

Yurii VASILEV

National Mineral Resources University (University of Mines)

Organization and Management Department, Saint Petersburg

yur\_vas@mail.ru

## DETERMINATION OF COAL PRODUCTION COMPETITIVENESS OF THE RUSSIAN FEDERATION

**Summary.** The paper is devoted to the analysis of the quality and competitiveness of the Russian export coal products. The export quality standards, which coal production should correspond to, are considered. The official information review of production quality published by the largest coal-mining companies of the Russian Federation is made. The formula of the integrated quality indicator for the competitiveness assessment of the Russian coal production has been corrected. The calculations of competitiveness indicators for coal products of JSC "Kuzbassrazrezugol" are made. The recommendations of integral quality rate applications for the competitiveness estimation of Russian coal are provided.

**Keywords:** coal quality; coal rank; competitiveness; integrated indicator of quality; quality indicator.

## OCENA KONKURENCYJNOŚCI PRODUKCJI WĘGLA KAMIENNEGO W FEDERACJI ROSYJSKIEJ

**Streszczenie.** Artykuł jest poświęcony analizie i ocenie konkurencyjności rosyjskich węglowych produktów eksportowych. W teoretycznej części artykułu określono kluczowe kryteria jakościowe, jakim powinna odpowiadać produkcja węgla kamiennego kierowanego na eksport. Następnie dokonano przeglądu oficjalnych informacji o jakości produkcji węgla kamiennego, publikowanych przez największe przedsiębiorstwa wydobywające węgiel w Federacji Rosyjskiej. W celu oceny konkurencyjności rosyjskiego eksportu wykorzystano zmodyfikowany, zintegrowany wskaźnik jakości węgla kamiennego. W empirycznej części artykułu na podstawie skorygowanej formuły obliczono wskaźniki konkurencyjności dla produktów węglowych spółki akcyjnej „Kuzbassrazrezugol”. W zakończeniu artykułu przedstawiono zalecenia praktyczne, pozwalające zastosować zintegrowany wskaźnik jakości w ocenie konkurencyjności rosyjskiego węgla.

**Słowa kluczowe:** jakość węgla, klasa węgla, konkurencyjność, zintegrowany wskaźnik jakości węgla kamiennego.

## 1. Introduction

The coal branch of the Russian Federation is characterized by the most popular source of raw materials in comparison with other branches of fuel and energy complex. In the Russian Federation there are 22 coal-mining fields and 129 separate fields.

In spite of the fact that the coal mining share in GDP in the Russian Federation equals to about 0,65%, coal contribution to the economy of Russia is great. The coal industry has essential impact on the allied industries' development what provides a multiplicative effect. Coal is a raw material source for the chemical industry. It is one of formation elements of the final metallurgical products. It occupies a considerable share in goods turnover of the railroads.

Currently, the coal market in Russia is under a strong influence of fuel and energy complex processes as well as in the branches tightly connected with it. The coal share in the total volume of mining fossil fuels resources has equaled from 10% to 12%<sup>1</sup>.

When speaking about the issues of global and domestic market of coal production of the Russian Federation, it is necessary to take its heterogeneity into account. Thus such heterogeneity may find its impact in different aspects. The technological heterogeneity is one of such aspects presenting the necessity of studying coking coals, power generating coals and anthracites separately. These coals represent the products which are not interchangeable as their properties are unique. Each of these coals has various coal ranks (A, Д, ДГ, CC, T etc.).

The geographical heterogeneity is another aspect consisting in available various segments of the world coal market. Among them there are such segments as the Atlantic and Pacific ones<sup>2</sup>.

According to the long-term program of the Russian coal industry development for the period until 2030 approved by the order of the Russian Federation Government No.14 24.01.2012, one of the requirements for perspective development of the coal industry is a transition from "simple" energy resource trade in the external and internal markets to the hi-tech "power product" trade providing (on the basis of deep coal processing) efficiency increase of its final use and reduction of transport expenses for consumer delivery.

Taking into consideration the changes and challenges of the recent years as well as the Government decisions of the Russian Federation, there was a requirement of the Long-term

---

<sup>1</sup> Krasnianskii G.L., Zaidenvarg V.E., Kovalchuk A.B., Skryl A.I.: Coal in Russian economy. Economika, Moscow 2010, p. 137.

<sup>2</sup> Molchanov O.Y.: Methodical aspects of the international competition in the coal market. The Mining information and analytical bulletin. 2010, No. 2, p. 94.

program updating, and in 2014 the Russian Ministry of Energy accepted the Program of coal branch development till 2030 (it is referred as the Program below). The expected and volume reference points, particularly the forecast volumes of coal mining, have been changed in the Program. However, the main long-term goals have been remained unchangeable. It is supposed that implementation of the Program will allow the following: increasing competitiveness of coal production in the international markets; improving labor productivity by 5 times due to applying progressive technologies; completing modernization of the fixed business assets of the coal branch.

The Russian researchers strongly emphasize in their works the Russian coal quality improvement considering the coals used in the domestic market and the exported ones<sup>3</sup>. Also a number of works is devoted to the issues of increasing competitiveness in general and particularly in the coal industry enterprises<sup>4</sup>.

The subjective and functional competitive forms are defined as the main forms of competition considering the problems of the enterprise activity management in terms of foreign trade. The subject competition gives a possibility of various coal ranks to be interchangeable in this market. The second one is the competition between the different types of fuel (in particular, gas and coal). The different forms and types of competition provide various levels of competitiveness<sup>5</sup>.

It is noted that the competitiveness of coal branch, taking into account the features of the latter, needs to have a reflection at six levels:

1. Competitiveness of coal production which is defined by such mutually influencing factors as the level of scientific and technical progress, production quality and its price.
2. Competitiveness of the coal enterprise which depends on the production efficiency, management efficiency, production potential and product range.
3. Competitiveness of the coal company (association).
4. Competitiveness of the coal branch.
5. Competitiveness of the coal basin (region).
6. Competitiveness of the country.

In relation to the market of coal production, coal competitiveness is defined as an ability of coal production to be recognized by the consumer from the other types of fuel and energy

---

<sup>3</sup> Aleshinsky R.E.: New energetical companies on Russian coal markets. IC MEI, Moscow 2007; Glinina O.: Energy efficiency and clean coal technologies. *Coal*, 2011, No. 1; Davydov M.V. Reformed coal – stable and reliable resource of Russian electric power industry. *Coal*, No. 9, 2011; Islamov S.R.: Low-rank coal conversion into high-energy fuel. *Coal*, No. 3, 2012; Krasnianskii G.L., Zaidenvarg V.E., Kovalchuk A.B., Skryl A.I.: Coal in Russian economy. *Economika*, Moscow 2010; Molchanov O.Y. Current trends of the world coal market development. *The mining research and information bulletin*, No. 1, 2010.

<sup>4</sup> Embulaev V.N., Tonkih A.I.: Coal enterprise management development to increase its competitiveness. *Dal'nauka*, Vladivostok 2010; Laktionov-Mandelstam E.A.: Technical regulation system development of coal quality for increasing their competitiveness in the market. *The MGGU Scientific Bulletin*, No. 9, 2012; Mesyats M.A.: Enterprise foreign trade activity management (evidence from Kemerovo region coal industry). *Kuzbassvuzizdat*, Kemerovo 2006.

<sup>5</sup> Mesyats M.A.: Enterprise foreign trade activity management (evidence from Kemerovo region coal industry). *Kuzbassvuzizdat*, Kemerovo 2006, p. 9.

resources offered by the rival suppliers due to higher consumer properties and (or) the best technical and economic indicators<sup>6</sup>.

However, it should be noted that considering the problems of competition and competitiveness in the case of the Russian companies, it is necessary to carry out the analysis separately on the external and internal markets. These segments strongly differ by the number and importance of influence factors. According to the requirements imposed to coal production it has a direct impact on the determination of production and the enterprise competitiveness.

In this regard, the above-stated determination of coal competitiveness is represented more applicable in the case if a coal company is aimed at a foreign market. One of the serious problems of using coal in the domestic market is the technological readiness for the absence of coal power to use better quality power generating coals, and also there is a lack of coals interchangeability<sup>7</sup>.

So the concept of coal competitiveness may differ depending on the coal market and the type of coal consumption (power, metallurgy) in other words, coal rank.

In the domestic market the coal competitiveness depends not only on the qualitative characteristics of the coal rank but mainly on the consumer equipment which may be initially designed under the quality of the coal extracted in this region. First of all, it is related to the coal used for the needs of the Russian power industry.

O.Y. Molchanov outlines that "considering high dependence of the Russian coal industry on the export delivery volume, it is necessary to pay especially close attention to this issue and constantly trace both the current competitiveness of the Russian coals, and also those processes which can lead to its change as for the best and worst condition"<sup>8</sup>.

In this paper we are going to focus mainly on studying the issues connected with technological heterogeneity of coal and its influence on the coal competitiveness. Above all, the matters of the subjective competition in the case of targeting at a foreign market are considered.

## 2. Research methodology

Actually for the competitiveness assessment of mining companies some indicators may be used. Among them there are such indicators as the range of products, integrated quality

---

<sup>6</sup> Mesyats M.A.: Enterprise foreign trade activity management (evidence from Kemerovo region coal industry). Kuzbassvuzizdat, Kemerovo 2006, p. 11.

<sup>7</sup> Aleshinsky R.E.: New energetical companies on Russian coal markets. IC MEI, Moscow 2007, p. 25; Krasnianskii G.L., Zaidenvarg V.E., Kovalchuk A.B., Skryl A.I.: Coal in Russian economy. Ekonomika, Moscow 2010, p. 363.

<sup>8</sup> Molchanov O.Y.: Methodical aspects of the international competition in the coal market. The Mining information and analytical bulletin. 2010, No. 2, p. 94.

indicator, production profitability, level of providing long-term contracts, level of sales volume and some others. Currently, one of the most important indicators, due to the necessity of keeping positions for the Russian coal companies in the foreign markets, is the integrated indicator of production quality calculated using the following formulas (1) and (2)<sup>9</sup>.

$$I_i = \sum_{j=1}^m I_{ij} \times a_{ij} \quad (1)$$

$$I_{ij} = \frac{q_{ij}}{q_{ij}^3} \quad (2)$$

where

$j = 1, \dots, m$  – characteristics of the  $i$ -number quality indicator;

$q_{ij}, q_{ij}^3$  – the  $j$  value of the  $i$ -number characteristics of quality indicator according to the estimated and reference production;

$a_{ij}$  – weighted coefficient of the  $j$  characteristics for the  $i$ -number quality indicator.

However, it is necessary to notice that the given calculation of  $I_y$  indicator is fair when it is necessary that the value of this characteristic should be closer to the reference value or exceed it. In the case if the characteristic value has to be less than the reference value or tend to zero, it is necessary to use the following formula (3).

$$I_y = \frac{q_{ij}^3}{q_{ij}} \quad (3)$$

For the calculations of competitiveness by the given formulas it is necessary to define the reference values of the indicators of coal competitiveness.

Currently, coal quality is defined by technical properties of coals (tab. 1)

---

<sup>9</sup> Ponomarenko T.V.: Strategic assessment methodology of mining companies competitiveness. The Polytechnical University publishing house, Saint-Petersburg 2011, p. 49.

Table 1

## Main technical properties of coals

Name	Symbol, unit	Description
Ash-content	Ar, %	It is one of the most important quality indicators for determining the coal value as power fuel. For each percent of decrease/increase of ash-content the coal price is increased/decreased by 1,5%.
Water content	W, %	It is a characteristic property. Coal fuel is characterized by the content of coal moisture in which condition it is shipped or used. It is caused by water passing through the coal layers and rocks containing it, coal, coal range. For each percent of moisture decrease/increase the price of coal is increased/decreased by 1,3%.
Sulfur content	S,%	This property has no unambiguous negative impact on the combustion value. However, the high content of sulfur in coal fuel leads to harmful emission increasing at power plants. Therefore, it defines "coal environmental friendliness". There are no effective ways of coal desulfurization.
Specific heat	Q <sub>a</sub> , Kcal/kg	The amount of heat, fuel mass unit allocated during burning in the environment of the compressed oxygen sate with water vapor.
Volatile content	V, %	It is determined by the difference between the general weight loss and the loss due to the moisture evaporation in the heating process.
Caking index	Y, MM	It is crushing coal ability in the heating process without air to obtain the plastic state with a strong porous monolith formation. It is estimated by the plastic layer thickness.
Coking	-	It is a property of coal or mix to form the lumpy coke meeting industrial requirements. It is classification parameter in the international classification of coal types.

Source: Own elaboration based on: Krasnianskii G.L., Zaidenvarg V.E., Kovalchuk A.B., Skryl A.I.: *Coal in Russian economy*. Ekonomika, Moscow 2010, p. 249-250.

It is noted that one of the most important aspects of international coal trade is introduction of the generally accepted standards regulating the requirements of the delivered production quality, conditions and its delivery terms, price formula and the other components of export-import transactions. At present one of such standard examples in the field of international coal trade is the SCoTA standard (Standard Coal Trading Agreement). It is used in the international trade system of Global Coal. In fact, it is a standard contract form for coal supply within export-import transactions. The SCoTA standard requirements regulate coal quality delivered from various countries including Russia (tab. 2).

Table 2

## The international standards of coal quality

Ratio	Standard SCoTA		
	RSA	Columbia	Russia
Ash-content, %	<15	<11	<15
Water-content, %	<12	<14	<14
Sulfur content, %	<1	<0,85	<0,75
Specific heat, KCal/kg	6000	6000	6000

Source: Laktionov-Mandelstam E.A.: *Technical regulation system development of coal quality for increasing their competitiveness in the market*. The MGGU Scientific Bulletin, No. 9, 2012, p. 47.

In the works devoted to the improvement of the Russian coal quality, as a rule four main ratios are identified: ash-content, water content, sulfur content, heating capacity<sup>10</sup>.

The coal companies specify the following main quality ratios of product, except for the above-mentioned ones: volatile content; thickness of plastic layer; mass content of mineral impurity; mass content of fines.

The largest exporters of coal production are JSC "SUEK", JSC "Kuzbassrazrezugol", JSC "HK SDS-Ugol".

There are no qualitative indicators of extracted coal on the business official sites (for example, JSC "SUEK"). Those companies, which perform qualitative characteristics data of extracted coals, do it in different manner. On the official site of the JSC "Kuzbassrazrezugol Coal Company" the data are presented in a form of average and limit values. The heating capacity is presented by the average and the average among the lowest values. The JSC "HK SDS-Ugol" presents the qualitative characteristics in a form of ranges from the lowest to the limit values.

The information provided complicates the comparison of coal qualitative characteristics for various companies and calculations of coal production competitiveness.

For implementing the calculations we took reference values of the SCoTA standard for Russia.

It is necessary to use the formula (2) to calculate  $I_y$  indicator by the characteristic "specific heat". The formula (3) is applied to calculate this indicator for the other characteristics.

As values of the international standard are taken for a standard, it is efficient to make the analysis of the Russian coal competitiveness by its ranks used for export in the greatest volumes. Coal rank data for 2009 are provided in tab. 3.

<sup>10</sup> Krasnianskii G.L., Zaidenvarg V.E., Kovalchuk A.B., Skryl A.I.: Coal in Russian economy. Economika, Moscow 2010, p. 266; Molchanov O.Y.: Current trends of the world coal market development. The mining research and information bulletin, No. 1, 2010, p. 42.

Table 3

## Export supply structure of the Russian power generating coal

	Coal rank						
	ДГ	СС	Г	Д	Т	А	Б
Export supply ratio, %	26,6	22,8	18,7	16,7	10,8	3,7	0,7

Source: Krasnianskii G.L., Zaidenvarg V.E., Kovalchuk A.B., Skryl A.I.: *Coal in Russian economy*. Ekonomika, Moscow 2010, p. 261.

For the calculation of competitiveness we use the coal ranks with export share exceeding 15% (coal ranks Д, Г, ДГ, СС).

Data for calculation implementation of the specified coal ranks were taken from the official site of the JSC "Kuzbassrazrezugol" (tab. 4).

Table 4

## Quality parameters of JSC "Kuzbassrazrezugol" production

Coal pit	Coal rank	Maximum weight content, %			Minimum specific heat $Q_a$ , KCal/kg
		water, W	ash, Ar	sulfur, S	
Kedrovsky	ССОМ	9	11	0,5	6930
	ССПК	8	10,5	0,5	7060
	СССШ	13	25	0,5	5700
Mokhovsky	Д	16	18,5	0,4	5500
	ДОМСШ	13	15,5	0,4	5750
	ДПКО	11	12	0,4	6090
Elovsky site of Mokhovsky	Д	22	18,5	0,7	4470
Bachatsky	ССПК	9	10	0,5	7260
	ССО	9	11	0,5	7100
	ССМСШ	11	13	0,6	6900
Krasnobrodsky (Novosergiyevsky field)	ССПКО	9	11	0,5	6900
	ССМСШ	12	18	0,5	6300
Taldinsky	ДГ	14	20	0,5	5350
	ДГОМСШ	13	16	0,5	5800
	ДГПКО	11	17	0,5	5900
Sartakinsky	Д	21	18,6	0,6	5100
	ДПКО	17	15	0,6	5400
	ДОМСШ	20	17,9	0,6	5200
Erunakovsky	Г	12,5	25	0,6	5520
	ГОМСШ	11	16	0,6	6000

Source: <http://www.kru.ru/ru/about/indices/quality>.



### 3. Results

The calculation of integrated quality parameters of coal ranks is presented in tab. 5.

The following values of  $a_{ij}$  weight coefficients were used in the integrated indicator calculations by formula (1): for an ash-content - 0,3; for water-content - 0,25; for sulfur content - 0,2; for specific heat - 0,25. The choice of such values was caused by tab. 1 information. It is obvious that the weight coefficient of ash-content has to exceed the value of moisture (the ash-content influences the price for 15% more strongly than water-content). The sulfur content has the lowest coefficient as it has no direct influence on coal heating capacity.

Table 5

Integrated quality parameters of coal of JSC "Kuzbassrazrezugol Coal Company"

Coal pit	Coal rank	Index of competitiveness				
		$I_W$	$I_{Ar}$	$I_S$	$I_{Qa}$	$I_i$
Kedrovsky	ССОМ	1,56	1,36	1,5	1,16	<b>1,39</b>
	ССПК	1,75	1,43	1,5	1,18	<b>1,46</b>
	СССШ	1,08	0,6	1,5	0,95	<b>0,99</b>
Mokhovsky	Д	0,88	0,81	1,88	0,92	<b>1,07</b>
	ДОМСШ	1,08	0,97	1,88	0,96	<b>1,18</b>
	ДПКО	1,27	1,25	1,88	1,02	<b>1,32</b>
Elovsky site of Mokhovsky	Д	0,64	0,81	1,07	0,75	<b>0,80</b>
Bachatsky	ССПК	1,56	1,5	1,5	1,21	<b>1,44</b>
	ССО	1,56	1,36	1,5	1,18	<b>1,39</b>
	ССМСШ	1,27	1,15	1,25	1,15	<b>1,20</b>
Krasnobrodsky (Novosergiyevsky field)	ССПКО	1,56	1,36	1,5	1,15	<b>1,39</b>
	ССМСШ	1,17	0,83	1,5	1,05	<b>1,10</b>
Taldinsky	ДГ	1	0,75	1,5	0,89	<b>1</b>
	ДГОМСШ	1,08	0,94	1,5	0,97	<b>1,09</b>
	ДГПКО	1,27	0,88	1,5	0,98	<b>1,13</b>
Sartakinsky	Д	0,67	0,81	1,25	0,85	<b>0,87</b>
	ДПКО	0,82	1	1,25	0,9	<b>0,98</b>
	ДОМСШ	0,7	0,84	1,25	0,87	<b>0,89</b>
Erunakovsky	Г	1,12	1,67	1,25	0,92	<b>1,26</b>
	ГОМСШ	1,27	0,94	1,25	1	<b>1,39</b>

Source: Own elaboration.

The results of calculations show that in fifteen cases out of twenty the integrated indicator has the value more than a unit, i.e. 75% of coal ranks mined in different coal pits of JSC "UK Kuzbassrazrezugol" are competitive.

However, in the analysis of indexes according to characteristics it is visible that only seven coal ranks completely meet the SCoTA standard requirements.

The coal production of the Bachatsky open pit is completely competitive as it meets the standard requirements (all  $I_y$  indexes have value of more than a unit). The coal production of the Sartakinsky open pit is completely noncompetitive (incompetency by all characteristics, except sulfur content).

The production of the Mokhovsky open pit (except for the Elokhovsky site) is competitive according to the value of  $I_i$  coefficient. However, the values of  $I_y$  indicators show that the coal rank  $\mathbb{D}$  does not meet the standard requirements according to the water-content, ash and caloric contents, and the  $\mathbb{D}$ OMCIII mark -by the indicators of ash and caloric content.

The data calculated show that the most competitive coal rank is CC of various fractions (more often ПКО, less rare MCIII). The coal rank  $\mathbb{D}$  of ПКО fraction is completely competitive in the Mokhovsky open pit.

#### 4. Conclusion

It is also necessary to mention that the integrated indicator of quality production cannot be fully applied for the coal competitiveness assessment in the foreign markets as the coal export delivery term should be consistent with the total standard.  $I_y$  indicators calculation provides more information, especially concerning the application of statistic methods, in particular, the dispersive analysis. The integrated indicator is efficient to apply in the case of competitiveness level comparison of various enterprises if the rival production characteristics are used as reference values.

However, the use of coal integrated quality parameters in the domestic coal market of the Russian Federation is connected with the choice of increased complexity of reference values. Unlike the foreign market, in domestic market of the Russian Federation there are no standard values of quality indicators to which the coal mined has to correspond. It refers to the fact that the equipment of the Russian power industry is often designed under the quality indicators of the coal mined in this region.

#### Bibliography

1. Aleshinsky R.E.: New energetical companies on Russian coal markets. IC MEI, Moscow 2007.
2. Glinina O.: Energy efficiency and clean coal technologies. "Coal", No. 1, 2011.

3. Davydov M.V.: Reformed coal – stable and reliable resource of Russian electric power industry. “Coal”, No. 9, 2011.
4. Embulaev V.N., Tonkih A.I.: Coal enterprise management development to increase its competitiveness. Dal'nauka, Vladivostok 2010.
5. Islamov S.R.: Low-rank coal conversion into high-energy fuel. “Coal”, No. 3, 2012.
6. Krasnianskii G.L., Zaidenvarg V.E., Kovalchuk A.B., Skryl A.I.: Coal in Russian economy. Ekonomika, Moscow 2010.
7. Laktionov-Mandelstam E.A.: Technical regulation system development of coal quality for increasing their competitiveness in the market. “The MGGU Scientific Bulletin”, No. 9, 2012.
8. Mesyats M.A.: Enterprise foreign trade activity management (evidence from Kemerovo region coal industry). Kuzbassvuzizdat, Kemerovo 2006.
9. Molchanov O.Y.: Methodical aspects of the international competition in the coal market. “The Mining information and analytical bulletin”, No. 2, 2010.
10. Molchanov O.Y.: Current trends of the world coal market development. “The mining research and information bulletin”, No. 1, 2010.
11. Ponomarenko T.V.: Strategic assessment methodology of mining companies competitiveness. The Polytechnical University publishing house, Saint-Petersburg 2011.
12. Available at: <http://www.kru.ru>

## Omówienie

W artykule przedstawiono analizę jakości rosyjskiego węgla eksportowego i konkurencyjności rosyjskiej produkcji górniczej. W tym celu zidentyfikowano i opisano standardy, którym powinna odpowiadać produkcja kierowana na eksport. Na podstawie tych standardów opracowany został zintegrowany wskaźnik jakości produkcji górniczej. Wskaźnik ten może zostać wykorzystany do oceny konkurencyjności w tych przedsiębiorstwach górniczych, w których do oceny jakości produkcji stosowane są identyczne kryteria i miary. W przypadku porównań międzynarodowych konieczne jest uzupełnienie lub dostosowanie kryteriów użytych w konstrukcji wskaźnika do standardów ewidencji i oceny jakości węgla kamiennego stosowanych w danym regionie.