

Trends in and Prospects for the Coal Industry Development in Russia's Eastern Regions

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Abstract — The paper presents an analysis of trends in coal industry development in Russia's eastern regions and its significance for the national coal industry. The study focuses on the prospects for the coal industry development in Russia's east and the potential directions of coal use there. The coal production and supplies for export are projected for the period up to 2035.

Index Terms: coal, production, supplies, export, balance reserves, eastern regions of Russia, projects, trends.

I. INTRODUCTION

The coal industry of Russia's eastern regions plays a significant part in providing Russia's regions with resources and exporting them. The eastern regions are East Siberia and the Far East. Coal plays a leading role in the energy balance of these regions and is the primary fuel for thermal power plants. The coal industry is of high social significance as a mainstay of the coal-producing entities of the federation.

The coal share in the fuel consumption structure of the federation entities of the eastern regions ranges between 5% and 95% and averages 50%. It accounts for 50-60% in West Siberia and 0-8% in European Russia. In the retrospective, coal consumption decreased both in the country and in the eastern regions. Coal is consumed in the coal-mining regions of the country. It is supplied to other Russia's regions and for export. The coal share in exports in the eastern direction is growing steadily. For the reasons of the high social and economic significance of the coal industry in Russia's east, the study of its development appears to be of great importance.

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II. CURRENT STATE

Russia is one of the world leaders in the volumes of coal reserves, production, consumption, and export [1]. The coal industry share of the eastern regions increases and at present is sufficiently high (Table 1). The analysis of the dynamics of coal supplies from the eastern regions revealed a considerable growth of coal supplies for export with the relative stability of supplies to the internal market (Table 2). In the structure of export supplies, in 2011-2018, the European regions of Russia increased the coal supplies by 28%, West and East Siberia approximately twice, and the Far East almost by four times. During this period, coal supplies in the eastern direction increased almost nine times and in the western direction only by 28% [2]. The growing coal supplies for export in the eastern direction were provided by the enterprises of the eastern regions and West Siberia.

The tendency toward coal production growth was observed primarily in the regions supplying coal for export. Starting in 2010, most of them increased coal production and export almost twice, excluding the Sakhalin region, where coal export increased more than 14 times. In 2019, the share of coal supplied for export made up from 35 to 90% of production volumes for different regions. Of great significance for the coal industry in the eastern regions is closeness to the trade markets and shorter transportation distances compared to West Siberia. China, Japan, and other APR countries are major coal importers from Russia's eastern regions.

In the internal coal market, coal consumers in the eastern regions are situated basically in the coal production areas and those close to them. Power plants are the major coal consumers in Russia's east. In the considered period, coal supplies for coking purposes in the eastern regions increased against the decrease in coal supplies for coking in the country as a whole.

III. COAL RESERVES

The eastern regions of Russia possess considerable balance and non-commercial reserves of steaming and coking coals, including those of deficient ranks (Table 3). The share of the eastern regions in the structure of coal reserves accounts for 45%, that of West Siberia is 46%, and of the European part of Russia - 9% [3]. The available

Table 1. Coal industry of Russia and its eastern regions (as of 2019)

Indicator	Russia	Eastern regions
Balance reserves (A+B+C1), billion t	196.2	88.0 (44.7%)
The number of enterprises:	187	65 (34.8%)
including		
- mines	57	5 (8.8%)
- open-pits	130	60 (46.2%)
Production capacity, million tons	541.1	218.1 (40.3%)
Number of dressing works	64	7 (1.9%)
Coal production, million tons	441.4	161.4 (36.5%)
-underground mining, million tons	107.3	6.8 (6.3%)
-surface mining, million tons	334.1	154.6 (46.3%)
Coal processing, million tons	206.0	49.0 (23.8%)
Coal import, million tons	21.1	3/4
Coal supply by coal producers, million tons	373.6	141.7 (37.9%)
including export, million tons	206.3*	47.1 (24.5%)
	192.3**	
Consumption, million tons (2018)	233.0	91.6 (39.3%)
including internal, million tons	211.9	88.2

Source: [2]

* JSC Russian Railways

** CDU TEK

Table 2. Characteristic of the coal industry of Russia's eastern regions, million t

Indicator	Year				
	2010	2015	2017	2018	2019
Production	111.2	131.2	142.8	152.8	156.2
Processing	20.4	39.7	47.4	47.4	49.0
Supplies, including:	109.3	119.8	128.8	137.9	141.7
-export	16.3	34.2	38.4	42.0	47.3
-Russia's regions, of which	93.0	89.1	90.4	95.9	94.4
- Coking demand	0.1	1.9	2.6	2.6	2.7
- Power plants	64.5	64.3	63.1	63.1	67.5
-Population and residential consumers	13.7	11.5	12.2	12.2	13.1
-Other consumers	14.7	11.4	12.6	12.6	12.6

Source: [2]

Table 3. Coal reserves of the eastern regions of Russia by category of reserves as of January 1, 2019, billion t

Type of coal	Balance reserves by category			Non-commercial reserves
	A+B+C1	C2	A+B+C1+C2	
Total, including	88.0	39.9	127.8	29.2
- brown (lignite)	61.2	25.4	86.6	12.0
- hard	26.7	14.4	41.2	17.1
of which coking	8.9	4.5	13.4	1.4
including highly valuable ranks	4.3	2.7	7.1	0.1
Anthracite	0.03	0.03	0.07	0.07
Surface mining, including	71.7	28.5	100.1	16.0
- brown (lignite)	57.8	22.5	80.3	10.4
- hard	13.9	6.0	19.8	5.6
of which coking	2.1	0.4	2.5	0.1
including highly valuable ranks	1.4	0.3	1.8	0.0
Anthracite	0.02	0.01	0.03	0.02

Source: [3]

Table 4. Projection of coal production in the eastern regions of Russia, million t/year.

Federation entity	Year		
	2019	2030	2035
	actual	projection	
Total, including	160.5	185-227	195-271
Krasnoyarsk Territory	42.7	43-50	39-50
Republic of Khakassia	27.1	35-41	37-45
Trans-Baikal Territory	23.9	27-30	27-36
Republic of Sakha (Yakutia)	18.6	24-31	29-35
Irkutsk Region	13.1	11-12	11-13
Sakhalin Region	12.9	14-15	14-19
Primorye Territory	7.9	9-10	9-11
Khabarovsk Territory	6.3	10-13	12-16
Amur Region	1.7	2-8	6-15
Republic of Tyva	3.4	4-4	4-8
Kamchatka Territory	0.0	1-3	1-8
Chukotka Autonomous Area	0.0	1-4	2-8
Other	2.9	4-6	4-7

Source: Authors' estimates

Table 5. Projection of coal export from the eastern regions of Russia, million t/year

Federation entity	Year		
	2019	2030	2035
	actual	forecast	
Total, including	47.13	64-95	74-129
Republic of Khakassia	11.27	17-22	17-25
Sakhalin Region	11.78	12-13	12-13
Trans-Baikal Territory	8.51	10-13	12-15
Republic of Sakha (Yakutia)	8.64	12-17	16-22
Khabarovsk Territory	3.28	6-9	6-11
Krasnoyarsk Territory	1.1	2-4	2-8
Republic of Tyva	0.1	1-6	2-11
Amur Region	0	0-2	2-6
Kamchatka Territory	0	1-2	1-6
Chukotka Autonomous Area	0	1-3	1-6
Other	2.45	2-4	3-6

Source: Authors' estimates

considerable coal resources and production capacities in the eastern regions allow us to consider coal as a reliable resource to meet the demand of domestic consumers and to supply it for export.

IV. POTENTIAL FOR COAL PRODUCTION GROWTH

The new and existing program documents of different levels include projects for the exploitation of new deposits, reconstruction, and expansion of the capacity of operating enterprises. At the same time, some existing enterprises use 50-90% of their production capacity. The projects address different coal utilization areas, first of all, its export, then the construction of coal-fired power plants, and the development of coal chemistry in the future. In recent years, the projects have been worked out for mining the deposits in the northern and north-eastern areas that are the most vulnerable from the environmental viewpoint but possess the reserves of coal demanded in the world market. Foreign companies are much interested in developing some of the deposits.

As for the international coal market, a coal demand projection made by international organizations is favorable for the intensive development of coal export from Russia's eastern regions to the potential coal importers [4]. The main coal competitors of Russia are Australia, Indonesia, and Mongolia in the future.

Construction of large coal-fired power plants in East Siberia and the Far East to meet the internal demand and to export electric power was considered in different Governmental [5-7], federal and regional strategies and programs. According to the documents, the plans were to construct coal-fired power plants on the run-of-mine coal and low-grade products of processing the coking and steaming coal.

Practically all brown and low-grade hard coals can be used in coal chemistry. The existing projects for the development of the coal chemical industry are at different stages of progress: from tentative estimation to specific steps of implementation. In the nearest future, coal supplies for coal chemistry will not essentially influence the coal production volumes.

According to the new projects, the production volumes for different deposits amount from 0.4 to 45 m t/year, and to 355 m t for the eastern regions as a whole. With the reconstruction and increase in the capacity of operating enterprises, coal production can reach up to 75 m t/year.

The dates of project implementation depend on various factors, the most important of which are the state (often absence) of the transport infrastructure, availability of investment, demand for products, distance from the trade markets, and competition with other energy carriers. The

run-of-mine coal is produced basically for the internal market, its processing products (concentrates of steaming and coking coal) are intended for the world market, and the low-grade processing products should be used to satisfy the needs of the energy sector.

The coals of the eastern regions contain some valuable associated components [8-10]. Owing to the high sorption properties of coal, a considerable amount of different metals and rare-earth elements remained in it in the process of deposit formation. This is how the complex deposits (uranium-coal, germanium-coal, rare-earth-coal ones) appeared, which creates the preconditions for complex utilization of coal deposits.

V. FACTORS INFLUENCING THE TRENDS IN COAL INDUSTRY DEVELOPMENT OF THE EASTERN REGIONS OF RUSSIA

The analysis of trends in the coal industry development of the eastern regions of Russia revealed the following main favorable factors for coal production increase:

- availability of considerable coal reserves, including the coal highly-demanded in the world market, which is suitable for different uses: export, energy sector, by-product coke industry, coal chemistry;
- measures included in the program of coal industry development and other documents, such as the arrangement of interaction between science and industry, strengthening of the science-and-technology framework of coal companies and branch scientific centers; improvement in the transport infrastructure, including the port infrastructure, for development of coal export; development of coal-based energy sector using the advanced technologies of coal combustion; and others;
- location of coal deposits of the eastern regions promising for export development close to the world's key coal importers, namely the APR countries;
- the mid-term and long-term forecasts show the dynamics of the world coal consumption growth, mainly owing to the APR countries

The coal industry development of the eastern regions is hampered by the following factors:

- economic consequences of coronavirus pandemic in the world;
- deceleration of activity in the world coal markets;
- the fluctuation of the demand for and prices of coal in the world coal market;
- a lag between the development of the railway transport capacities and required shipping capabilities;
- environmental constraints on the development of the coal-based energy sector.

VI. PROSPECTS FOR THE DEVELOPMENT OF COAL PRODUCTION AND SUPPLY

The coal industry development in the eastern regions of Russia and potential coal supply for export were projected for the entities of the eastern regions of Russia according to the economy and energy development scenarios, which were developed at MESI SB RAS [11,12], and the authors'

estimates based on the existing trends in coal consumption and the analysis of program documents (Tables 4 and 5). The rise in the coal supply for export also depends on the increase in coal processing. The study relies on the software developed with the authors' participation [13, 14].

Table 4. Projection of coal production in the eastern regions of Russia, million t/year.

Source: Authors' estimates

Table 5. Projection of coal export from the eastern regions of Russia, million t/year

Source: Authors' estimates

VII. CONCLUSION

The main trends in coal industry development are related to the growing export component in coal production. Therefore, the coal industry in the regions depends on the demand for coal and the price fluctuations in the world coal market. Foreign companies are interested in the exploitation of some deposits. Coal production expansion at these deposits depends both on the extent to which these companies participate in the projects and on the stability of their interests.

The prospects for coal export development also depend on the potential expansion of the internal and external coal markets; geopolitical conditions that limit coal consumption, and opportunities to increase the geological exploration. Despite the existing demand for coal, the growth of its export can be limited by the capabilities of transport infrastructure, the tariffs of coal shipping, and the absence of demand for low-grade products of coal processing in the internal market.

The creation of industrial clusters based on coal deposits (which will combine production enterprises for processing coal and technology-related waste; energy facilities; coal chemical enterprises and enterprises providing reclamation and other measures aimed at decreasing the environmental damage) appears to be the most effective alternative for the economy and environment. The run-of-mine coal, low-grade beneficiation products, and gas from the coal seams can be used as fuel for energy facilities. The end products of coal chemical enterprises are the products with a high value-added, which are produced in coal processing, degassing of coal seams, mine water, slag, and emissions into the air after coal combustion at power plants. Associated valuable elements in coal can be extracted by effective technologies and the introduction of clean combustion technologies. Since coal deposits are unique in their quality and other characteristics and conditions of deposit exploitation, such projects should be implemented approaching each deposit individually.

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