

Comparison Of Vietnam And Poland coal resources & coal demand in the past and how it will change in future

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Abstract: The article in individual chapters discuss domestic coal resources in Poland and Vietnam, types of coal occurrence in both countries, the processing status and main domestic mining companies. The last part will be a comparison of mining prospects and plans for the development of coal mining in both countries and a summary of positive practices in both countries.

1. Introduction

Poland is the biggest coal producer in Europe. The coal mining industry plays a key role in energy production. More than 78% of the energy is produced from brown and hard coal. After break down of the global coal market, the coal mining sector changed. Now Poland has 5 main hard coal producers and 4 big producers of brown coal. The most important now in the Polish mining sector is to establish more economic manage system, put more attention on environmentally friendly technologies of exploitation and preparation and be more competitive on the global market but still play the key role in Europe [8].

Vietnam is one of the most important producers of anthracite. After 1995 position of the coal industry and coal in the economy in Vietnam has changed. VINACOMIN is the leading company in Vietnam coal market. Coal industry plays an important role in the fast-growing economy in Vietnam and also in energy production. Vietnam starts putting more responsibility on environmental protection but another thing is increasing production efficiency in processing plants, build new underground mines and close open-pit mines [3].

2. Coal resources and coal basins

The documented balance of coal resources in Poland at the end of 2017 is 60 496 mln tons. Steam coal is 70.67%, coking coal is 28.03% and rest of coal types is 1.30% of all coal resources. Deposits currently in use is 37.19% of balance coal resources (22 497 mln tons). The hard coal deposits in Poland occurred in 3 coal basins:

- Upper Silesian Coal Basin (GZW) - main coal basin on the south area in Poland. In this basin are almost all opened coal mines. Area of GZW is 5 600 km² and got 80.00% of all documented balance resources of coal.

- Lublin Coal Basin (LZW) - located in the east of Poland. In this basin work 1 coal mine "Bogdanka". The area of perspective deposits got 9 100 km² and area of documented deposits is 1 200 km². Only 0.9% of this basin is currently being developed.
- Lower Silesian Coal Basin (DZW) - exploitation was finished in the 2000 year. The main reason for stopped exploitation was hard geological conditions.

Currently, available data shows that coal reserves in Vietnam are about 49.8 billion tons. Coal resources are classified into a few categories: measured & indicated reserves (categories A+B+C1) is 33%, inferred (C2) 39% and prognostic resources (P) is 28%. In Vietnam appeared all types of coal: anthracite (already mined), bituminous coal, sub-bituminous coal, lignite coals, and peat coal. Coal plays a key role in the Vietnam economy and energy sector. Most important coal basins are located in Quang Ninh, Red River Delta, Thai Nguyen, Bac Kan, North Path, Da River, Ca River, Na Duong, Nong Song, Ba River, Mekong River Delta (Fig. 1). Vietnam got one of the biggest resources of anthracite. Quang Ninh coal basin is the most important area for coal mining, where has almost all currently coal mines and coal preparation plants. Quang Ninh basin is located in the northeast part of the country, it occupies the area of about 5900 km² of which 2800 km² is forest land and 510 km² is agricultural. Coalfields in this area is located very close to the coast so it is a very good location to send coal for the international coal market. Exploitation begins in this basin in 1839. Quang Ninh coalfield got 8.7 billion tons of coal resources (anthracite). Most important coal deposits in Quang Ninh basin: Mao Khe, Trang Bach, Nam Mao, Vang Danh, Uong Thuong, Dong Vong, Nga Hai, Khe Tam, Giap Khau, Nui Bao, etc. and are shown in Figure 2. Most important ports are Cam Pha Port and Hon Gai [2, 3, 4, 5, 7, 8, 9].

3. Coal industry policy, companies, and production trends

In 2018 the plan for Polish hard coal mining sector was accepted and signed by the Council of Ministers (published by Ministry of Energy). After break down of coal global market, the most important change was the creation of new mining company Polska Grupa Górnicza S.p. z o.o. in 100% owned by Government. This company consists of coal mines from old companies Kompania Węglowa S.A. and Katowicki Holding Węglowy S.A. New company is an owner of three consolidated mines: KWK Ruda (mines Bielszowice, Halemba-Wirek and Pokój), KWK ROW (mines Chwałowice, Jankowice, Marcel and Rydułtowy), KWK Piast-Ziemowit (mines Piast and Ziemowit) and two individual mines KWK Bolesław Śmiały and KWK Sośnica.

Other coal companies are Jastrzębska Spółka Węglowa S.A. the main coking coal producer (mines KWK Borynia-Zofiówka-Jastrzębie, KWK Budryk, KWK Pniówek, KWK Knurów-Szczygłowice), Tauron Wydobywanie S.A. (mines Brzeszcze, Janina, Sobieski), Siltech Sp. z o.o. (private mine), Eco-Plus Sp. z o.o. (private mine), PG Silesia (property of Czech investors) and Spółka Restrukturyzacji Kopalń S.A. (preliminarily aimed for liquidation of unprofitable coal mines). In the last 10 years, coal production is decreasing due to the changing economy and energy sector.

The most important institution is Ministry of Industry and Trade (MOIT) and is responsible for the state management of all energy industries, namely electricity, new and renewable energy, coal and the oil and gas industries. The Ministry is not only determined first-line policy it has also supervisory responsibilities for energy sector such as a state-owned companies VINACOMIN and Electricite de Vietnam (EVN). The Ministry is also responsible for master plans for electricity, coal, oil and natural gas exploitation and supply.

In 2005 was founded VINACOMIN from the merging of Vinacoal and Vietnam Mineral Corp (or Vimico). VINACOMIN Holding Corporation Ltd. with 54 coal mines it is the biggest coal mining company in Vietnam. VINACOMIN hold 5 big opencast mines, 15 open pits, some smaller coal mining sites, and 30 underground coal mines. This is an economic Corporation with 100% owned by the State. 95% of coal production in Vietnam is from VINACOMIN Company. Till 2030 the plan for the coal industry is to gratify coal demand for a fast developing economy. The coal demand in 2030 should reach a level of about 127 mln tons [2, 3, 4, 6, 8, 9].

4. Coal preparation status

Coal preparation in Poland and Vietnam is similar and it can be described by comparing in schedule:

Beneficiation technology	Poland	Vietnam
1. Preparation of coal	Crushers, screens, handpicking belts, metal catchers	Crushers, screens, handpicking belts, metal catchers
2. Initial classification	Vibrating screens	Vibrating screens
3. Coal beneficiation	Jigs, heavy dense medium separators, dense medium cyclones, spirals, flotation	Jigs, heavy dense medium separators, dense medium cyclones, spirals, flotation
4. Dewatering, Thickening & filtration	Screens, centrifugal machines, dewatering sieve, radial thickener Dorra	Screens, centrifugal machines, dewatering sieve, radial thickener Dorra

In both countries are used similar technologies to separate useful coal particles from wastes. The biggest difference is that in Poland to separate medium grain classes are mostly used jigs. This method is very popular. In coal preparation plants in Vietnam, there is a tendency to separate medium grain classes by using dense medium cyclones [1, 3, 6, 9].

5. Development plan and challenges to overcome

In Poland the main target for coal mining industry is to creating conditions conducive to profitable construction, an efficient and modern hard coal mining sector, based on cooperation, knowledge and innovation, which is acting in a friendly way and a predictable software and legal environment, allows for effective use of resource, social and economic capital to ensure high energy independence of Poland and to support competitiveness national economy. Other important points are [8]:

- Recovery and stabilization of liquidity, profitability, and efficiency economic and financial sector of hard coal mining, including through adjustment production capacity to market needs and export opportunities.
- Vertical integration of mining and energy and creating an effective one steam-coke coal group model.

- Satisfying domestic demand for hard coal, including in particular for the production of electricity, heat, and coke.
- Ensuring access to new coal deposits and ensuring an appropriate level of investment where it will ensure the highest efficiency economic.
- Development of employee competencies and knowledge.
- Reducing the impact of the hard coal mining sector on the environment and increasing the use of mining waste and accompanying minerals.
- Innovations in hard coal mining. Creation of the intelligent mine, ensuring a high level of occupational safety.

Most important targets to reach in coal processing [1, 6, 7, 9]:

- Implementation of CMMS (Computerized Maintenance Management System) and PIMS (product information management systems), including the area of production quality forecasting, planning, and integration of the extraction process with the enrichment and sale process.
- Modernization of plants for enrichment technology in the full graining range.
- Full automation of technology sections and complete processing processes.
- Reducing the duration of processes wet to minimize the contact of grains carbon with water.

In Vietnam, between the year 2011 and 2030 will be closed 19 mines with a total capacity of 11 million tons/year. Which 9 opencast coal mines with total capacity 8.2 million tons/year: Nui Beo (3.5 mln tons/year), Ha Tu (1.65 mln tons/year), Southwest Da Mai (1.0 mln tons/year), East Da Mai (0.4 mln tons/year), Bang Nau (0.55 mln tons/year), Northwest Khe Tam (0.03 mln tons/year), Khe Sim (1.05 mln tons/year), West Khe Sim (0.05 mln tons/year) and 10 smaller opencast mines (2.7 mln tons/year). The share of underground coal mines will increase from 45% in 2011 to 75% in 2020 and 80% in 2030 (Government plan for coal industry) [2, 3, 4, 9].

Between 2015 and 2030 coal mining industry will invest to open 19 new mines, 5 mines will be owned by VINACOMIN in North East basin (Quang Ninh), 9 new mines (North East basin) and 5 pilot mines (Hung Yen, Thai Binh in Red River Delta basin). Between years 2016-2030 will be constructed few new preparation plants Khe Than 2, Bao Dai, Dong Trieu-Pha Lai and in 2017 was started the test phase of coal preparation plant Khe Cham IV. The master plan is also presented for the coal mining industry in table [2, 3, 4, 5, 10].

Tab. 5 Master plan for the development of Vietnam coal industry (Mt) [13].

<i>Coal area</i>	<i>2020</i>	<i>2025</i>	<i>2030</i>
<i>Total run-off-mine coal</i>	92,430	119,250	120,732
I. North-East basin	72,330	85,050	83,282
1.1. VINACOMIN	64,530	67,150	59,782
In which: banned area & coal bearer	6200	7400	7300
1.1.1. Uong Bi coal field	19,280	20,550	20,950

1.1.2. Hon Gai coal field	9,350	9,800	8,800
1.1.3. Cam Pha coal field	35,900	36,800	30,032
1.2. New coal mines	7,800	17,900	23,500
II. Other interior basins	3,050	2,650	2,700
III. Out of Vinacomin	3,550	6,550	9,750
IV. Red River Delta basin	13,500	25,000	25,000

Other plans for the coal preparation industry [10]:

- The coal industry will be developed on the basis of efficiently exploiting, processing; making a positive contribution to ensuring national energy security; prioritize domestic demand; ensuring the import and export rationally in the direction of only exporting domestic coal types that do not need to be used
- Promote the investigation, exploration, and evaluation of domestic coal resources and reserves to prepare a reliable resource base for the sustainable development of the coal industry.
- To speed up the business activities and invest abroad to meet coal demand for socio-economic development of the country.
- To ensure that the coal production and consumption meet the requirements for sustainable development, develop coal industry effectively, synchronously and in accordance with the general development of economic sectors; diversify methods of investment and coal trading; to maximize internal resources in combination with expand international cooperation to research and apply advantage technology in exploration, coal mining, processing and use; reduce losses in coal mining and take into account the reasonable investment for environmental protection, labor safety, resource management, risk management
- Implementing coal trading in harmony with the world coal market.
- To develop the coal industry in association with the ecological environment protection and improvement in the coal region, minimizing the impact on cultural conservation areas; actively contributing to the socio-economic and tourist development

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