal deposits. In 2010 the Russian-Chinese Commission made a 25-year bilateral agreement in which Russia is expected to deliver at least 15 million tons of coal annually over the next five years. The arrangement further mandates that after the first five years Russia will deliver larger volumes of at least 20 million tons of coal per year.

In addition to direct investment in coal deposits, Russia has allocated large grants to support other state-tied programs that will impact its coal sector. These include the development of new roads, railways, bridge and shipping port installations.\textsuperscript{43} Russia’s Trans-Siberian Railway and Highway are ideally positioned to transport coal to the more distant and industrialized Russian cities, such as St. Petersburg and Vladivostok. Figure 5 illustrates the Trans-Siberian Rail and Highway transportation passageway. The Trans-Siberian Rail and Highways strategically run not only through Russia’s critical coal towns, but also through towns possessing several of Russia’s most productive coal basins, two of which are the Kuznetsk and Kansk-Achinsk basins. The Trans-Siberian Railway and Highway span from St. Petersburg to Vladivostok. Vladivostok is home to the largest system of container ports, which supply natural resources to Asian markets. According to Sergei Shmatko, “this is a significant amount [of transportation infrastructure] that would make China one of the most attractive and strategic markets for the Russian coal industry.”\textsuperscript{35} It is also important to note that China is less likely to

\textsuperscript{42} Ministry of Energy, 2010.
\textsuperscript{43} Rosbalt Information Agency.
rely on Russian natural gas as it would Russian coal. More recently the two have established close partnerships and are expected to engage in bilateral trade to benefit their respective economies.

Smelting processes\textsuperscript{45} (especially steel) and electricity are arguably the largest drivers of Russian coal production, and the two combined have played a significant role in the development of the industry for more than a century. In fact, Evplanov says that the Russian coal industry provides fuel primarily for metallurgical and chemical processors, and then to electric power grids.\textsuperscript{46} According to McCaffray, historical records suggest that coal and steel production had been the essence of Russian’s national strength.\textsuperscript{47} McCaffray further maintained that it was blast furnaces, rolling mills, and density of rail networks that augmented economic progression, and not natural gas and petroleum.\textsuperscript{48} The demand for Russian coal comes on the heels of an expanding international and domestic steel industry. In fact, Sergei reports that in the coming years the production of Russian coal will increase due to a projected increase in steel production.\textsuperscript{49} The developing, energy-demanding economies of China and India are likely to require additional coal fuel for power and metallurgy because their respective coal supplies cannot sustain their burgeoning economies on their own. Although India has appreciable coal reserves, its coal imports are steadily rising to meet a growing demand for coking and steam coal as additional power plants emerge in the country.\textsuperscript{50} Sergei suggests that in lieu of a limited domestic Russian coal market, external coal markets are likely to be a major factor in the growth

\textsuperscript{44} Paillard.
\textsuperscript{45} Metal extraction process in which steel is heated at high temperature in an enclosed furnace.
\textsuperscript{46} Evplanov.
\textsuperscript{47} McCaffray.
\textsuperscript{48} McCaffray.
\textsuperscript{49} Sergei.
\textsuperscript{50} Miller.
of domestic coal companies. Vorkutaugol, for example, predicts that the increase in coking coal consumption up to 2010 will go from 30 to 50 percent. More recently, Mechel, one of Russia’s leading mining and steel companies stated their intent to participate in the privatization of coal assets in India, and to develop other mineral mining industries. Mechel maintains that the growing Indian steel industry is one of the company’s largest incentives to produce coal; more specifically coking coal.

It is clear that Russia will likely increase coal production in the coming years. A key question that remains is, given global transition from traditional coal and hydrocarbon fuels to

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51 Sergei.
52 Sergei.
Figure 5. Proven Coal Reserves and Productive Coal Regions of Russia. The above was generated using several sources (Goudkoff, 1923; Craig, et al., 1994; International Energy Agency, 2009; Keith Philippe).
cleaner fuels; can Russia’s coal industry be sustained in the long run, especially given the context outlined in this paper? The answer to this is still unclear.

**The Production of Coal: A State Imperative**

Energy development trends since 2000 suggest that although gas and oil are critical energy fuels, Russia’s domestic energy concerns will eventually shift its focus from petroleum and natural gas to coal-fired power plants.\(^{53}\) Despite the unprofitability of several coal reserves, reports still maintain that Russia’s coal industry is poised for progress.\(^{54}\) Coal development is slated as a key component of Russia’s strategy for energy-balance.\(^{55}\)

The coal industry faces many challenges, most of which had emerged over the last few decades. Channon, Chandler, Butrin, Lawson, the Ministry of Energy of the Russian Federation, Sergei, Cheskidov, and Volkov, et al. all highlight some of the challenges the sector confronts.\(^{56}\) They include: transportation bottlenecks; cost of transportation being too close to that of cost of production; lack of port capacity and poor logistics; geographic limitations and unnavigable geological conditions; termination of mines due to high production costs and low sales; underutilization of productive mines due to limited coal demand from some Russian regions; increasing frequency of mining accidents; questionable mine integrity; reduced production-efficiency; international pressure on environmental impacts of mining; technological challenges; and finally, equipment inefficiencies. For example, in 2001 “a commission of the Ministry of

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\(^{53}\) Sokol, et al.

\(^{54}\) Malyshev.


\(^{56}\) Channon; Chandler; Butrin; Lawson; Ministry of Energy, 2003; Sergei; Cheskidov; Volkov, et al.
Energy was surprised to discover that a coal conveyer operating in one of the Rostov Coal (Rostovugol) mines had been made in Belgium in 1908.57

Despite industrial challenges, Russia is still set to intensify coal production. The following section highlights some of the efforts that Russia is implementing to further develop the industry. In 2008–2009, the Russian Ministry of Energy developed an energy strategy for coal as a part of their broader strategic energy development goals entitled “Energy Strategy of Russia until 2030.” The state introduced five primary strategic objectives for a coal-intensive industry. First, the state intends to introduce a reliable supply of economy and population with high-quality solid fuel and its products. Second, it will ensure competitiveness in the face of market saturation by alternative energy sources. Third, Russia will promote sustainable and safe development of the coal sector on the basis of modern scientific and technological capabilities and technologies that meet environmental standards. Fourth, the state will further develop basic coal mining areas and fields in Siberia, the Far East and European Russia. This development will also include the expansion of mining within areas having favorable geological conditions. Finally, Russia seeks to improve the quality of coal production by increasing the depth of enrichment of coking coal, and by adopting new technologies of enrichment and processing of coal.58

Among several indicators, Russia’s Energy Strategy up to 2030 suggests that a strong coal industry is a national imperative and that the Russian Federation remains resolute about increasing production over the next several years.59 It is no surprise that the state and private sectors intend to use coal primarily for generating electricity and for metal smelting operations.

57 Butrin.
The Russian government envisages coal production primarily in the coal-rich regions of Kemerovo and Krasnoyarsk (see Figure 2).\(^{60}\)

Other reports further maintain that the industry is poised for progress. Some of the objectives of Russian–EU energy dialogues are to improve investment opportunities in Russia’s energy sector, to upgrade and expand energy production and transportation infrastructure, to minimize environmental impact, to encourage the diversification of energy markets, and to promote energy efficiency and savings.\(^{61}\) Some experts suggest the production cost per unit of coal will rise slowly up to 2030, even though coal will remain the least costly type of fuel.\(^{62}\) Russia has managed to triple its seaborne coal exports from 2000 levels to a total of 76 million tons in 2008, despite coal-transportation constraints. Since 2010, Mechel holdings was set to begin operations at one of Russia’s untapped, high-potential coal deposits (Elga coking coal deposit) in order to ramp up coal production.\(^{63}\) Mechel also has plans for about 28 million tons of export capacity at a new coal industrial complex, Muchka Bay Terminal 2. Moreover, Russia’s coal exports to Asia is positioned to receive assistance through increased cargo expansion at newly developed shipping ports such as the Pacific Port of Muchka. This port is home to the Siberian Coal and Energy Company, SUEK, which has produced nearly 13 million tons of annual export since 2010.\(^{64}\)

In addition to advances in the private sector, recent studies have suggested that the use of advanced technology that could lead Russia’s coal industry to develop a more efficient and clean

\(^{61}\) Barysch, et al.
\(^{62}\) Nekrasov and Sinyak.
\(^{63}\) US Energy Information.
\(^{64}\) US Energy Information.
Some of these technological advances include liquid coal and improved combustion techniques. Other advances include the use of pulverizing coal injections. According to Kakaras, et al., this technique was scheduled to be completed in 2012 and was expected to increase the state’s coal energy efficiency, eliminate the need for natural gas and reduce Russian coking coal consumption by almost 20 percent.

As the world’s oil production approaches its maximum (2020–2030), Russia is determined to advance and sustain coal production, and, therefore, will continue to adopt and implement strategies to meet this objective. However, the future of the industry, including how well it meets energy-balance goals, remains relatively unclear.

**Conclusion**

No single fossil fuel has played a more critical role in the development of Russia since the rule of the tsars than coal. Coal is arguably the most stable source of energy in Russia. The development of Russia has been linked closer to coal mining than it has to other important fuels like natural gas, oil and nuclear material. Russia had undertaken great privation to sustain the coal sector, and the production of coal is set to increase over the next several decades. With rapidly diminishing global oil supply; increasing foreign energy demands; vast regions of unexplored coal beds; access to some of the world’s most productive coal basins (Kuzbass and Kanks-Achinsk); heavy coal-mining prospects in promising Russian coal basins (Republics of Tyva and Sakha); and the development of some of the world’s most extensive railway corridors accessing remote coal-rich reserves, Russia is clearly set to continue its pursuit of coal for the next several decades. Despite gasification of several Russian districts—allowing natural gas

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65 See Sharypov et al., 2004; Sharypov et al., 2006.
66 See Shchipko and Boris, 1995; FEA, 2002; Boiko et al., 2003; Anshits, et al., 2010
67 Kakaras et al., 2004.
68 Sinyak et al., 2013.
pipelines to replace coal-sourced heating systems—coal produces more energy per unit than gas and petroleum; and, of the top three fossil fuels, is least likely to exhaust. As the early economic development of the Russian Empire was spurred by coal—so too will the longevity of the Federation.69

Russian coal competes with its petroleum, natural gas, and nuclear fuels. Coal-fired power plants in the Russian Federation are also only fitted to aging Soviet scrubbers and particulate matter control systems, most of which foreign coal investors and international regulatory agencies discourage using in coal processing.70 While coal production is projected to increase based on national energy consumption, the need for increasing coal production in Russia will be focused on increased global energy demands, diminishing petroleum and natural gas reservoirs, broad impact on environmental problems, geographic and geological constraints, and transportation bottlenecks.

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