TENDENCIES OF COAL INDUSTRY DEVELOPMENT IN UKRAINE

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ABSTRACT


Methods. Complex analysis of data regarding mine productivity, coal reserves, mine funds as well as coal consumption and electricity generation has been presented in the paper. The studies of statistics related to geological and extraction thickness in longwall faces are discussed.

Findings. The current state of Ukraine coal mining industry and prospects of its development for the period until 2020 are considered. The analysis of Ukraine mine fund conditions is carried out. Statistical data of gross coal production at state-maintained and private mines are given. The reasons for low profitability and coal production decline in the country are considered. Results of the research into ash content of extracted coal, formation and accumulation of mine waste are interpreted. The main promising trends of efficient energy resources use and reduction of environmental impact on coal-mining regions are emphasized.

Originality. According to the analysis of the current state of coal industry, several options of its further development are formulated.

Practical implications. The presented results can be used to evaluate the investment attractiveness of Ukraine coal mining enterprises.

Keywords: coal-mining industry, coal extraction, mine fund, tendencies, perspectives

1. INTRODUCTION

Currently, due to geopolitical situation in Ukraine, the present state of the coal mining industry and its position in our country are of topical interest and, in fact, an open issue. Military actions in Eastern Ukraine paralyzed a large part of domestic enterprises. Lack of production capacities at the abandoned coalmines affected work of thermal power energy, metallurgy and other industries.

The tendencies of coal industry development in Ukraine have brought about many researches. Particular attention to these questions is paid in the papers (Amosha, Starichenko & Cherevatskyi, 2013; Zvyagilskiy & Zaloznova, 2013). However, in the context of the events taking place in the country, the problems of coal mining industry have not been yet sufficiently considered. The current difficult situation in the energy sector increases the role and importance of coal as a guarantor of Ukrainian energy independence.

2. CURRENT STATE OF COAL INDUSTRY

2.1. Coal reserves

Ukraine is a country with vast coal reserves of all grades. The estimated coal reserves in Ukraine are 33.9 bill t which is around 4% of the world coal reserves whereof 15.4 bill t are anthracite and bituminous coal and 18.5% – lignite (Energy Information Administration, 2016). Figure 1 shows the distribution of world coal reserves by countries. According to the estimation of Ukrainian geologists, the interior of our country could contain more than 110 bill t of coal (Ukraine coal, 2013). At present, the reserves of operating mines account to about 6.5 bill t.
In 2015, the total amount of gross coal production was 39.7 ml mln t that is 38.8% less than the level of 2014 (Statistical Information..., 2016). Production of coking coal in 2015 dropped by 49.8% (7,984 mln t) to 8.155 mln t, and steam coal – by 35.3% (17.252 mln t) to 31.7 mln t. The dynamics of coking and thermal coal production, as well as overall coal production in 2000 – 2015 are shown in Figures 4, 5.

The sharp decline in coal production volumes began with the expansion of the territory affected by warfare in Donetsk and Luhansk regions in June 2014.
As a result, problems arose with the coal transportation to thermal power plants (TPP). Railway communication was disrupted and delivery of materials and equipment to coal mining enterprises ceased (Krasnyk, 2015; Egorova & Otto, 1998). Due to the caused damage, coal production was continued only at 28 of the 90 state-owned mines, and 62 coal mines worked in the life-sustaining regime – in other words they only pumped water.

Under these circumstances, coal mines subordinated to the Ministry of Energy and Coal Industry of Ukraine reduced their coal production by 62% in 2015 (10.984 mln t) to 6.742 mln t including coke production decline by 57.6% (2.652 thou t) to 1.950 mln t, steam coal by 63.5% (8.332 mln t) to 4.792 mln t. At the end of 2015, the share of coal production at state mines in overall fuel balance was 16.8%.

The general map of coal production distribution in Ukraine by regions in 2015 is presented in Figure 6.

The regional distribution of rough coal production by mines of all forms of ownership is as follows: Donetsk region – 14.367 mln t (−44.9% compared to 2014), Luhansk region – 4.332 mln t (−75.8%), Dnipropetrovsk region – 18.832 mln t (−0.4%), Lviv region – 1.982 mln t (+9.2%), Volyn region – 243 thou t (−16.5%).
In 2015, mines of Dnipropetrovsk region – where DTEK Pavlohradvuhillia is the sole operator – produced the largest amount of coal – 47% from total production in the country. DTEK Pavlohradvuhillia comprises 10 mines as well as transportation and production infrastructure enterprises. The rough coal production of DTEK Pavlohradvuhillia mines in 2015 is shown in Figure 7.

Figure 7. Rough coal production of DTEK Pavlohradvuhillia mines in 2015, mln t

Heroiv Kosmosu mine achieved the best results among all the mines of DTEK Pavlohradvuhillia and became one of the most efficient in domestic coal-mining industry. According to the data of 2015, the average production capacity of coal enterprises in Dnipropetrovsk region was 1.7 mln t.

Currently, 35 state maintained mines are beyond the zone of combat operations, with two of them operating in water hoisting mode. On average, the other 33 mines produce around 20 thou t of coal per day (about 250 thou t of finished product per month). The produced coal is exclusively of thermal grades (mostly gas-coal), coal products are shipped to Vuhlehirska TPP and energy enterprises of DTEK company.

2.4. Coal consumption and power generation

Coal takes only 29% in the structure of primary energy consumption in Ukraine. For comparison, this figure in Germany is 58%, China – 70% and Poland – 90% (Popovich, 2014). It should be noted that, despite the fact that coal occupies the first place in the structure of energy resources, natural gas share in their consumption is the highest – 41%. It determines the dependence of Ukraine on natural gas import (Bondarenko, Lozynskyi, Sai & Anikushyna, 2015). Specific share of the consumed natural gas in other countries of the world is only 19%. The structure of energy resources consumption in Ukraine and in the world is shown in Figure 8.

Figure 8. The structure of energy resource consumption in Ukraine (a) and in the world (b), %

The main consumers of coal are power plants, population, metallurgical and coke plants. The total capacity of all generating power plants is 53 GW whereof about 52% of power is produced by thermal power plants. The share of TPP operating on coal in the total balance of power generation is 45%. The dynamics of coal consumption in Ukraine is shown in Figure 9.
In peacetime, about 90% of the produced steam coal was consumed by power generation companies in the country. The remaining part was distributed between metallurgical plants (4%), population (3%) and other industries (cement producers, soda and sugar factories). In 2000 – 2013, the average coal consumption was 40 mln t, i.e. 50% of the total coal production.

Thermal coal is used at 14 TPPs in Ukraine. However, the main feature of coal conversion into energy is that the domestic power plants are designed for the combustion of different coal types because of closeness of their delivery to TPPs. Table 1 shows thermal power plants distribution according to the type of coal used.

<table>
<thead>
<tr>
<th>Name of TPP</th>
<th>Coal type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zuiivska</td>
<td>G (gas flame coal)</td>
</tr>
<tr>
<td>Zaporizka</td>
<td></td>
</tr>
<tr>
<td>Vuhlehirvskia</td>
<td></td>
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<tr>
<td>Kurakhivska</td>
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<tr>
<td>Ladyzhynska</td>
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<tr>
<td>Dobrotvirska</td>
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<tr>
<td>Burshtynska</td>
<td></td>
</tr>
<tr>
<td>Trypilska</td>
<td>A (anthracite)</td>
</tr>
<tr>
<td>Zmitivska</td>
<td></td>
</tr>
<tr>
<td>Prydniprovskia</td>
<td>S (short-flame coal)</td>
</tr>
<tr>
<td>Starobeshivska</td>
<td></td>
</tr>
<tr>
<td>Slovianska</td>
<td></td>
</tr>
<tr>
<td>Luhanska</td>
<td>S (short-flame coal)</td>
</tr>
<tr>
<td>Kryvorizka</td>
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</tbody>
</table>

Thereby, seven from 14 TPPs of Ukraine technologically designed for operation on high-reactive coal type G (gas flame coal), six for burning of low-reactive coals A (anthracite) and S (short-flame coal) types and Kryvorizka TPP can operate just only on coal S type which exceptionally produce in Donetsk region. The main problem is that almost all anthracite mines are in the zone of military activities (Shakhorsk, Krasnyi Luch, Antratsyt, Rovenky, Sverdlovsk). On 35 functional mines are extracted coal L (long flame coal), G types and only some F (fat coal) types use for coal coking.

To provide the country with coal and electricity, Ministry of Energy and Coal Industry of Ukraine signed an agreement with Steel Mont Trading Ltd company about the supply of South African coal. Hence, at the end of 2014, the country received about 500 thou t of anthracite.

2.5. Coal price in domestic market

Coal in Ukraine is sold through direct contracts with mining companies and consumers or with the state enterprise “Vuhillia Ukrainy” as the operator of the wholesale market.

About 65% of all coal supplies from state enterprises are sold under contracts with “Vuhillia Ukrainy”. The wholesale market operator distributes coal products at fixed prices. This done by cross-subsidization of loss-making state-owned mines at the expense of profitable ones. Private companies set prices for their products based on supply and demand in Ukraine, taking into account general trends in international markets.

The wholesale price of a ton of marketable coal product from state-owned enterprises grew by 27.6% to UAH 627.8 (USD 52.7) in 2014. The production cost increased by 30.8% to UAH 1,766.3 (USD 148.2). To partially cover this gap 2014, the state allocated USD 768.5 mln from the national budget, compared to USD 1.7 bill in 2013.

2.6. Coal ash content

The most important indicator of the quality of extracted coal is ash content. Ukrainian coal has high ash content, and it can not be used directly in energy and coking industries. Over 90% of all coal is processed at coal-preparation plants. Mines are selling marketable output primarily as washed products with average ash content 20 – 25% (Chernyavskiy, 2016).

The conducted analysis (Bondarenko, Russkii, Yar-kovych & Malashkevych, 2014) shows that ash content of coal has a tendency of gradual growth. Thus, over 15 years, this index has increased by 3.8% reaching 40.2% in 2015. The maximum value of the average coal ash content was 41.1% in 2011. The graph of average ash content in coal produced at Ukrainian mines is presented in Figure 10.

High ash content of coal is explained by low geological thickness of seams. The use of traditional technologies for coal extraction is accompanied, as a rule, by the significant wall rock undercut of the roof or floor. It increases the ash content of coal due to artificial mixing with waste rock which reduces its quality.
Analytical research into statistics of mining and geological thickness of longwall faces in DTEK Pavlohradvuhillia mines shows that annual average mining thickness varies from 1.05 to 1.2 m. The geological thickness of coal seams in various mines has a value from 0.7 m (Pavlohradskia mine) to 1.54 m (Ternivska mine).

The dynamics of the average value of mining and geological thickness in longwall faces of DTEK Pavlohradvuhillia mines in 2000 – 2015 is shown in Figure 11.

According to the present data the average value of wall rock undercut changes within the range from 0.1 to 0.3 m. While at some mines, the wall rock undercut in longwall faces reaches 0.4 – 0.5 m.

Wall undercut rock is not only the product deteriorating coal quality but also a source of waste rock accumulation on the surface. Annually, mines and coal-preparation plants store more than 20 mln t in waste dumps. Consequently, more than 3,000 hectares of land are disposed annually.

High ash content of coal negatively influences financial condition of coal mining enterprises. As nonproductive transportation expenses on haulage of rough coal from the mine to preparation plant grow, the release of marketable products reduces and the volumes of coal product realization decrease.

The expenditures of coal mining enterprises and preparation plants incurred by transportation, stockpiling and payments for waste rock allocation make around 15% of the primary production cost. The limited possibilities of waste rock application in our country and foreign countries make it necessary to develop and implement rational non-waste and low-waste technologies of underground mining.

3. PERSPECTIVES OF UKRAINE COAL INDUSTRY DEVELOPMENT TO 2020

According to the analysis of the situation in coal industry, it is possible to formulate the following perspectives of its development:

– by the end of 2020, coal industry will function entirely within market relations and the government will not regulate and subsidize the activity of coal enterprises;
– the economic and political situation in the country will become stabilized, coal mines will reach annual production of 50 mln t, while a part of mines with low technical and economical levels and small coal reserves will be liquidated and conserved;
– coal consumption will gradually reduce, the share of nuclear and alternative energy in the energy balance of the country will grow.
4. CONCLUSIONS

2014 was a crucial moment for the coal industry of Ukraine. Coal mining enterprises worked in extremely difficult conditions. Mines significantly reduced their production volumes, and some enterprises stopped their operation. The results of the analysis showed the difficulties of maintaining production profitability in unfavorable mining and geological conditions.

Domestic reserves have low attractiveness for investors, particularly in view of the fact that in recent years, new deposits of high-quality coals (Mozambique, Mongolia and Indonesia) have been explored. The tendencies in the world show that coal demand has been dropping as the result of harsh environmental norms and standards especially in the countries of European Union. Coal mines in Germany, France, Great Britain and Belgium are closed. China, the main coal producer and importer reduces it consumption. Currently, China has chosen a strategy of coal substitution by alternative energy sources.

Taking into account the experience of developed countries, it is necessary to intensify research activities aimed at the efficient use of energy resources and reduction of man-made impact on the environment. It is time to explore the feasibility of thermal energy of deep rocks, develop man-made deposits, to advance coal gasification, utilize mine methane gas. Following these strategy will enhance the competitiveness of Ukrainian coal. Thereby the coal industry must take the path of “green” clean energy.

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ABSTRACT (IN UKRAINIAN)

Мета. Аналіз сучасного стану та перспектив розвитку вугледобувної галузі України до 2020 року.

Методика. Для досягнення мети використано комплексний аналіз даних виробничої потужності вугільних підприємств, запасів вугілля, шахтних фондів, а також споживання вугілля та вироблення електроенергії. Представлений дослідження статистичних даних геологоїчної та віймальної потужності в очисних вибох.

Результати. У статті проведено аналіз поточного стану вугільної промисловості України та представлені перспективи її розвитку до 2020 року. Проведено аналіз стану шахтного фонду України. Наведені статистичні дані видобутку вугілля підприємствами державних і недержавних форм власності. Розглянуто причини низької рентабельності видобутку вугілля у країні. Представлені результати досліджень зольності вугілля, утворення та накопичення відходів гірничодобувних підприємств. Виділені основні пріоритетні напрямки ефективного використання енергосервісів і зниження екологічного впливу на вугледобувні регіони.

Наукова новизна. Згідно проведенного аналізу поточного стану вугільної промисловості сформульовано три напрями її подальшого розвитку.

Практична значимість. Представлені результати можуть бути використані для оцінки інвестиційної привабливості вугледобувних підприємств України.

Ключові слова: вугільна промисловість, запаси вугілля, шахтний фонд, тенденції, перспективи

ABSTRACT (IN RUSSIAN)

Цель. Анализ современного состояния и перспектив развития угледобывающей промышленности Украины до 2020 года.
Методика. Для достижения цели использован комплексный анализ данных производственной мощности угольных предприятий, шахтных фондов, а также потребления угля и производства электроэнергии. Представлены исследования статистических данных геологической и вынимаемой мощности в очистных забоях.

Результаты. В статье проведен анализ текущего состояния угольной промышленности Украины и представлены перспективы ее развития до 2020 года. Проведен анализ состояния шахтного фонда Украины. Представлены статистические данные добычи угля предприятиями государственной и негосударственной форм собственности. Рассмотрены причины низкой рентабельности добычи угля в стране. Представлены результаты исследований зольности добываемого угля, образования и накопления отходов горнодобывающих предприятий. Выделены основные приоритетные направления эффективного использования энергоресурсов и снижения экологической нагрузки на угледобывающие регионы.

Научная новизна. Согласно проведенного анализа текущего состояния угольной промышленности сформулировано три направления ее дальнейшего развития.

Практическая значимость. Представленные результаты могут быть использованы для оценки инвестиционной привлекательности угледобывающих предприятий Украины.

Ключевые слова: угольная промышленность, запасы угля, шахтный фонд, тенденции, перспективы

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