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Alternative directions of coal supply to Poland as a result of the Russian-Ukrainian war

Introduction

The result of the armed attack by the Russian Federation (hereafter referred to as Russia) on Ukraine (on 24 February 2022), was the introduction of packages of sanctions imposed on Russia by many global economies. In particular, the decision to sanction was taken by countries that are part of the European Union ([Russia's military aggression 2022](#)). In the fifth package of EU sanctions against Russia ([EU 2022; OJ L 111, 8.4.2022](#)), one of the bans introduced was a ban on the purchase, import and transfer of coal and other solid fossil fuels that originate in or are exported from Russia. This ban is to take effect from August 2022.

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In response to the aforementioned ban on the import of Russian coal into the EU announced at the beginning of April 2022 (EU 2022; OJ L 111, 8.4.2022), Poland has also introduced an embargo on the transportation (import or transit) of coal originating from Russia and Belarus (Ustawa 2022). In accordance with Article 8 of the aforementioned Act (Ustawa 2022), goods classified under either CN codes 2701 or 2704 of the combined nomenclature (abbreviated as CN) are prohibited from being transported. According to Methodological CN 2022, the following goods are covered by code 2701: coal; briquettes, ovoids and similar solid fuels manufactured from coal. Code 2704 also includes (coke and semi-coke of coal, of lignite or peat (whether agglomerated or not), and retort carbon Methodological CN 2022). The aforementioned act took effect from 16 April 2022.

From 2010 to 2021, between 8.3 and 19.7 million tonnes of hard coal were imported into Poland annually, with coal supplies from Russia accounting for as much as 57–74% (Figure 1). In terms of volume, steam coal dominated (see Figure 1). From 2010 to 2021,

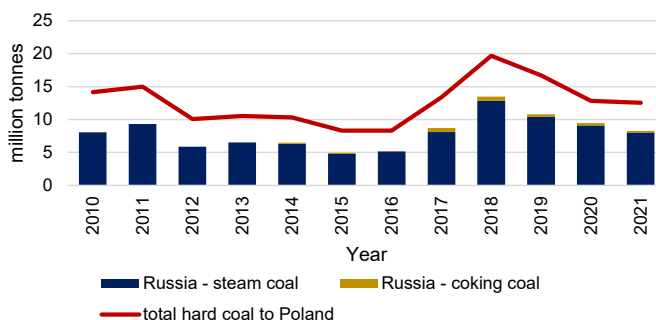


Fig. 1. Coal imports from Russia to Poland, 2010–2021
Source: own elaboration based on (ARP 2010–2022) data

Rys. 1. Import węgla z Rosji do Polski w latach 2010–2021

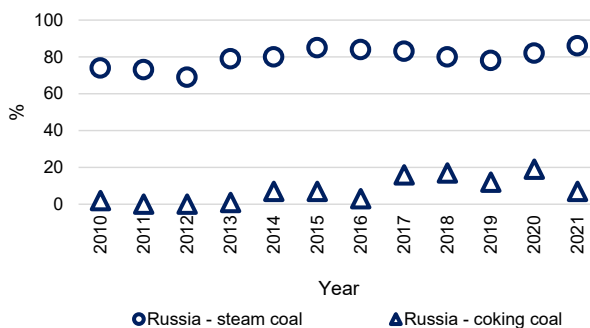


Fig. 2. Share of Russia in coal imports to Poland, 2010–2021
Source: own elaboration based on (ARP 2010–2022) data

Rys. 2. Udział Rosji w imporcie węgla do Polski w latach 2010–2021

between 4.8 and 12.9 million tonnes of this coal were imported annually from Russia, which accounted for 69 to 86% of total steam-coal imports to Poland (see Figure 2). The share of coking coal in the total imports of this commodity reached a maximum of 19% in 2020 (see Figure 2), which amounted to 0.3 million tonnes in volume terms (see Figure 1).

Faced with the introduction of an embargo on coal imports from Russia, the aim of the article is to introduce other alternative directions of coal supply to Poland. As the dominant proportion of imports is steam coal, the authors will focus on this type of coal.

1. Position of Russian coal in Poland

As shown in the introduction, Russia has been an important supplier of steam coal to Poland (see Figure 1). The question arises of whether Poland has been an equally important market for Russia so far. In 2010–2021, annual Russian steam-coal exports ranged from 109.6–158.3 million tonnes (see Figure 3), of which the share of exports to Poland accounted for 4–9%. Deliveries to the European Union as a whole (EU-27) accounted for 24–39% of all Russian steam-coal exports between 2010 and 2020, falling to 18% according to preliminary data for 2021. The apparent downward trend in the supply of this coal to the EU since 2018 was associated with the strong decarbonization policies of Western European countries.

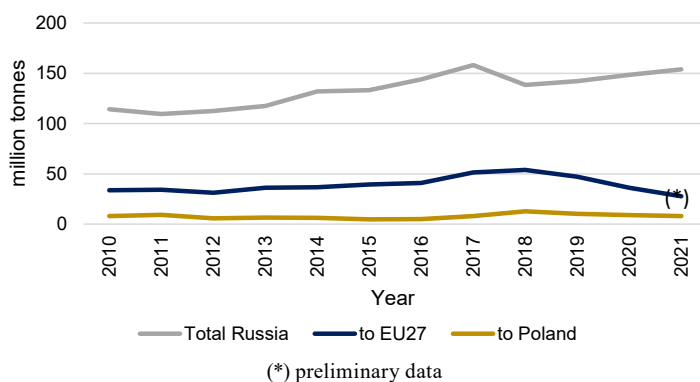


Fig. 3. Comparison of steam-coal exports from Russia to the EU-27 and Poland, 2010–2021
Source: own elaboration based on (Coal Information 2020; Coal 2021; CAA 2020; Russia 2022; Eurostat 2022a, b) data

Rys. 3. Porównanie eksportu węgla energetycznego z Rosji do UE 27 i Polski w latach 2010–2021

Annually, 4.8–12.9 million tonnes were imported to Poland from Russia, which accounted for 8–25% of domestic steam coal consumption (see Figure 4). In 2017–2021, the share of Russian coal imports in Polish production ranged from 13–21%. The increasing share of Russian coal imports in Polish production was associated not only with the

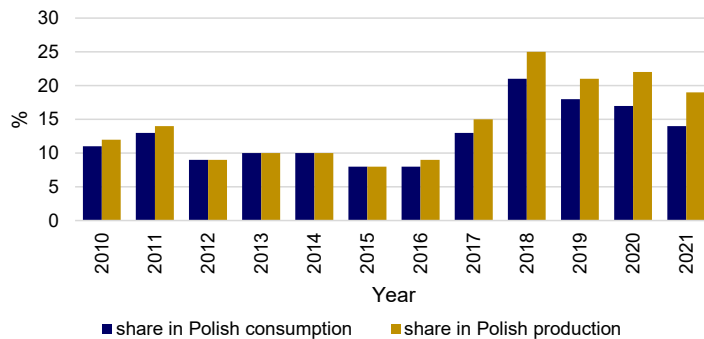


Fig. 4. Share of imported steam coal from Russia in Polish steam-coal production and consumption, 2010–2021
Source: own elaboration based on (GUS 2011–2021a; ARE 2022; ARP 2010–2022) data

Rys. 4. Udział importowanego węgla energetycznego z Rosji w polskiej produkcji i zużyciu tego surowca, lata 2010–2021

downward trend in domestic coal production observed for years, but also with the relatively high volume of coal imported into Poland. At that time, imports of steam coal from Russia amounted to 9.1–12.9 million tonnes/year. Whereas the share of Russian steam coal imports was at the level of 15–25% of the total consumption of this commodity in Poland. Analysis of statistics (ARP 2012–2022) suggests that the main consumer of steam coal from Russia is the statistical group of other domestic consumers, which includes, for example, households.

Analysis of the share of Russian steam coal imported to Poland in domestic consumption and production suggests that this commodity played a relatively important role on the Polish market. In addition, Poland was one of the most important markets in Europe for Russia. Steam coal imported to Poland as of 2018 accounts for 22–29% of the volume of coal shipped by Russia to all EU-27 countries (see Figure 3). The importance of the Polish market is confirmed by the fact that two coal producers in Russia, specifically the SUEK company (the largest coal producer and exporter in Russia) and the KTK company (ranked among the top Russian exporters), have opened offices for sales representatives in Poland.

2. Steam coal traded on the international market

With the cessation of Russian coal imports, the question has arisen of what coal (from which directions) could replace the gap in the Polish market. The graphs presented in Figure 5 show information on the quality of coal traded on the international market (as of the end of June 2022). The leading exporters on the world market have been taken into account: Australia, Indonesia, South Africa, the US and Colombia. In addition, for comparative purposes, the top left graph presents the quality parameters of Russian coal offered at Baltic ports.

Qualitative information was taken from methodologies presented in publications by the following key industry players (as of the end of June 2022): Argus Media Ltd. (Argus 2022a), S&P Global Platts (Platts 2022a) and McCloskey (McCloskey 2022). The data presented refers to steam-coal quality parameters, offered on the spot market, i.e. the so-called spot market deliveries.

For the graphs in Figure 5, the three most important quality parameters, which are also the most important price-forming parameters, were taken into account: calorific value (Q), ash (A) and sulphur (S). The calorific value in the available journal methodologies (Argus 2022a; Platts 2022a; McCloskey 2022) was expressed in kcal/kg as NAR (net as received) or GAR (gross as received). Therefore, the authors converted it to a unit of energy: MJ/kg as NAR. For ash and sulphur, the values were expressed as a percentage (%). In all the presented coal-quality parameters, they refer to grain fineness class of 0–50 mm.

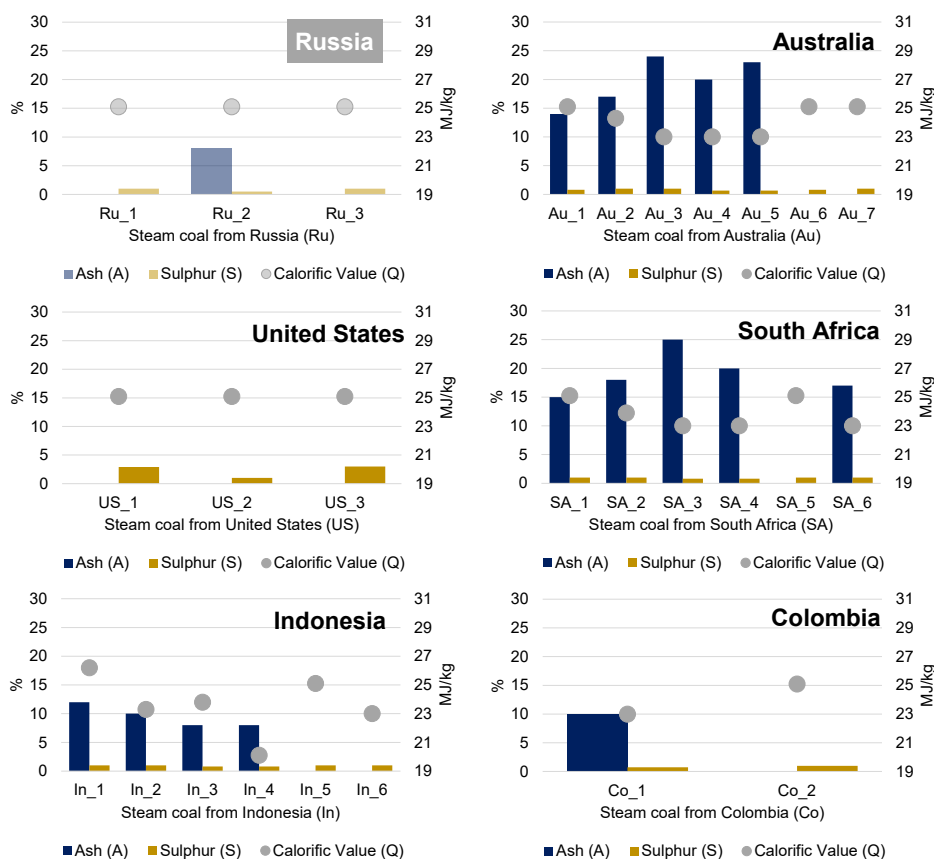


Fig. 5. Quality parameters of coals traded on the international market, June 2022
 Source: own elaboration based on (Argus 2022a; Platts 2022a; McCloskey 2022) data

Rys. 5. Parametry jakościowe węgla będących przedmiotem handlu na rynku międzynarodowym, czerwiec 2022

The quality specifications shown in Figure 5 demonstrate that coal offerings from Australia, South Africa, Indonesia and Colombia have low sulphur content (less than 1%). By contrast, a characteristic feature of coals from Australia and South Africa is the relatively high ash content (from 12% to nearly 25%).

Over the period 2010–2021, buyers from the European Union (apart from Russia) were the most attractive market for coal from Colombia and the US (see Figure 6a). However, when looking at the share of exports to the EU-27 in a country’s total exports (see Figure 6b), the European Union was an important market for coal from the US and Colombia.

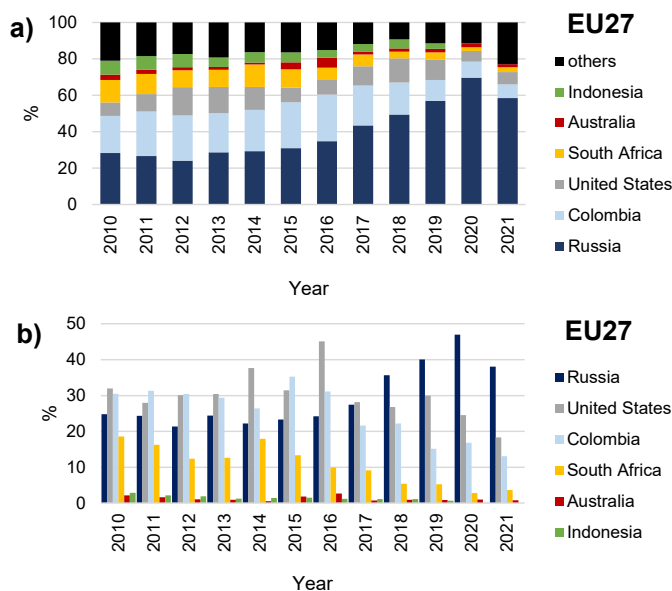


Fig. 6. Main suppliers of steam coal to the EU-27, 2010–2021

a) structure of the main suppliers of steam coal,

b) share of imports to the EU-27 in a country’s total steam-coal imports

Source: own elaboration based on (Eurostat 2022a, b; Coal Information 2020; Coal 2021) data

Rys. 6. Główni dostawcy węgla energetycznego do UE 27 w latach 2010–2021:

a) struktura głównych dostawców węgla energetycznego,

b) udział importu do UE 27 w całkowitym imporcie węgla energetycznego danego państwa

The first supply direction is Australia, which in the authors’ opinion, is a relatively reliable exporter. Admittedly, in terms of quality among the analyzed coals, the coal from Australia may have a relatively high ash content (see Figure 5), reaching up to 25%. Due to the relatively long distance (13.5–14.7 thousand nautical miles, approximately 25.0–27.2 thousand km), the sailing time of a bulk carrier with coal at sea to the main seaports may be about 40–44 days (see Table 1). To date, the European Union has not been such an attractive market for Australian coal. Steam-coal exports to the EU-27 accounted for only 1–3% of

Table 1. The estimated sea distance between selected coal exporters and major seaports in Poland

Tabela 1. Szacunkowa morska odległość pomiędzy wybranymi eksporterami węgla a głównymi portami morskimi w Polsce

Exporting countries		Polish seaports in the Baltic Sea	
country name	location of the sea-coal port	distance, thousand nautical miles (thousand km)	days at sea
Australia	East Coast	13.5–14.7 (25.0–27.2)	40–44
Indonesia	Kalimantan	11.2–11.5 (20.7–21.3)	33–34
South Africa	East Coast	9.1 (16.9)	28
Colombia	Caribbean Sea	7.0–7.3 (13.0–13.5)	20–22
United States	East Coast, the Gulf of Mexico	4.5–6.2 (8.3–11.5)	13–18

Source: own elaboration based on (Ports 2022; Sea 2022) data.

Australia's total steam-coal exports (see Figure 6b). However, it should be borne in mind that China's ban on imports of Australian coal, which has been in place for two years, has caused the country to look for new markets for its commodity.

A second important route of steam-coal supplies to Poland could be coal from Indonesia. Due to the fact that Indonesia has been the largest exporter of steam coal in the world for many years (see data: Coal Information 2020; Coal 2021), the authors felt that this route of supply should also be considered. However, the authors recognize that Indonesian coal has so far been a relatively rare import to Europe. Nevertheless, faced with a ban on Russian imports, Germany, for example, announced at the end of May 2022 (ESDM 2022a) its intention to develop cooperation and import coal from Indonesia.

In terms of quality, Indonesia offers the widest spectrum of different coal grades varying in terms of calorific value and ash content (see Figure 5). In terms of distance, coal bulk carriers have to cover a distance of more than 11,000 nautical miles (approx. 21,000 km) for more than 33 days (see Table 1). For Indonesia, as for Australia, the European direction was not an essential market for coal off-take. The share of Indonesia's steam-coal exports to the EU-27 between 2010 and 2021 was only 1–3% (see Figure 6b). The country, like Australia, mainly targets Asian customers. Due to weather difficulties (anomalous rainfall), as well as problems with the availability of transport equipment at ports (which Indonesia encountered in the first half of 2022), mining companies from the country suggested to the Indonesian Ministry of Energy and Natural Resources (ESDM) to lower their production targets for 2022 (Platts 2022b). Furthermore, in order to secure coal supplies for the domestic power industry, the ESDM imposed a ban on coal exports from 1 to 31 January 2022 (ESDM 2022b). The aforementioned factors, including the possibility that the ESDM will impose another halt on Indonesian coal exports, may reduce the availability of Indonesian coal in the coming months.

The United States is a swing exporter, i.e. one that is particularly active on the international market during times of high coal prices. As a result of its response to the rapidly changing international coal market, the US Energy Information Administration, in its June 2022 forecast, made a 4% upward revision to the previous month's forecast, indicating that steam-coal exports in 2022 could reach 41.6 short tons (37.7 million tonnes) (EIA 2022). Of the sources of coal supply under analysis, the US offers coal with relatively high sulphur contents of up to 3% (see Figure 5). In 2010–2016, exports to the European Union accounted for as much as 36–53% of total US steam-coal exports (see Figure 6b). In terms of distance, US seaports are the closest to Poland (about 4,000–6,000 nautical miles, which equates to more than 8,000–12,000 km), as a result, bulk coal carriers can cover this route in about 13–18 days (see Table 1).

The EU steam coal market was also a relatively important outlet for coal from Colombia. Between 2010 and 2016, as much as 33–40% of exports were directed to this market (see Figure 6b). The decline in interest in the European direction, observed in subsequent years, was due not only to the redirection of part of its production to Asian buyers but also to competition with the increasingly strengthening Russian coal offering. Although, in terms of quality, Colombia offers a rather attractive commodity (see Figure 5), there is some uncertainty surrounding coal exports from this direction. For several years, Colombia has been experiencing mining, geological and labor difficulties related to mine workers. In addition, the suspension of production by quarantines during the Covid-19 pandemic significantly reduced production and exports from the country. As a result, steam-coal exports fell well below 60 million tonnes between 2020 and 2021. According to Fenalcarbon (the Colombian federation of coal producers), in the first half of 2022, Colombia did not have much capacity to increase its production (Elnuevosiglo 2022). On top of this, the continuing desire to profit from coal exports stimulated by high international coal prices could cause coal shortages in the domestic market in the following months.

Some uncertainty also surrounds the supply of steam coal from South Africa. In the first half of 2022, problems with the railways delivering coal to the Port of Richards Bay intensified, specifically cable theft and vandalism of the rail infrastructure (Transnet 2022). Furthermore, the global increase in demand for South African coal, among other things, has resulted in restrictions on the number of vessel clearances per customer at the Port of Richards Bay from 1 June 2022 (Argus 2022b). All these factors have a slowing effect on coal exports from this country. In terms of quality, the South African commodity is characterized by a relatively high ash content (see Figure 5), ranging from 15 to 25%. However, due to the increasing focus on Asian customers, the South African commodity also has coal offerings with lower calorific values (e.g. 5,500 kcal/kg, which equates to approx. 23 MJ/kg). Bulk carriers with South African coal have to cover a distance of more than 9,000 nautical miles (almost 17,000 km) in approximately 28 days (see Table 1).

Figure 7 shows the minimum and maximum steam coal price offer (6,000 kcal/kg, which equates to approximately 25 MJ/kg) from the spot market calculated for offers from Australia, Indonesia, South Africa, the US and Colombia. These figures relate to the calculated

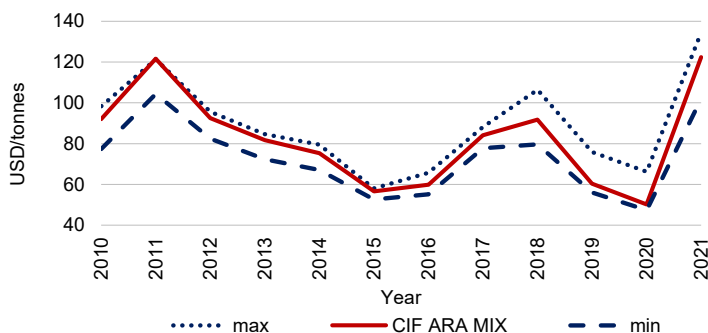


Fig. 7. Price range of steam-coal indexes on FOB basis (6,000 kcal/kg) of coal from Australia, Indonesia, South Africa, Colombia and the US against the CIF ARA MIX index
Source: own elaboration based on (Argus 2022c; BP 2022; CTI Platts 2022; ICR Platts 2022; Coal Information 2019; GlobalCoal 2022; World Bank 2022) data

Rys. 7. Zakres cenowy indeksów węgla energetycznego na warunkach FOB (6000 kcal/kg) węgla z Australii, Indonezji, RPA, Kolumbii i USA na tle indeksu CIF ARA MIX

average annual offer prices on an FOB (free-on-board) basis for 2010–2021. In addition, a calculated average annual steam coal price at ARA ports (ARA – Amsterdam–Rotterdam–Antwerp) is presented. This graph was intended to illustrate the consistent trend of coal price volatility on the international market over the long term. The difference between the minimum and maximum offer from 2010 to 2021 varied over time – it ranged from 5 USD to 32 USD per tonne.

3. Coal transport in Poland

An important issue worth looking into when considering alternative routes of coal supply is the issue of its transport. Analysis of official national statistics (GUS 2011–2021a, b, c; GUS 2014, 2018, 2020; ARP 2012–2022) shows that in the case of importing coal to Poland, it is mainly rail and sea transport that is used, while road and inland waterway transport accounts for only a marginal part (approximately 2%). Over the period 2010–2020, the share of hard coal imports by rail and sea varied; in some years it was dominated by rail, reaching even over 70%, and in other years by sea, amounting to well over 50%. The dominance of rail transport was influenced by the relatively close proximity of the main supplier of hard coal to Poland, namely Russia, and until the first half of the second decade of the 21st century, the Czech Republic. Analysis of the last two years' of statistics (calculated on the basis of ARP 2012–2022 data) shows that the share of rail imports from Russia accounted for more than half of the hard coal imported into Poland.

Taking into account the analyzed alternative directions of coal imports, it can be seen that this commodity will be brought to Poland by sea; therefore, the capacity of Polish sea ports is an important issue.

Figure 8 shows how the volume of coal and coke handled in the four main seaports (Gdańsk, Gdynia, Szczecin and Świnoujście) has changed in relation to imports and exports against the background of domestic sea imports and exports of this commodity. The analysis of the volumes presented in the above figure shows that over the period 2010–2020, the seaport of Gdańsk was growing in importance in relation to imports. Since 2016, its share in the total coal and coke handling in Poland in relation to imports has exceeded 60%. In volume terms, they ranged between 3.0 and 6.5 million tonnes/year.

Analyzing the handling capacity of coal in relation to imports at all terminals and wharves of the four seaports handling this cargo (PPS 2022; PGE 2022; GBT 2022; PHS 2022; BCPS 2022) the authors estimated that it is around 16–18 million tonnes/year. In the authors' opinion, Polish ports have the necessary capacity and infrastructure to receive and store imported coal during the calendar year. Nevertheless, the authors estimate that the piling up of coal supplies in the short term at the ports may lead to the formation of bottlenecks, which will in some way impede the relatively rapid flow of coal within the country.

Another question that comes to mind concerns possibilities regarding the dispatching of imported coal to inland customers.

In recent years, the managers of the four major seaports (some of which are still under construction) have carried out major investments to improve the port's transport communi-

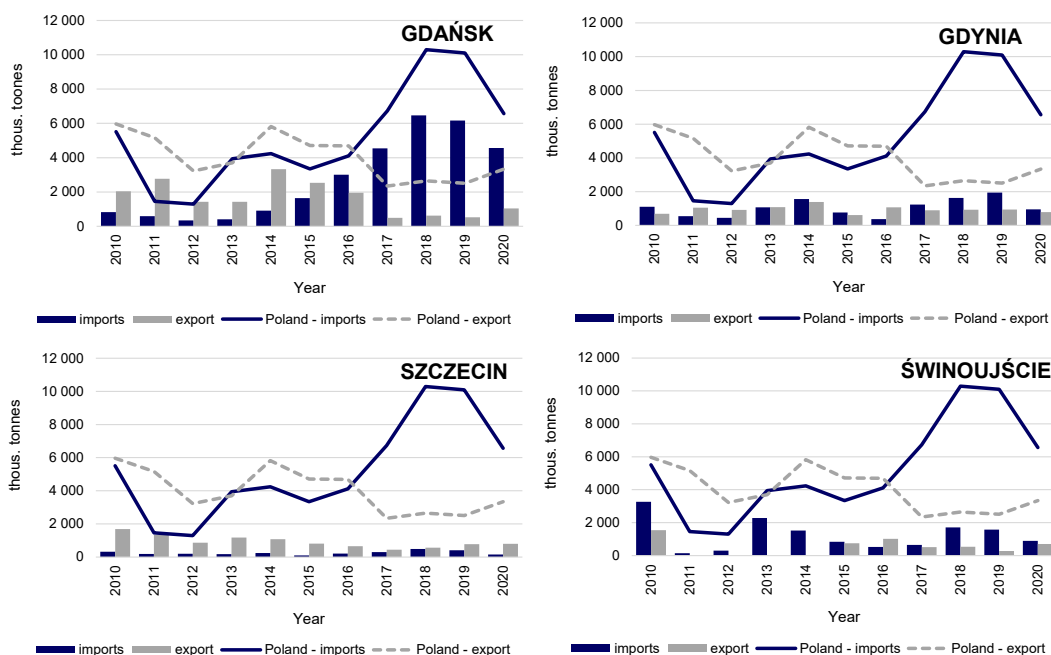


Fig. 8. Handling of coal and coke in the main seaports in Poland, 2010–2020

Source: own elaboration based on (GUS 2011–2021c) data

Rys. 8. Przeladunki węgla i koksu w głównych portach morskich w Polsce, lata 2010–2020

cation with the national rail network. For example, the company PKP Polskie Linie Kolejowe is carrying out investments related to improving the infrastructure for rail access to seaports in Gdańsk and Gdynia (PKP PLK 2022a; Port Gdynia 2022a), and Szczecin and Świnoujście (PKP PLK 2022b). These investments are expected to be completed between 2022 and 2023.

The Port of Gdynia is also working on dredging the water bodies (Port Gdynia 2022b). In the Port of Gdansk, the modernization of the fairway and the extension of quays in the inner harbor have been completed (Port Gdańsk 2022). The Port of Szczecin is in the process of modernizing the fairway (Port Szczecin 2022), which is to be deepened to 12.5 m.

The next major issue related to the transport of coal from seaports to customers is the rolling stock, especially coal wagons. Between 2010 and 2020, the number of units of this rolling stock fluctuated between 56.1 and 59.4 thousand (see Figure 9). From 2018 onwards, a decline in the number of coal wagons in Poland is visible, to reach the aforementioned lowest level in 2020.

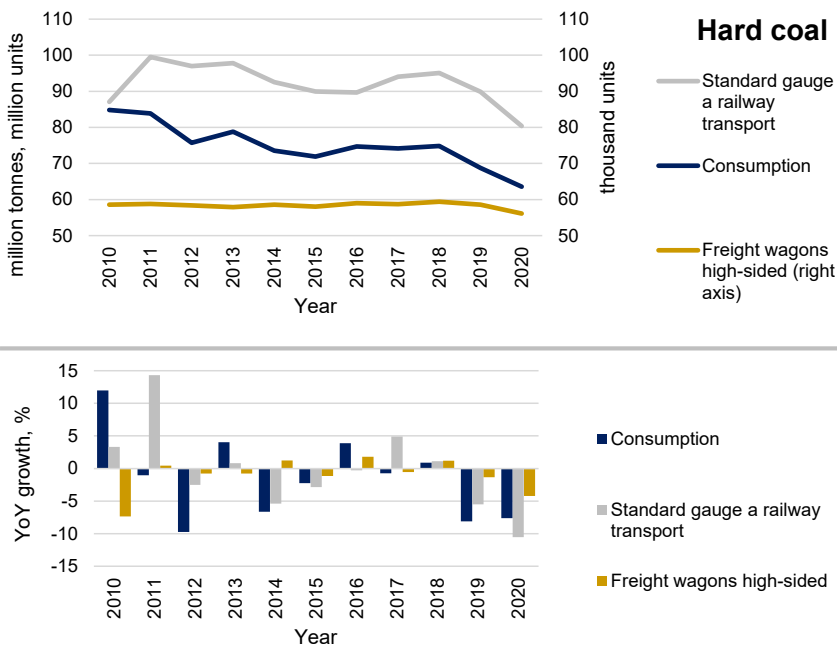


Fig. 9. Changes to coal rolling stock in Poland, 2010–2020
 Source: own elaboration based on (GUS 2011–2021a, b) data

Rys. 9. Zmiany w taborze węglarek w Polsce, lata 2010–2020

However, it should be noted that both the consumption of hard coal in Poland (see Figure 9) and its transport by rail (including domestic, export and import) are decreasing. This goes some way to explaining the declining number of units in this wagon fleet.

Summary and final conclusions

The disappearance of Russia as one of the important sources of steam coal to Poland implies many problems. Many countries have already established supply chains for their commodity and the emergence of a new market with concomitant difficulties (e.g. weather, infrastructure, logistics) make the search for alternative sources of coal a challenge.

Poland is a specific market for coal and a phenomenon on the European scale. In addition to the commercial power sector, which is adapted to burning coal with specific (and above all constant) quality parameters, households are an important group of consumers. It should be noted that households mainly burn coarse and medium grades, and the standard trade on the international market relates to coal fines. It is for coal fines (grain class 0–50 mm) that steam coal prices are quoted at the ports of exporters or importers on the so-called spot market, i.e. the market for short-term deliveries. In the event that coal fines of the aforementioned grain class are imported into Poland, it should be noted that pea-type coals (PN-82/G-97001 grain size: 8–31.5 mm) and possibly nut-type coal II (PN-82/G-97001 grain size: 25–50 mm) may be separated by sieving.

In the article, the authors considered five countries as alternative routes of coal supply to Poland: Australia, Indonesia, Colombia, South Africa and the US. However, the coal supply of each of these countries carries certain risks. Logistical and weather problems in Indonesia, South Africa and Australia mean that increasing the supply of coal from these countries in the relatively short term will be severely hampered, and coal from the US is often highly sulphidized. Colombia faces internal problems (weather, social, environmental, among others), which also have a significant impact on the availability of this commodity on the international market.

In recent years, steam coal imports from Kazakhstan have been growing in importance in Poland. However, the authors of this article have deliberately not considered this direction. It should be noted that the transport of coal from Kazakhstan, whether by sea or rail, must take place through Russian territory. This situation significantly increases the risk of certainty of coal supply from this customer.

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ALTERNATIVE DIRECTIONS OF COAL SUPPLY TO POLAND AS A RESULT OF THE RUSSIAN-UKRAINIAN WAR

Keywords

steam coal, international trade, spot market, Poland

Abstract

The aim of this article is to provide an overview of other alternative directions of coal supply to Poland following the February 2022 embargo on coal imports from Russia. Due to the dominant role of steam coal in imports to Poland, the authors focused on this type of coal. Analysis of the share of Russian steam coal imported into Poland in domestic consumption and production suggests that this commodity has played a relatively important role in the Polish market. In 2010–2021, between 4.8 and

12.9 million tonnes were imported annually from Russia to Poland, accounting for 8–25% of domestic steam-coal consumption. In 2018–2021, steam coal imported into Poland accounted for 22–29% of the volume of coal shipped by Russia to all EU-27 countries. In order to fill the gap left by Russian coal, this article considers alternative routes of coal supply to Poland, namely from Australia, Indonesia, Colombia, South Africa and the US, and presents the qualitative characteristics of the coal offered by these alternative routes of coal supply and traded on the international market. Between 2010 and 2021, steam-coal-price offers from these countries followed a consistent trend, with the difference between the minimum and maximum offer ranging from USD 5–32/tonne. As the steam coal supply of each of the analyzed routes of supply is fraught with some risk, the authors have also identified in the article those directions that may present some difficulties. It was found that coal offerings from Australia, South Africa, Indonesia and Colombia have low sulphur content (less than 1%), while coals from Australia and South Africa have relatively high ash content (from 12% to nearly 25%). Towards the end, the article also addresses issues related to the transport of coal to Poland and its dispatching within the country. As the analyzed alternative directions of coal imports involve importing this commodity by sea, the authors also analyzed the reloading capacity of Polish seaports and the rail transport fleet.

ALTERNATYWNE KIERUNKI DOSTAW WĘGLA ENERGETYCZNEGO DO POLSKI W OBLICZU ROSYJSKO-UKRAIŃSKIEJ WOJNY

Słowa kluczowe

węgiel energetyczny, handel międzynarodowy, rynek spot, Polska

Streszczenie

Celem artykułu było przybliżenie innych, alternatywnych kierunków dostaw węgla do Polski, spowodowanych wprowadzeniem w lutym 2022 r. embarga na import węgla z Rosji. Ze względu na dominującą rolę węgla energetycznego w imporcie do Polski, autorzy skupili się na tym rodzaju węgla. Analizując udziały sprowadzonego do Polski rosyjskiego węgla energetycznego w krajowym zużyciu i produkcji można wysnuć wniosek, że surowiec ten odgrywał relatywnie istotną rolę na polskim rynku. W latach 2010–2021 rocznie z Rosji sprowadzano do Polski od 4,8 do 12,9 mln ton, co stanowiło 8–25% krajowego zużycia węgla energetycznego. W latach 2018–2021 sprowadzany do Polski węgiel energetyczny stanowił 22–29% wolumenu wysłanego węgla przez Rosję do wszystkich krajów UE27. W celu wypełnienia luki po węglu rosyjskim, w niniejszym artykule rozważono alternatywne kierunki dostaw tego surowca do Polski, a mianowicie: Australię, Indonezję, Kolumbię, RPA i USA. Przedstawiono charakterystykę jakościową węgla (oferowanego przez te alternatywne kierunki dostaw) oraz będącego przedmiotem handlu na rynku międzynarodowym. W latach 2010–2021 oferty cenowe węgla energetycznego z tych państw utrzymywały się w zgodnym trendzie, a różnica między ofertą minimalną a maksymalną zawierała się w granicach 5–32 USD/tonę. W związku z tym, że dostawy węgla energetycznego każdego z analizowanych kierunków obciążone są pewnym ryzykiem, w artykule autorzy wskazali również te, które mogą stanowić pewne utrudnienie. Stwierdzono, że oferty węgla z Australii, RPA, Indonezji i Kolumbii charakteryzują się niską zawar-

tością siarki (poniżej 1%), a węgle z Australii i RPA posiadają relatywnie wysoką zawartość popiołu (od kilkunastu do blisko 25%). Pod koniec w artykule poruszono także kwestie związane z transportem węgla do Polski oraz jego ekspedycją wewnątrz kraju. W związku z tym, że analizowane alternatywne kierunki importu węgla wiążą się ze sprowadzeniem tego surowca drogą morską, autorzy również przeanalizowali zdolności przeładunkowe polskich portów morskich oraz park wagonowy w transporcie kolejowym.

