Will the Limitations in Transport Infrastructure Hinder the Production of Siberian Coal?

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Abstract: This article analyses the structure of coal transportation in Russia and points out a steady growth of exports in an easterly direction against the reduction of domestic consumption and stable supplies to the West. Thus, coal is truly core and strategic cargo for the country. The article discusses external and internal growth factors of the coal industry (opportunities for coal production, prospective demand for coal, port infrastructure development etc.). One of the main factors hindering the development of Siberian coal production is the underdevelopment of the transport infrastructure. Due to insufficient railway and port capacities, traffic congestion on the main coal lines either has already reached its limit or will do it in the next few years.

In order to develop the railway infrastructure for future coal traffic (possible increase up to 50–80 Mt), a substantial investment is required. Given high capital intensity of new coal capacities and transport infrastructure, the future of coal production and transportation in Russia should be considered together as a single production-transportation task. This paper is based on the SONAR model (Sector Oriented and National model’s Adjustment research). In order to reflect the limitations and conditions devised for coal production, transportation and consumption, we use a set of mesolevel energy systems, the main would be the Russian Energy Model reflecting the relationship between the energy sector and geographically grouped consumers of fuel and energy. The article discusses the problems of financial support for the development of the transport infrastructure. The State needs to devise distinct and viable schemes to attract private capital.

Keywords: Rail transportation of coal; Production capacity; Transport infrastructure; Financing of infrastructure projects

JEL Classifications: O21, Q31, Q37, R41, R42

1. Current State of the Problem

Nearly all 83 subjects of the Russian Federation consume coal, whereas only 24 regions produce it. Coal reserves and associated production are distributed unevenly across the country. The most important coal-mining areas—the Kuznetsk and Kansk-Achinsk Basins, as well as a number of other large ones (Irkutsk, Minusinsk, Ulug-Khem)—are situated in the geographic centre of the country, far from the border crossings used for coal exporting, and from industrialised European Russia.

According to the data on coal transportation by rail in the Russian Federation (Figure 1), the
biggest portion is shipped via the following railways: West Siberian Railway, Krasnoyarsk Railway, East Siberian Railway and Far Eastern Railway.

![Diagram showing rail transportation of coal from Russian basins in 2012]

**Figure 1.** The structure of rail transportation of coal from Russian basins in 2012  
*Source: Rosstat, Rosinformugol*

An analysis of coal traffic demonstrates that areas of most active rail shipments are influenced by the location of the major coal-mining regions: Kuznetsk, Kansk-Achinsk, East Siberian, Far Eastern (Primorsk and Yakutsk), Pechora and Eastern Donetsk. In total, 90% of all coal is transported by these railroads.

The coal from the **Kuznetsk Basin** is transported to many regions both East and West, using the South Siberian Railway and the Trans-Siberian Railway in both directions. The most significant routes for coking coal are the ones to metallurgical plants in the Urals and Western Siberia; thermal coal is mainly shipped to power plants in Central and Ural Federal Districts and Western Siberia, and to a lesser extent to the Volga District, Eastern Siberia and the Far East.

Top-priority export points for Kuznetsk coals are ports at the Black Sea, at the Baltic Sea, in the north, at the Pacific and overland border crossings with the CIS countries, the Baltic states and China.

Lignite **Kansk-Achinsk** coals are shipped for electric energy use to different parts of the country. Some coals are transported to the Far East, some are shipped to Siberian regions, and the least portion goes to European Russia. The share of domestic coal traffic accounts for about 98%.

Bituminous **Khakass** coal extracted at the Minusinsk Basin is shipped towards the Trans-Siberian Railway via the South Siberian Railway in two directions: to the west and to the east.

Lignite coals from the other basins and fields in **Eastern Siberia** are transported to Siberian and Far Eastern regions for electric energy use via the East Siberian Railway. Domestic coal traffic in this area prevails; only bituminous coals from the Tugnuysky mine are shipped to ports in the Far East to be exported.

As a rule, 25% of coal produced in the **Far East** (the Far Eastern Railway) goes for export mostly due to the coking and thermal coal from the Neryungri Basin (aggregate transport node
Tynda). Far Eastern coals are shipped also to Amur Oblast, Primorsky and Khabarovsk Krai for electric energy use.

The majority of coal in the Pechora Basin is shipped via the Northern Railway. The main destinations for coking coal traffic are metallurgical plants in Central Russia (OJSC Severstal, Novolipetsk Steel) and Southern Ural (Nizhniy Tagil Iron and Steel Works). Thermal coal from the Pechora Basin is delivered to the Northwestern Federal District and Kaliningrad Oblast, as well as the Central Federal District. Coal is mainly exported from ports at Murmansk and Arkhangelsk.

Bituminous coals from the eastern part of the Donetsk Basin are currently used to produce electric energy. Major domestic coal traffic via the North Caucasian Railway is dedicated to supporting power systems in European Russia. The share of domestic traffic is around 80%. Approximately 85% of this amount is transported locally (to customers in North Caucasian regions). Exporting coal from the Eastern Donetsk Basin is focused on border crossing with Ukraine. Due to the geographic position of the basin, export shipments have an average length of haul.

In 2012, the busiest lines were those carrying coal from the Kuznetsk region and running to the west: Novokuznetsk–Novosibirsk (~ 40 Mt), Novokuznetsk–Barnaul (~ 70 Mt), Barnaul–Omsk (~ 60 Mt), Novosibirsk–Omsk (~ 50 Mt), Omsk–Yekaterinburg (~ 70 Mt), Omsk–Tyumen (~ 40 Mt), Tyumen–Yekaterinburg (~ 40 Mt), Yekaterinburg–Moscow-Centre (~ 60 Mt), Yekaterinburg–Vologda (~ 40 Mt).¹

The same year, Trans-Siberian lines carried 25–35 Mt of Kuznetsk, Kansk-Achinsk and various East Siberian coals to the east, all the way from Tayshet to Vladivostok.

In an easterly direction along the Baikal–Amur Mainline, from Tayshet to Vanino, coal traffic increased by 8–10 Mt. It is worth mentioning that the major increase of coal traffic to the west via the Trans-Siberian Railway was observed in the first half of the period under discussion, while the major increase of traffic to the east happened in the second half. At the same time, in the European part of the country, amounts of coal transported by the Northern Railway decreased by 2–3 Mt. Traffic also decreased on the lines running in the westerly direction via the Trans-Siberian Railway, from Tayshet to Krasnoyarsk (6 Mt) and from Krasnoyarsk to Tayga (3.2 Mt), due to lower consumption of Kansk-Achinsk coal.

Thus, the changes in coal transportation by rail observed over the period between 2000 and 2012 showed a load increase, especially on lines carrying coal from the Kuznetsk Basin. Coal traffic is gradually reoriented from the westerly direction towards the east.

2. Methods

In order to analyse and forecast the development of sectoral subsystems of the fuel and energy complex (TEK) in the national economy, the Institute of Economics and Industrial Engineering SB RAS applies a set of methods dubbed SONAR-TEK. Kuleshov, et al. (2014) presents its key ideas as follows:

- non-rigid unification of principal model structures of the national economic level, which are inclusively configured on the same economic, industrial and regional forecasts;

¹ Coals from Kansk-Achinsk, Khakasia and Novosibirsk are also included, but in small amounts.
particular model structures of the industrial or regional levels singularly finish national economic models.

In order to reflect the limitations and conditions devised for coal production, transportation and consumption, we use a set of mesolevel energy systems, the main would be the Russian Energy Model reflecting the relationship between the energy sector and geographically grouped consumers of fuel and energy. The model takes into account the production and consumption of 8 kinds of fuel and energy resources, including bituminous and lignite coals, as well as considers 3 main types of transport: rail transport for coal products and furnace oil, pipelines for natural gas, high-voltage lines for electric energy.

The model is designed to forecast at the time interval which allows evaluating the efficiency of large-scale and long-term projects. The model provides multivariate calculations under various criteria and conditions, i.e. allows making payments under different scenarios.

3. Discussion of External and Internal Growth Factors

3.1 Opportunities for Coal Production

In Russia, the proportion of coal among other fuels used in the power industry is noticeably smaller than in the majority of developed countries. The following barriers (geographic, environmental, technological, economic, institutional, etc.) hinder Russia from exploiting larger share of coal:

- Coal extraction has always been problematic when expressed in logistical terms: primary prospective consumers and suppliers of coal are many hundreds of miles apart.
- Underdeveloped transport and energy infrastructure decreases industrial effectiveness.
- Restrictions related to environmental consequences of coal-fired generation have recently become much more urgent.
- Fragmented and insufficient R&D funding by sectoral and academic research institutes. Russia is decades behind on advanced countries in the development and implementation of coal extraction, processing, transportation and application technologies.
- Russian coal and power engineering are not competitive. Therefore, the industries are growing more dependent on imported technology and equipment.
- Russian state policy on coal-fired power industry has never been coherent.

Despite these restrictions, Russia has an enormous potential for augmenting coal production output. Total inferred coal resources of all types and ranks are evaluated at 4450.7 Mt. However, Russian coal reserves are scattered unevenly across the country, with two-thirds occurring in Siberia. Easiest-to-extract high-quality bituminous coal is localised in the Kuznetsk Basin (Western Siberia). Eastern Siberia holds 81.4% of all in-place lignite coal reserves used to produce electric energy in Russia. The major part is concentrated in the Kansk-Achinsk Basin (Krasnoyarsk Krai).

A significant number of deposits are situated in poorly developed areas associated with stressful natural conditions, such as deposits of the Tungska, Taymyr, Zyryanka and Lena basins in Krasnoyarsk Krai, Sakha (Yakutia), Magadan Oblast and Chukotka Autonomous Okrug. Although the basins require high production and transportation costs to be developed, they will not be in demand during the analysed period.

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3.2 Prospective Demand for Coal

Favourable trends in the world market allow coal producers to increase their output remarkably. However, it is obvious that a simple production growth strategy can no longer be a priority in the future. World market competition implies that only those exporters will take free niches of unsatisfied demand which will be able to provide products that are competitive in terms of quality and price on the regular basis.

Experts predict that the global market for coking coal will go up by at least 20% in the next 20 years. The three main importers of coking coal will be Brazil, India and China. In the forecast period, the average annual rates of increase in coking coal imports will be as follows: 12% for Brazil, 13% for India and 6% for China.

Asia is becoming more and more attractive for Russian exporters. Since China has decreased its supply, Russian coal has got a chance to gain a foothold in the Japanese, Korean and Taiwanese markets. The main Russian coal miners’ partner in the European market of coking coal is Ukraine, where coke plants satisfy their demands with raw materials from Russia, the United States and Canada. A niche for Russian coal is estimated at 7–9 Mt.

The main export destinations for bituminous thermal coal are the Asia-Pacific region, which accounts for more than half the world's supply (including Japan's 17.4%), and Europe, which imports more than a third of world coal. Russian coal is mainly targeted at non-CIS countries, over 90% is exported there; 67% goes to Europe, and 18% is forwarded to Asia-Pacific.

Competition in the Atlantic market will be higher in part because that shale gas, which gradually replaces coal in the United States, helps increasing demand for coal in Europe. However, we can only speak about keeping the levels of Russian coal supply or a slight increase (by 5–10 Mt) to the Baltic countries. Potentially attractive export destinations are booming economies of Southeast Asia. Still, high risks are involved here due to an uncertain ratio of exports and imports for the world's largest producer and consumer of coal, China. Australia and Indonesia will remain the major suppliers in this region, but new competitors are arising (the Tavan-Tolgoi deposit in Mongolia; Benga and Moatize in Mozambique). As estimated by Churashev(2013), Russian companies can look forward to a free niche for coal supplies to the East 30–50 Mt.

Two serious causes limit the growth of the thermal coal domestic market: the industrial demand for thermal coal is stabilised, and the domestic households' demand has dropped as a result of gas infrastructure development in regions (Table 1).

Only major players in the energy industry can assure an increase in thermal coal consumption. According to the Energy Strategy of Russia for the period up to 2030, the share of coal in fuel consumption by thermal power plants should go up from 26 to 34–36% due to the declined share of gas from 70 to 60–62% (Ministry of Energy of the Russian Federation, 2009). It is assumed that the power capacities introduced in European Russia and the Urals will cover a significant portion of their demand for fuel with the Kuznetsk and Kansk-Achinsk coals. Under different scenarios, power stations in the Siberian Federal District might experience an increase in bituminous coal consumption by 20–35 Mt, as well as an increase in demand for lignite coal by 32–43 Mt.

However, a prospect to develop coal-fired generation in Russia has long been a stumbling block between the real situation in the industry and regularly adopted policy documents. Gas continues to displace coal, which reflects in suspended coal projects in the electric power industry. According to foreign and Russian experts and their most pessimistic forecasts, the domestic market size could fall by more than a half, from the current 177 Mt to 70–80 Mt (Krasnyanskiy, 2010).
Table 1. Prognosis for the flow of demand for the Russian coal, Mt

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal power stations</td>
<td>91.6</td>
<td>108.3</td>
<td>91.6</td>
<td>102</td>
<td>105</td>
<td>110</td>
<td>115</td>
<td>120</td>
</tr>
<tr>
<td>Coking</td>
<td>44.3</td>
<td>42.5</td>
<td>37.5</td>
<td>39</td>
<td>42</td>
<td>42</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Domestic households, population, etc.</td>
<td>26.3</td>
<td>25.9</td>
<td>24.4</td>
<td>23</td>
<td>20</td>
<td>18</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Other consumers</td>
<td>29.7</td>
<td>24.4</td>
<td>23</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Deep coal processing</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Export (total)</td>
<td>98.6</td>
<td>101.2</td>
<td>107.4</td>
<td>116.4</td>
<td>140</td>
<td>150</td>
<td>155</td>
<td>170</td>
</tr>
<tr>
<td>thermal coal</td>
<td>88.6</td>
<td>87.6</td>
<td>94.1</td>
<td>98.4</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>125</td>
</tr>
<tr>
<td>coking coal</td>
<td>10</td>
<td>13.6</td>
<td>13.3</td>
<td>18</td>
<td>25</td>
<td>35</td>
<td>40</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>289.8</td>
<td>302.3</td>
<td>283.9</td>
<td>299</td>
<td>327</td>
<td>350</td>
<td>365</td>
<td>390</td>
</tr>
</tbody>
</table>

Source: Program for Development of Russia’s Coal Industry till 2030

Before the economic crisis, the majority of policies declared priority development of coal-fired generation, all the documents adopted after 2009, even with upbeat estimates, stipulate an insignificant growth rate (0.8% a year, according to the Longterm Program for the Development of the Coal Industry for the Period up to 2030). Each subsequent forecast features lower levels of prospective coal consumption on the domestic market.

3.3 Port Infrastructure Development

The most challenging obstacle to enlarging Siberian coal use remains the underdeveloped transport infrastructure. The total railway and port capacity in Siberia and the Far East is insufficient to manage an increasing cargo turnover.

The largest export turnover goes via seaports, and their share is continuously growing. Currently, about two-thirds of all Russian exported coal is shipped from seaports. Moreover, shipments from Far Eastern ports are developing fast. In 2012, their portion reached 39.6% of total export turnover (56% of all port exports) (see Fig. 2).

Figure 2. The structure of coal export supplies (Source: Rosinformugol, Metal Expert Group)
One of the main tasks on coal transportation for the next decade is to synchronise the construction and development of marine terminals with the railway infrastructure development. By 2030, volumes of transhipped coal are expected to double in a northerly direction, to triple in a southerly direction, and to grow by a factor of 2.5 in an easterly direction. According to Program for Development of Russia's Coal Industry till 2030 by Ministry of Energy of the Russian Federation (2014), and Strategy of Seaport Infrastructure Development in Russia up to 2030 by Federal State Unitary Enterprise (2012), total port capacity should reach 140 Mt by 2020 and 190 Mt by 2030 (under the optimistic scenario).

The Ministry of Transport of the Russian Federation also considers building a "public" coal marine terminal to meet the needs of small and medium-sized shippers. It has been announced that the new coal port will likely be constructed at Sukhodol Bay. In the Northwestern District, a terminal in the Vysotsky port (with the capacity of 7.5 Mt) is currently under development. In 2017, in the Southern District, there will be built a dry-bulk area at the Taman Seaport where each of two coal terminals will have the capacity of approximately 12.5 Mt (UCL Holding and SUEK serve as investors).

It has been planned to build a new coal terminal on the western shore of the Kola Bay named Lavna. Moreover, large-scale modernisation projects will take place in the ports of Murmansk (capacity increase up to 18.5 Mt) and Arkhangelsk (up to 6–8 Mt).

In the direction towards Vanino, the shortfall in capacity will not be solved even with the Kuznetsovsky tunnel inaugurated in December 2012. Its launch has increased the capacity of the railway by 15–20 Mt up to 52 Mt, but in the nearest 5 years (taking into account the coal companies' plans to increase total cargo by 100 Mt) even this measure is not enough. It is necessary to build two more tunnels; otherwise companies will not be able to ship the expected volumes.

Major port projects are assumed to be implemented on a public-private partnership basis. Prospective volumes of coal traffic via Russian ports are displayed in Table 2.

<table>
<thead>
<tr>
<th>Basin</th>
<th>Port</th>
<th>2008</th>
<th>2010</th>
<th>2012</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>Murmansk</td>
<td>10</td>
<td>9.6</td>
<td>10.8</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>Kandalaksha</td>
<td>0.4</td>
<td>0.8</td>
<td>0.8</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Arkhangelsk</td>
<td>0.6</td>
<td>0.6</td>
<td>0.8</td>
<td>6.5</td>
</tr>
<tr>
<td>Baltic region</td>
<td>The Baltic states</td>
<td>16</td>
<td>15.3</td>
<td>20.6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Ust-Luga</td>
<td>3.5</td>
<td>8.9</td>
<td>12.4</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Vyborg &amp; Kaliningrad</td>
<td>0.5</td>
<td>0.4</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Vysotsk</td>
<td>2.5</td>
<td>2.3</td>
<td>3.2</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Saint Petersburg</td>
<td>0.1</td>
<td>0.2</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Southern</td>
<td>Ukraine</td>
<td>20.2</td>
<td>14.5</td>
<td>15.4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Russian ports</td>
<td>8</td>
<td>8.5</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>The Far East</td>
<td>Vladivostok &amp; Vostochny Port</td>
<td>18.5</td>
<td>19.9</td>
<td>24.6</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Vanino</td>
<td>8</td>
<td>11</td>
<td>11.6</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>88.3</td>
<td>92</td>
<td>106.8</td>
<td>158.7</td>
</tr>
</tbody>
</table>

Source: Program for Development of Russia’s Coal Industry up to 2030[^5], Strategy of Seaport Infrastructure Development up to 2030[^7].
Having analysed the opportunities for further development of coal production in Russian basins and deposits, forecasts of the demand for coal on the domestic and international markets, and prospects for the development of seaports, we considered a few economic growth scenarios (where GDP increases by 2–6 percent a year) and determined capacities for rail transportation of coal. In this section, we discuss development indicators for coal production and shipping in 2030 perspective according to the baseline scenario.

Prospective volumes of coal traffic through aggregate transport nodes are displayed in Table 3.

<table>
<thead>
<tr>
<th>Railways</th>
<th>Basins, deposits</th>
<th>Cargo shippers, transport nodes</th>
<th>Production by year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Far Eastern Railway</td>
<td>Urgal deposit</td>
<td>Urgal</td>
<td>2</td>
</tr>
<tr>
<td>Far Eastern Railway</td>
<td>Elga deposit</td>
<td>Ulak</td>
<td></td>
</tr>
<tr>
<td>Far Eastern Railway</td>
<td>South Yakutsk Basin</td>
<td>Tynda</td>
<td>5</td>
</tr>
<tr>
<td>Zabaykalskaya Railway</td>
<td>Apsatsk deposit</td>
<td>Chara</td>
<td></td>
</tr>
<tr>
<td>East Siberian Railway</td>
<td>Zheronskoe deposit</td>
<td>Ust-Ilimsk</td>
<td>0.1</td>
</tr>
<tr>
<td>Zabaykalskaya Railway</td>
<td>Nikolskoe and Tataurovskoe deposits</td>
<td>Chita</td>
<td>14.3</td>
</tr>
<tr>
<td>Zabaykalskaya Railway</td>
<td>Nikolskoe deposit</td>
<td>Ulan-Ude</td>
<td>0.3</td>
</tr>
<tr>
<td>East Siberian Railway</td>
<td>Irkutsk Basin</td>
<td>Irkutsk</td>
<td>13.5</td>
</tr>
<tr>
<td>Krasnoyarsk Railway</td>
<td>Kansk-Achinsk Basin (eastern part)</td>
<td>Kansk</td>
<td>18</td>
</tr>
<tr>
<td>Krasnoyarsk Railway</td>
<td>Kansk-Achinsk Basin (western part)</td>
<td>Achinsk</td>
<td>27</td>
</tr>
<tr>
<td>Krasnoyarsk Railway</td>
<td>Minusinsk Basin</td>
<td>Abakan</td>
<td>11.2</td>
</tr>
<tr>
<td>Krasnoyarsk Railway</td>
<td>Ulug-Khemsk Basin</td>
<td>Abakan (Kyzyl)</td>
<td>0.4</td>
</tr>
<tr>
<td>West Siberian Railway</td>
<td>Kuznetsk Basin</td>
<td>Novokuznetsk</td>
<td>184</td>
</tr>
<tr>
<td>Northern Railway</td>
<td>Pechora Basin</td>
<td>Vorkuta</td>
<td>12.9</td>
</tr>
<tr>
<td>North Caucasus Railway</td>
<td>Donetsk Basin (eastern part)</td>
<td>Rostov</td>
<td>7.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>296</td>
</tr>
</tbody>
</table>

*Source: Program for Development of Russia’s Coal Industry up to 2030 [5], the author’s estimation*
Figure 3 shows various directions and flows of coal traffic from Siberian Federal District between 2012 and 2030.

There is a chance to launch the North-Siberian Railway by 2030, which will make it possible to transfer a significant share of Siberian coal traffic running to the ports of northern seas and the Baltics that the Trans-Siberian Railway is not capable to handle. The total volume of coal transported on the line Bely Yar–Ukhta could reach 18 Mt. Nonetheless, the following lines will remain busy as well: Novosibirsk–Omsk (53 Mt), Omsk–Yekaterinburg (62 Mt), Omsk–Tyumen (42 Mt), Tyumen–Yekaterinburg (42 Mt).

The dominant coals in a westerly direction will still be the Kuznetsk ones; Kansk-Achinsk and Khakass coals will also be shipped.

Trans-Siberian lines will carry 40–50 Mt (instead of 30–35 Mt) of Kuznetsk, Kansk-Achinsk, Khakass, Tyva and Transbaikal coals in an easterly direction, all the way from Tayshet to Khabarovsk. In an easterly direction along the Baikal–Amur Mainline, from Tynda to Komsomolsk-on-Amur, coal traffic will reach 46 Mt due to the Elga coal deposit. The line Komsomolsk–Vanino will carry 25 Mt of coal, which accounts for nearly 100% of its capacity. Consequently, the need to export coal from the Elga deposit will make the line Khabarovsk–Vladivostok particularly busy by 2030 (65 Mt).
A stability analysis of coal traffic forecast showed that an accelerated economic development in the country has no substantial effect on domestic coal consumption and exports, although such changes are noticeable in certain regions. In particular, under a scenario with 5.4% economic growth, it is advisable to start the Ural Industrial—Ural Polar project, which covers a vast area within the administrative boundaries of the Ural Federal District and creates new primary fuel and energy consumers in the region.

5. Issues of Financial Support

In order to develop the railway infrastructure for advanced coal traffic by 2030 (possible increase up to 50–80 Mt), a substantial investment is required. The expansion of the Kuzbass—Northwest corridor costs 230 billion rubles; the same operation on the Kuzbass—Far East line is estimated at about 200 billion rubles. The total amount of rail finding is estimated at 1.2 trillion rubles. It is an enormous sum, which immediately leads to a question where to find potential financing sources. The main problem a lot of Russian strategies and federal programmes have is that they do not tend to be supported by the real sources of funding or based on coherent schemes on how to attract private investment.

The structure of the Russian financial market lacks a number of important instruments used on advanced financial markets. It limits the possibilities of fundraising while designing and developing transport, energy, housing and other infrastructure. Meanwhile, the need for investment is immense and cannot be entirely satisfied exclusively by the state.

This idea can be wonderfully illustrated by the construction of the Ulak–Elga railway necessary to develop the unique Elga deposit, which is rich in bituminous coal and situated in south-eastern Yakutia (the Republic of Sakha) 320 km to the north of the BAM road. The Elga deposit is one of the world's largest reserves of high-quality coking coal that is compliant with all international standards and suitable for open-cast mining at the level of 25-30 Mt for more than 100 years.

In the early 2000s, the Ministry of Railways, which commanded some inactive construction bases in the region after the start of the Baikal–Amur Mainline, began to build a railroad connecting the deposit with the BAM. A 60-km roadbed line was excavated, and a 120-km highway was built. However, in 2002 the leaders of the Ministry were accused of misappropriation of funds. The Elga project was shelved.

In the latter half of the 2000s, the global coking coal market saw exceptionally favourable conditions for Russian coal, especially in the Asia-Pacific region. Under these circumstances, the Elga project became more attractive due to the proximity to seaports and coal importers. That was its main advantage: the transportation leg of the Elga coal was one-third as long as the one of the Kuznetsk coal, its principal competitor. Another positive factor is a relatively low ratio of overburden (3.7 m$^3$/t). As a consequence, according to the AME Group, the Elga coal mine is ranked the seventh in the world in terms of production costs (66.34 USD at a port under FOB). The closest Russian rival, Raspadskaya coal mine, is only twenty-eighth on this list.

In 2007, Mechel OAO, allured by high commercial performance, arrived at Yakutia. The company participated in an asset auction for OJSC Yakutugol. The Government of Yakutia stipulated a compulsory condition: the winner must finish the railway connecting the BAM with the Elga deposit before 30 September, 2010. Mechel fought tooth and nail for the lucrative asset: the final bid was 58.2 billion rubles, against the initial price of 47.4 billion rubles.
The project started immediately, the road towards Elga was being built faster than the BAM. At the construction site, there were up to 70 contractors, 745 units of equipment and 1.6 thousand people working simultaneously. In January 2012, Mechel claimed that the construction of the railway was completed and the production at the field was launched in record time, despite the financial crisis of 2008–2009. However, this was achieved at a heavy cost. The company had to invest 2.5 billion USD in the Elga project, two of which were spent on the railroad. The initial project cost was estimated at 900 million USD. All purchases and construction were funded with the borrowed assets. Cheap loans taken out in western banks at 5% annual interest appeared to be insufficient. The company had to borrow short-term loans from domestic banks, which had to be refinanced.

In 2011, prices for metals, coal and iron ore began to decline, and Mechel's economic status began to deteriorate. The company started restructuring its assets: it sold and closed plants, reviewed its strategy and changed the commissioning period for new capacities. However, the debt went on growing and amounted to nearly 10 billion USD. Experts agree that Mechel would not have had to undergo such a painful restructuring if it had not entered the Elga project.

Despite the obvious economic and social importance of the Elga deposit, the Russian government never attempted to help the company, believing that Mechel's debt load is entirely its problem since the company had not aligned its capabilities with current market conditions. At the same time, such a policy is acceptable only up to a certain point. In view of the need to ensure the national economic security, the government is obliged to rescue the largest steel producers that may found themselves in a difficult position during a difficult period.

As one of the options to rescue the company with the biggest debt load in Russia, it has been proposed to sell one of Mechel's railway lines, Ulak–Elga, to JSC Russian Railways. The total proceeds of 70 billion rubles were expected to relieve the company's debt burden.

Russian Railways has an interest in this purchase because the Elga project is synergistic in its nature: it includes the Elga deposit where coal is produced and the transportation area with seaports that also belong to Mechel. The Ministry of Industry and Trade of the Russian Federation agrees with the solution. It is certain that “JSC Russian Railways, as an operator, is a perfect buyer for a railroad line”. The mischief is that Russian Railways (due to its financial standing) cannot provide the necessary amount of investment but refuses to buy the line with borrowed funds.

The State could have increased Russian Railways' capital, but the government decided not to amend the 2014 budget. It advised Mechel to seek co-investors for the Elga project, and the situation has was left in limbo.

The example of the Elga deposit has showed private business how a large infrastructure project depletes a company largely because of tight money. After Mechel's story, probably no one will dare to build large infrastructure projects at their expense, apart from certified state-owned companies. In this case, it is better to wait a few years for the commissioning of a highway, railway, power lines, and other infrastructure. Alternatively, ask the government for the money. For instance, Tuva Energy Industrial Corporation, developing the Elegest coal deposit, is about to build a rail line mainly with the help of the Russian National Wealth Fund (Ministry of Economic Development of the Russian Federation, 2014).

As a result, Russia's largest companies refer to various problems and inhibit the production of raw materials in pleasurable anticipation of state financial aid or infrastructure build-out. They could wait for these factors to coincide for decades.
Currently, the government is interested in developing transport infrastructure; it approved a model plan for the modernisation of the Baikal–Amur Mainline and the Trans-Siberian Railway. The total amount of investment for the modernisation project will account for 560 billion rubles through 2018: 110 billion will be directed from the state budget, 150 billion will come from the National Wealth Fund, and the remaining 300 billion rubles will be taken from the Russian Railways' investment programme. These data show that the share of public funding in the composition of investment is significantly higher than the proportion of debt financing. The total amount of allocated funds is half the required amount.

In current-day Europe, the practice of transport infrastructure concessions reveals that it is more rational for the State to assist investment projects not by public funding, but by providing loans from financial and credit institutions: the same amount of financing in the form of loans and loan guarantees reaches better results than grants because loans have a greater “motivational effect”. However, Russia can have a successful concession policy only when it becomes a strong state capable of guaranteeing equal partnerships with business, defending the interests of society (if necessary), and ensuring the accountability of concessions.

6. Conclusions

This paper analyzes trends in dynamics of the structure of coal transportation, considers external and internal growth factors of the coal industry and forecasts the future of coal production and transportation in Russia using a model which reflects the relationship between the energy sector and geographically grouped consumers of fuel and energy. Finally, we discuss issues of financial support of infrastructure projects.

Based on this investigation, the author concludes here that:

1) Expansion of railroads in Russia is justified by a particular interest in coal since this resource appears to be the dominant type of fuel cargo transported via rail. In the context of stagnating domestic consumption of coal, the key incentive for the coal companies to increase production was an increase in exports.

2) Due to insufficient railway and port capacities, traffic congestion on the main coal lines either has already reached its limit or will do it in the next few years.

3) Eastern direction has become a priority in coal exports: Russia sends more coal to the Asia-Pacific countries than to the West. This trend will continue in the future: in 2030, the volumes of Russian coal exported by sea will almost double. The highest growth rates will be observed in the Far East.

4) In order to develop the railway infrastructure for future coal traffic (possible increase up to 50–80 Mt), a substantial investment is required.

5) At present day, under severe budgetary constraints, the State needs to devise distinct and viable schemes to attract private capital, which will finance and operate infrastructure projects, and to guarantee equal partnership between business and government.
References


