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World steam coal management

Introduction

The purpose of this study is to trace the changes in trends of steam coal flows (exports and imports) between continents, which are closely linked to the volume of production and consumption within a given continent. The analysis covers a longer time horizon, encompassing the first two decades of the 21st century, i.e. 2000–2019. Between 2000 and 2001, steam coal still accounted for 55–69% of global coal trade, while in the following years its global share increased to 72–77%. Seeing the significant impact of steam coal on international trade, the authors decided to focus specifically on this coal.

In the course of the analysis, publications of several institutions dealing with international coal balance statistics were used, namely the International Energy Agency, Coal Importers Association e.V. (VDKi), The European Association for Coal and Lignite – Euracoal and BP p.l.c.

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According to BP (BP 2020), at the end of 2019 the world's proved reserves of coal amounted to 1 069.6 million tons, of which 70% was bituminous coal and anthracite, and the remainder was sub-bituminous coal and lignite. For comparison, at the end of 2001 (BP 2002) total coal reserves were 85.1bn tons less and were estimated to last 216 years, while in 2019 they were estimated to last 132 years.

1. Coal and other energy carriers

Global energy consumption in 2019 amounted to 583.9 exajoules (EJ) ($J \cdot 10^{18}$), registering a 16.2% increase over 2010 levels. The share of solid fuels increased by 12.8 percentage points during that period, which was less dynamic than the global increase. The share of coal fell by 3 percentage points only (from 30% in 2010 to 27% in 2019). However, in natural units, consumption increased by 9 EJ. The structure of production by energy carriers is presented in Figures 1 and 2, while the corresponding figures are shown

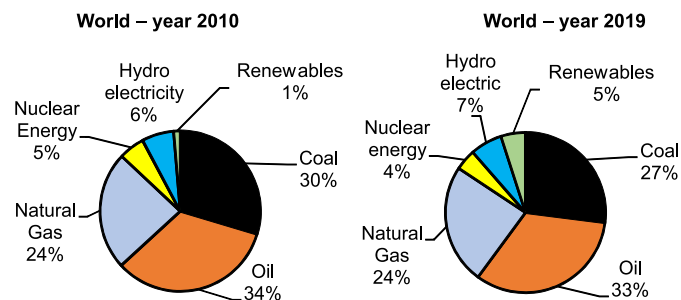


Fig. 1. Structure of world primary energy consumption
Source: own study based on: BP 2011, 2020; IMF 2021

Rys. 1. Struktura zużycia energii pierwotnej w świecie

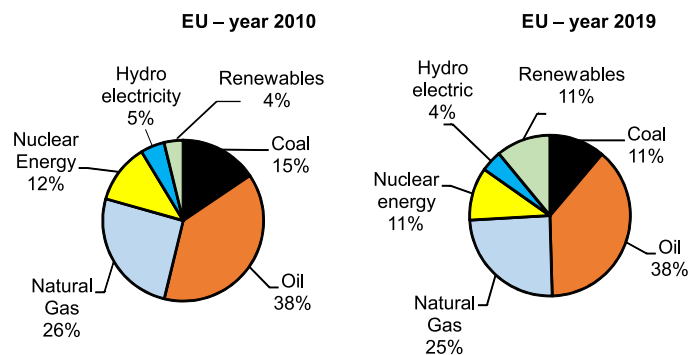


Fig. 2. Structure of EU primary energy consumption
Source: own study based on: BP 2011, 2020; IMF 2021

Rys. 2. Struktura zużycia energii pierwotnej w Unii Europejskiej

Table 1. Energy consumption in the world and in the EU by fuel and in EJ (exajoul – 10^{18} J)
 Tabela 1. Zużycie energii w świecie i Unii Europejskiej według paliw w EJ (exajul – 10^{18} J)

Name	Year	Energy carrier								Total	Fossil fuels
		Coal	Oil	Natural gas	Nuclear	Hydro	RES				
World	2010	149	169	120	26	32	7			503	437
	2019	158	193	141	25	38	29			584	492
	+/- 2019/2010	6.0%	14.4%	18.2%	-4.9%	15.9%	336.2%			16.2%	12.6%
EU	2010	11	28	19	9	3	3			73	58
	2019	8	26	17	7	3	8			69	51
	+/- 2019/2010	-31.9%	-4.9%	-8.9%	-15.6%	-15.4%	169.4%			-5.2%	-11.5%
EU share in consumption	2010	7.6%	16.4%	15.5%	33.1%	10.7%	42.1%			14.4%	13.2%
	2019	4.9%	13.7%	12.0%	29.4%	7.8%	26.0%			11.8%	10.4%

Note: 1 EJ = 23.88 million toe.

Source: own study based on BP 2011, 2020.

in Table 1. It should be mentioned that global GDP more than doubled during that period (100.7%).

The consumption of energy carriers in the European Union (EU) is different. The share of coal stood at 11% in 2019. This share decreased by 4 percentage points compared to 2010. EU energy consumption amounted to 69 EJ, a decrease of 5.2% compared to 2010. In 2019, the EU's share of global energy consumption was 11.8%. However, coal consumed in EU countries accounts for only 4.9% in global consumption (see Table 1). Compared to 2010, the largest increase in consumption goes to renewable energy sources (RES). The share of this energy carrier in 2019 was 11%, compared to 5% for the world as a whole. In 2010, the share of RES in the EU was 4%.

The graphs in Figures 3 to 5 show the structure of energy consumption for the three largest coal consuming countries, i.e. China, India and the United States. These three coun-

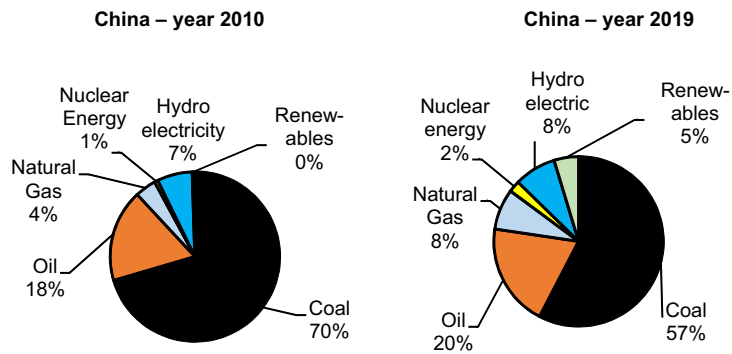


Fig. 3. Structure of primary energy consumption in China
Source: own study based on: BP 2011, 2020

Rys. 3. Struktura zużycia energii pierwotnej w Chinach według paliw

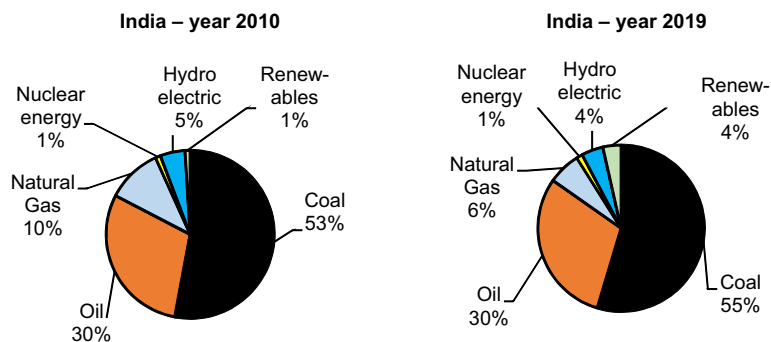


Fig. 4. Structure of primary energy consumption in India
Source: own study based on: BP 2011, 2020

Rys. 4. Struktura zużycia energii pierwotnej w Indiach według paliw

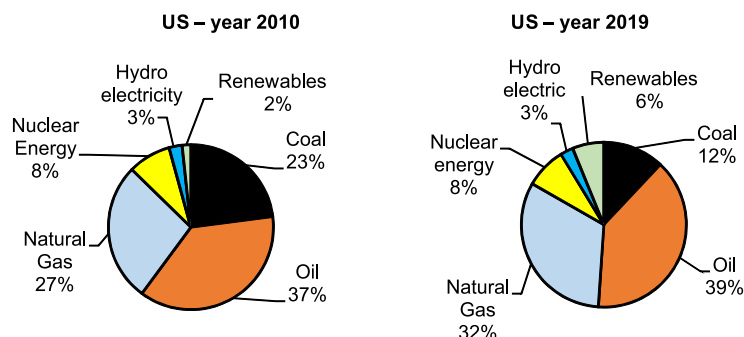


Fig. 5. Structure of primary energy consumption in the United States
Source: own study based on: BP 2011, 2020

Rys. 5. Struktura zużycia energii pierwotnej w USA według paliw

tries are also the largest consumers of energy overall. Their combined energy consumption accounted for 44% of total global consumption in 2010, rising to 55% in 2019. A 40% increase in China's energy consumption and a 55% increase in India's consumption largely contributed to this increase. In contrast, for the US, energy consumption fell by 1.2% over the same period.

In China's primary energy consumption coal accounts for the dominant share (57% in 2019). Although in the structure of primary energy consumption the use of coal decreased by 13% compared to 2010, it increased by 10 EJ in power units. In India, coal's share in consumption remained at 2010 levels, with coal consumption increasing by 8 EJ. Only in the US did coal consumption fall by 11 EJ. The share of coal in the structure of primary energy consumption in this country decreased by 11%; in 2019 it reached (12%) volumes similar to those of the EU (cf. Figures 2 and 5).

The dynamics of changes in the production and consumption of energy from coal, oil and gas is shown in Figure 6 and Table 2. The base year for the comparisons made in Figure 6 is 2010. Table 2, on the other hand, presents the evolution of the production and consumption of these three energy carriers in 1990, 2000 and 2010, compared to 2019. This comparative overview provides a good indication of the dynamics of the changes in production and consumption.

Almost all the time, the dynamics of changes in the production of natural gas and crude oil is positive. A different situation could be observed in 2009, when the financial and economic crisis caused a temporary drop in both production and consumption of these energy carriers. GDP fell by 0.1%, to rise by as much as 5.4% the following year i.e. 2010, and those increases continued. The pattern of changes for coal behave somewhat differently. Between 2014 and 2016, production fell back to its 2010 level. The changes were mainly driven by the decline in China's coal production due to its reduced output capacity caused by the closure of inefficient mines and the inspection of safety conditions in the mines. As a result, some

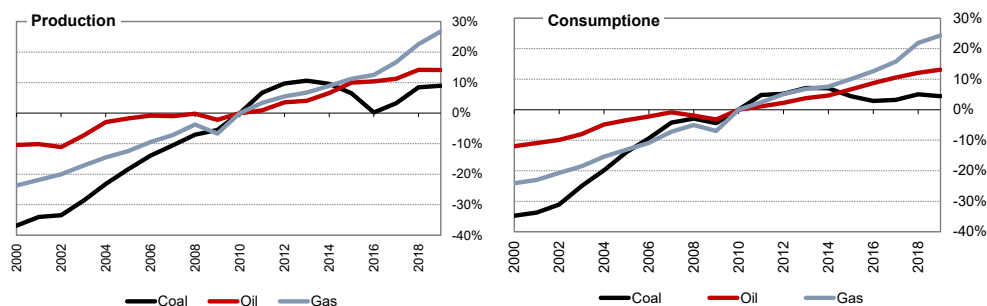


Fig. 6. Dynamics of fossil energy carriers production and consumption worldwide compared to 2010 as the base year

Source: own study based on: [BP 2011, 2020](#)

Rys. 6. Dynamika zmian produkcji i zużycia kopalnych nośników energii na świecie w stosunku do roku bazowego 2010

mines were then closed. Small changes in production in this country trigger big changes in global markets. In 2019, China's coal production reached 2013 levels.

The highest growth rate in production, as well as in consumption, was found for gas. Compared to 1990, gas production increased by 101.3%, and, counting from the year 2010, increased by 26.8% with an average annual growth of 2.7% in the latter period. Coal production has increased by 70% since 1990; however, calculated with reference to the year 2010, it has recorded only a 9% increase (with an average annual increase of less than 1%). The figures are even lower for coal consumption. Since 2014, it has been on a slight downward trend (cf. Figure 6).

Table 2. Changes in the production and consumption of energy carriers worldwide compared to 1990, 2000, 2010 (%)

Tabela 2. Zmiany w produkcji i zużyciu nośników energii na świecie w porównaniu z latami: 1990, 2000, 2010 [%]

Energy Carrier	Change (+/-)	Production			Consumption		
		Gas	Oil	Coal	Gas	Oil	Coal
Base year 1990	yoy	101.3	45.6	70.4	100.9	47.4	69.3
	per year	2.4	1.3	1.9	2.4	1.3	1.8
Base year 2000	yoy	66.2	27.4	72.7	63.7	28.5	59.9
	per year	2.5	1.3	2.9	2.6	1.3	2.5
Base year 2010	yoy	26.8	14.1	9.0	24.3	13.1	4.4
	per year	2.7	1.5	1.0	2.4	1.4	0.5

Source: own study based on: [BP 2011, 2020](#).

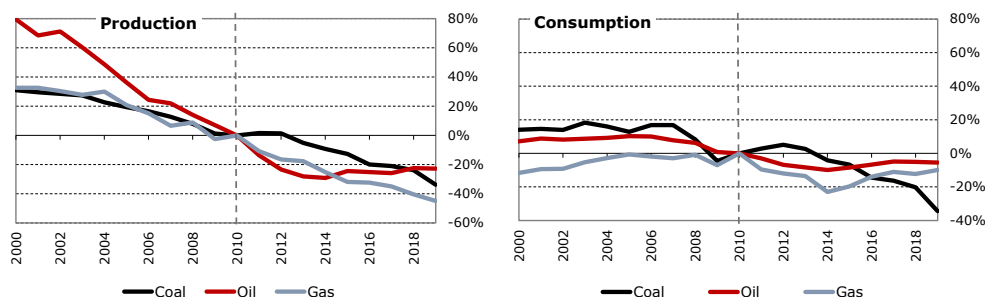


Fig. 7. Dynamics of fossil energy carriers production and consumption in the EU compared to 2010 as the base year

Source: own study based on: [BP 2011, 2020](#)

Rys. 7. Dynamika zmian produkcji i zużycia kopalnych nośników energii w UE w stosunku do roku bazowego 2010

In the European Union, the trend in gas, oil and coal production is different from that of the world economy (cf. Figures 6 and 7, and Tables 2 and 3). Fossil fuel production has fallen sharply. Globally, there has been a 70% increase in coal production since 1990, while the European Union has recorded a 71% decrease. Compared to 2010, the decline in EU production was 34%, giving an average annual decline of 4.5%. The European Union's major coal producers are Poland, Germany and the Czech Republic

The decline in oil and gas production is similar, at around 45% each. In the case of oil, the decline was influenced by the reduced extraction in the United Kingdom. The decrease in gas extraction, on the other hand, was mainly due to production reduction of more than 40% in the Netherlands and the UK.

Table 3. Changes in the production and consumption of energy carriers in the EU compared to 1990, 2000, 2010 (%)

Tabela 3. Zmiany w produkcji i zużyciu nośników energii w UE w porównaniu z latami: 1990, 2000, 2010 [%]

Energy carrier	Change (+/-)	Production			Consumption		
		Gas	Oil	Coal	Gas	Oil	Coal
Base year 1990	yoy	-46.6	-43.7	-70.8	36.0	-6.9	-59.6
	per year	-2.1	-2.0	-4.2	1.0	-0.2	-2.4
Base year 2000	yoy	-58.5	-57.0	-49.5	2.0	-11.8	-42.5
	per year	-4.5	-4.3	-3.5	0.0	-0.6	-1.9
Base year 2010	yoy	-45.0	-22.8	-33.8	-9.9	-5.5	-34.4
	per year	-6.4	-2.8	-4.5	-1.4	-0.6	-2.5

Source: own study based on: [BP 2011, 2020](#).

The consumption of fossil fuels is subject to different conditions and compared to production, the dynamics of the trends formed are different. Decarbonization, increased use of renewable energies, high CO₂ prices and increased energy efficiency are all factors that will ultimately lead to climate neutrality. What is more, these factors largely influence the use of coal in the EU economy. Since 1990, the only increase (36%) has been in the consumption of gas, while the use of oil and coal has fallen by 6.9% and 60% respectively. However, in the last ten years analyzed, the use of gas fell by 10%, oil by 5.5% and coal by 34.4% with an average annual rate of -1.4%, -0.6%, and -2.5%, respectively.

Many scientific publications have been devoted to the analysis of energy carriers (Szurlej 2015; Olkusiński et al. 2018; Grudziński 2018, 2019; Nyga-Lukaszewska et al. 2020).

2. Global steam coal flows

The main part of global coal trade, as well as seaborne coal trade, is steam coal trade. Between 2000 and 2018, its share in the global seaborne coal trade averaged 75% (calculations based on data from Coal Information 2013–2020), growing at a rate of 5.3%/year. In comparison, between 1976 and 2002, that trade grew at an annual rate of 6.4%, stimulated mainly by the increase in oil prices (Ekawan and Duchêne 2006).

Seaborne trade has traditionally been divided into the Atlantic basin and the Pacific basin (Ekawan and Duchêne 2006; VDKI 2005–2006; Lorenz et al. 2013; VDKI 2007–2020; Euracoal 2006–2020). On the other hand, current relations in the coal and sea freight markets play an important role. To balance the needs of current participants, part of the supply from the Atlantic market goes to the Pacific market (and vice versa).

Analysis of the seaborne trade in steam coal over a longer time horizon has made it possible to notice changes in the trends of this trade. Coal exports to economically developed

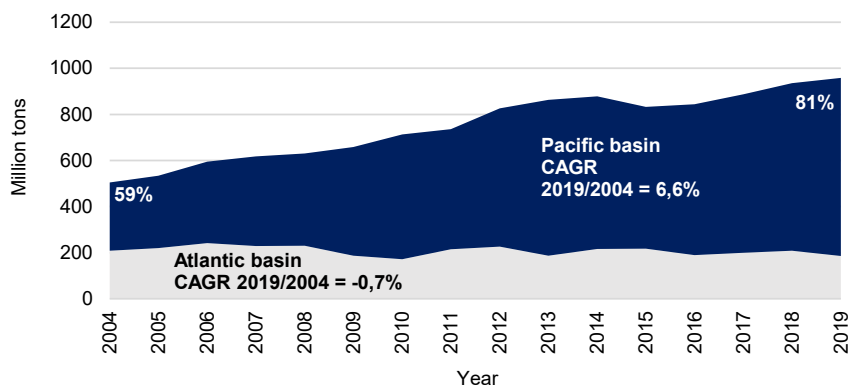


Fig. 8. Development of seaborne steam coal trade by the Atlantic basin and Pacific basin, 2004–2019
Source: own study based on: VDKI 2005–2006, 2007–2020; Euracoal 2006–2020

Rys. 8. Rozwój morskiego handlu węglem energetycznym w podziale na rejon Atlantyku i rejon Pacyfiku, lata 2004–2019

countries, mainly concentrated in Europe, are declining in importance, while exports to developing economies, concentrated in the Asian part of the world, are increasing. Between 2019 and 2004, the average annual rate of decline in steam coal trade within the Atlantic basin was -0.7% while in the Pacific basin it increased at a rate of $6.6\%/year$ (Figure 8).

Analyzing world seaborne steam coal trade, as well as its production and consumption over the 2000–2019 period (Figure 9), several turning points can be observed that interrupted the dominant upward trend and slowed down the average annual growth rate (cf. Figure 9 and Table 4). The global financial crisis of 2007–2009 affected world trade in steam coal, causing it to decline. Between 2007 and 2008, the trade decreased by 1% and seaborne trade experienced a 3% decrease. The average annual growth rate for 2005–2010 was 4% each, while for the earlier six years it was 5% and 6% respectively (see Table 4).

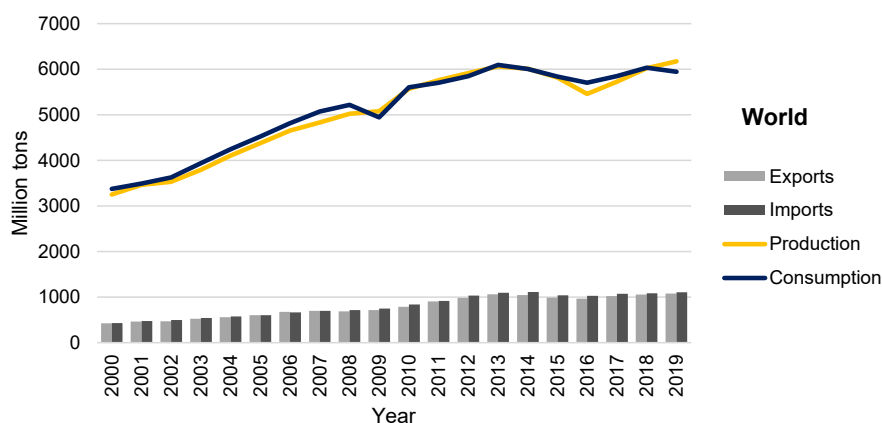


Fig. 9. Comparison of global seaborne steam coal trade, production and consumption, 2000–2019
Source: own study based on data from [Coal Information 2013–2020](#); [VDKI 2007–2020](#)

Rys. 9. Porównanie światowego handlu węglem energetycznym drogą morską oraz jego produkcji i zużycia, lata 2000–2019

Another slowdown in global steam coal production and consumption and seaborne trade occurred between 2014 and 2016, as a result of ongoing uncertainty in the global economy and a significant slowdown in economic growth in most developing countries. Between 2014 and 2016, production declined by 9% (to $5.5bn$ tons), consumption fell by 5% (to $5.7bn$ tons) and world trade in total steam coal, as well as by seaborne route, declined by 5% each (to $1.0bn$ and $0.9bn$ tons respectively). Over the 21 years analyzed, both global steam coal production and consumption grew at an average annual rate of 3% each to reach $6.2bn$ tons for production and $5.9bn$ tons for consumption in 2019. In contrast, the average annual growth rate of global exports and imports of this commodity for 2000–2019 was 5% each. Compared to 2000, exports increased 2.6 times and imports 2.5 times to reach $1.1bn$ tons each.

Table 4. Dynamics of changes in global steam coal production, consumption, exports and imports, 2000–2019 (%)

Tabela 4. Dynamika zmian produkcji, zużycia, eksportu i importu węgla energetycznego na świecie, lata 2000–2019 [%]

World	Production	Consumption	Exports	Imports	Trade	Seaborne trade
CAGR 2005/2000	6	6	7	7	7	8
+/-2005/2000	35	34	42	39	42	49
CAGR 2010/2005	5	4	6	7	5	6
+/-2010/2005	27	24	31	39	30	32
CAGR 2015/2010	1	1	5	4	4	4
+/-2015/2010	4	4	25	24	21	22
CAGR 2019/2015	1	0	2	2	4 (*)	2
+/-2019/2015	6	2	9	6	12 (*)	7
CAGR 2019/2000	3	3	5	5	5 (*)	5
+/-2019/2000	90	76	155	155	152 (*)	158

Note: (*) refers to years 2000–2018.

Source: own study.

Projections by the International Energy Agency ([WEO 2020](#)) show that under the Stated Policies Scenario, over the period to 2030 total world coal production will fall from 5.6bn tce (3.9bn toe) in 2019 to 5bn tce (3.5bn toe) at an average annual rate of -1.1% . Steam coal production will decline by 0.4bn tce to reach 4bn tce (2.8bn toe); the average annual rate of

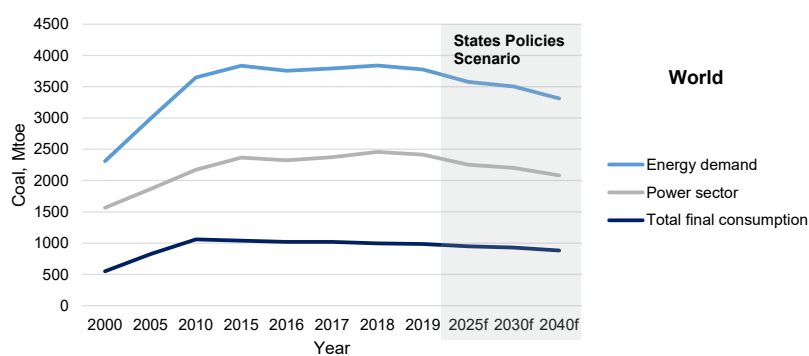


Fig. 10. World coal demand forecast over the period to 2040

Source: own study based on data from [WEO 2020](#)

Rys. 10. Prognoza światowego zapotrzebowania na węgiel w perspektywie 2040 r.

decline for 2019–2030 is -0.8%). Looking ahead to 2040, there will be a further drop in world coal production to 4.7bn tce (3.3bn toe; the average annual rate of decline for 2019–2040 is -0.8%). Steam coal production will decline to 3.9bn tce (after conversion: 2.7bn toe; the average annual rate of decline for 2019–2040 is -0.6%). Global coal demand will also decline (Figure 10): according to the Stated Policies Scenario, by 2040 it will have fallen to 3.3bn toe, with an average annual rate of decline of -0.6% (for 2019–2040). In the 2040 horizon, the share of world electricity generation from coal will be 22%, declining annually at an average rate of -0.7% .

3. Steam coal flows by continent

When analyzing steam coal flows by continent, the largest contributors to their global volume are (in descending order) Asia&Pacific, Europe, the Americas and Africa.

3.1. Asia and Pacific

The Asia-Pacific region is home to most of the world's leading producers (including China, India, Indonesia, Australia and Russia), users (including China, India, Indonesia, Japan and Southeast Asian countries), exporters (including Indonesia, Australia, Russia and South Africa) and importers (including China, India, Japan and Southeast Asian countries). This is why this part of the world has such a significant impact on global steam coal trade, both in terms of exports and imports.

As China is the largest producer, user and importer of steam coal in the world, any economic and political decisions taken by this country's government have strongly influenced international coal trade for years. For example, the preparations for the 2008 Olympic Games in Beijing resulted in a doubling of production and consumption of steam coal between 2000 and 2007. Over the 2009–2012 period, another strong (5-fold) increase in Chinese steam coal imports was observed, driven by, but not limited to (Cornot-Gandolphe 2013), price arbitrage between domestic production and raw material from international markets, and bottlenecks in the transport of domestic coal.

Similar to the global picture, the Asia-Pacific basin also saw a decline in steam coal trade during the 2007–2009 financial crisis and the 2014–2015 crisis (cf. Figures 9 and 11). Between 2007 and 2008, the annual export of this coal decreased by 2% to 0.4bn tons. The average annual growth rate for the 2010–2005 period was 7%, while for the previous six years it was 9% (see Table 5). Between 2014 and 2015, in this part of the world, exports decreased by 9% (from 0.68 to 0.63bn tons) and imports by 6% (from 0.84 to 0.76bn tons). Between 2000 and 2019, both production and consumption of steam coal in the Asia-Pacific region grew at an average annual rate of 5% and 6% respectively, reaching 4.7bn tons for production and 4.9bn tons for consumption in 2019. Exports and imports of this commodity for 2000–2019 grew at

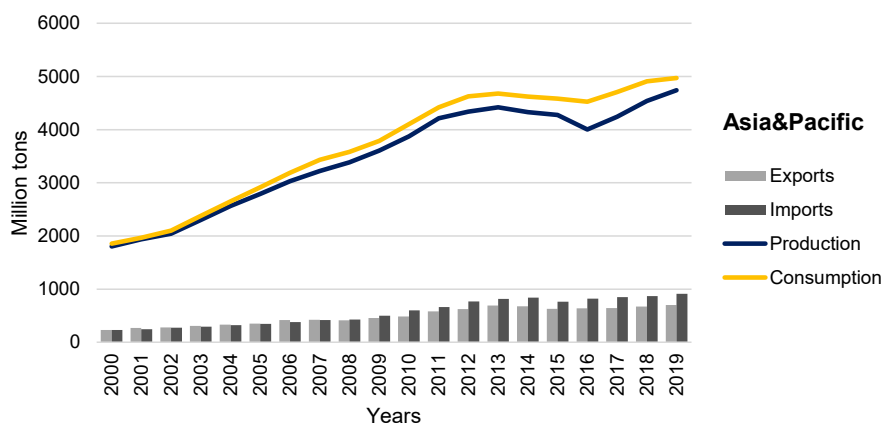


Fig. 11. Comparison of steam coal trade, production and consumption in the Asia-Pacific, 2000–2019
Source: own study based on data from [Coal Information 2013–2020](#)

Rys. 11. Porównanie handlu węglem energetycznym oraz jego produkcji i zużycia w obszarze Azji i Pacyfiku, lata 2000–2019

Table 5. Dynamics of changes in steam coal production, consumption, exports and imports in the Asia-Pacific, 2000–2019 (%)

Tabela 5. Dynamika zmian produkcji, zużycia, eksportu i importu węgla energetycznego w obszarze Azji i Pacyfiku, lata 2000–2019 [%]

Asia and Pacific	Production	Consumption	Exports	Imports
CAGR 2005/2000	9	9	9	8
+/-2005/2000	55	57	51	49
CAGR 2010/2005	7	7	7	12
+/-2010/2005	39	41	39	74
CAGR 2015/2010	2	2	5	5
+/-2015/2010	10	12	30	27
CAGR 2019/2015	3	2	3	5
+/-2019/2015	11	9	12	20
CAGR 2019/2000	5	5	6	7
+/-2019/2000	163	168	204	293

Source: own study.

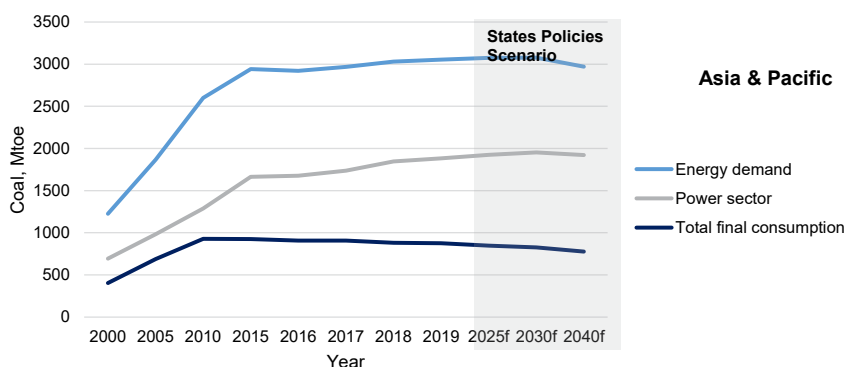


Fig. 12. Asia-Pacific coal demand forecast over the period to 2040
Source: own study based on data from [WEO 2020](#)

Rys. 12. Prognoza zapotrzebowania na węgiel w obszarze Azji i Pacyfiku w perspektywie 2040 r.

an average rate of 6%/year and 7%/year respectively. Compared to 2000, exports increased 3.0 times and imports 3.9 times, reaching 0.7 and 0.9bn tons, respectively.

For the Asia-Pacific basin alone, long-term forecasts ([WEO 2020](#)) predict an increase in coal-fired power generation, compared to 2019 (Figure 12). According to these projections, coal-fired power generation is expected to generate 8.3 PWh in 2040 (an increase of 2%); of this, as much as 14% is expected to be produced by coal-fired power plants in China. The share of the Asia-Pacific basin in the demand for electricity from coal will account for as much as 92% of global demand for this resource (down 14 percentage points in 2019) and amount to 1.9bn toe in 2040 (Figure 12). Support for coal-fired power generation in Asia, and thus increased demand for this resource, may be provided by high gas prices ([WEO 2020](#)). This may result in coal-importing countries slowing down their phase-out of coal-fired power.

3.2. Europe

The analysis of the steam coal flows on the European continent shows that they are dominated by imports (Figure 13). The main suppliers of coal to the European market in the analyzed 21 years were Russia, Columbia, the United States, as well as South Africa and Poland. In the case of the latter two producers, their share has been declining in recent years. South Africa has shifted its focus towards Asian customers, while declining coal production in Poland has also translated into lower supplies to the international market.

As recently as between 2000 and 2008, Europe's share in the global steam coal imports was in the range of 30–37%; by 2013 it had decreased to 20–25%, and in the following six years it was already several percent (cf. Figures 9 and 13). Until the 2007–2009 financial

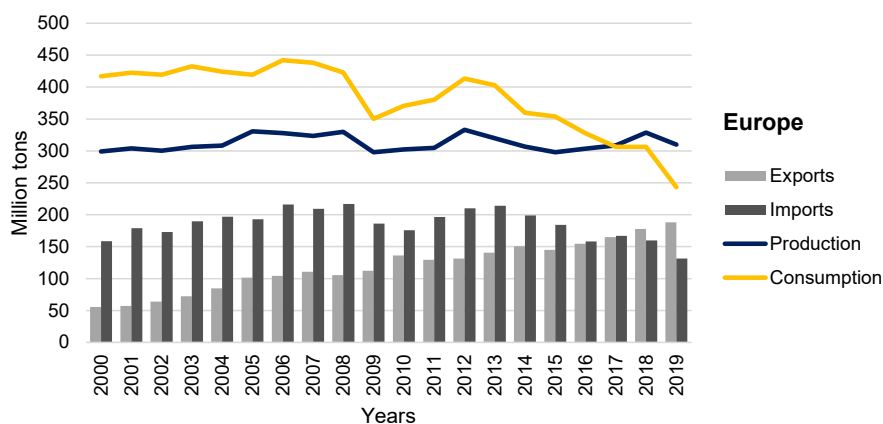


Fig. 13. Comparison of steam coal trade, production and consumption in Europe, 2000–2019
Source: own study based on data from [Coal Information 2013–2020](#)

Rys. 13. Porównanie handlu węglem energetycznym oraz jego produkcji i zużycia w Europie, lata 2000–2019

Table 6. Dynamics of changes in steam coal production, consumption, exports and imports in Europe, 2000–2019 (%)

Tabela 6. Dynamika zmian produkcji, zużycia, eksportu i importu węgla energetycznego w Europie, lata 2000–2019 [%]

Europe	Production	Consumption	Exports	Imports
CAGR 2005/2000	2	0	13	4
+/-2005/2000	10	1	84	21
CAGR 2010/2005	-2	-2	6	-2
+/-2010/2005	-9	-12	34	-9
CAGR 2015/2010	0	-1	1	1
+/-2015/2010	-1	-4	6	5
CAGR 2019/2015	1	-9	7	-8
+/-2019/2015	4	-31	30	-29
CAGR 2019/2000	0	-3	7	1
+/-2019/2000	4	-42	240	18

Source: own study.

crisis, imports of steam coal still showed a clear upward trend. Between 2000 and 2005, imports grew at an average annual rate of 4% and exports grew at a rate of 13% (see Table 6). The effects of the 2007–2009 financial crisis were severely felt in Europe in 2010: imports fell to 176 million tons, while in 2007 they were 34 million tons higher. Between 2008 and 2007, exports decreased by 5 million tons (down 5% yoy).

The slowdown in economic growth observed between 2014 and 2016 (see Figure 13) was reflected in the decline in steam coal production and imports (stocks at ports and held by users). Between 2014 and 2016, imports decreased by as much as 20%. The last three years of the analysis show a deepening downward trend in imports of this commodity (to 131.4 million tons in 2019). The acceleration of the decarbonization policies of EU countries has largely contributed to this, resulting in a decreasing consumption of steam coal. Between 2000 and 2019, steam coal consumption in Europe decreased by 42% falling at an average rate of $-3\%/year$.

Projections for the European market (WEO 2020) show that both coal demand from power generation and total final consumption will decline between 2019 and 2040 at an average rate of $4\%/year$ and $6\%/year$ respectively (see Figure 14). The share of coal consumption in total primary energy demand in 2040 will fall to 7% (49 million toe) displaced by an increasing share of renewables (28% i.e. 469 million toe). Coal-fired electricity generation will fall by 70% to 212 TWh (representing only 4% of coal-fired electricity globally). A significant factor behind the decline in demand for coal in Europe is the situation in the European Union. The economics of the power sector, the coal phase-out policy and the support policy for renewable energy sources in the EU Member States (WEO 2020) result in a reduced demand for coal in the 2025–2040 outlook. It is expected that the implementation of the European Green Deal will accelerate the transition of the power sector towards lower emission generation.

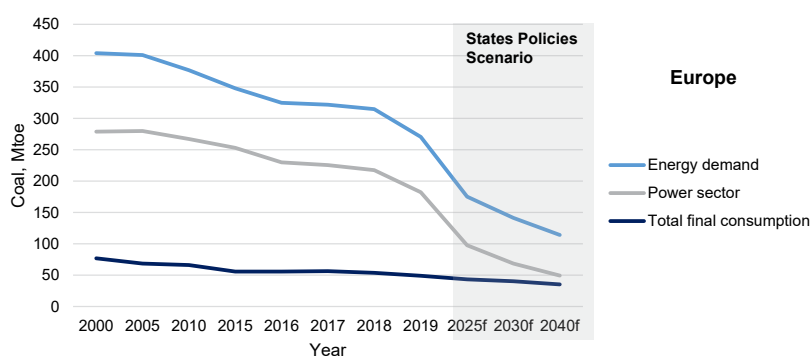


Fig. 14. European coal demand forecast over the period to 2040

Source: own study based on data from WEO 2020

Rys. 14. Prognoza zapotrzebowania na węgiel w Europie w perspektywie 2040 r.

3.3. Americas

The picture of the coal trade balance for the American continents shows that exports are clearly predominant. The volume of coal exports is mainly influenced by the production of two countries: the United States and Colombia, where the United States is described as a volatile exporter, appearing on the international market when prices are high, while for Colombia the export of this commodity is an important element for the economy of this country.

The 2007–2009 financial crisis and the economic downturn of 2014–2016, both mentioned in earlier chapters, also affected exports from this part of the world. Between 2008 and 2009, exports decreased by 15% to 95.6 million tons, and between 2014 and 2015 recorded a 20% decrease to 100.8 million tons (Figure 15). The decline in international steam coal prices observed in recent years resulting in reduced exports from the US as well as production disruptions in Colombia have contributed to the downward trend in exports from this region of the world. In 2019, steam coal exports from the Americas amounted to 106.4 million tons, growing at an average rate of 5%/year over the 21 years analyzed (see Table 7).

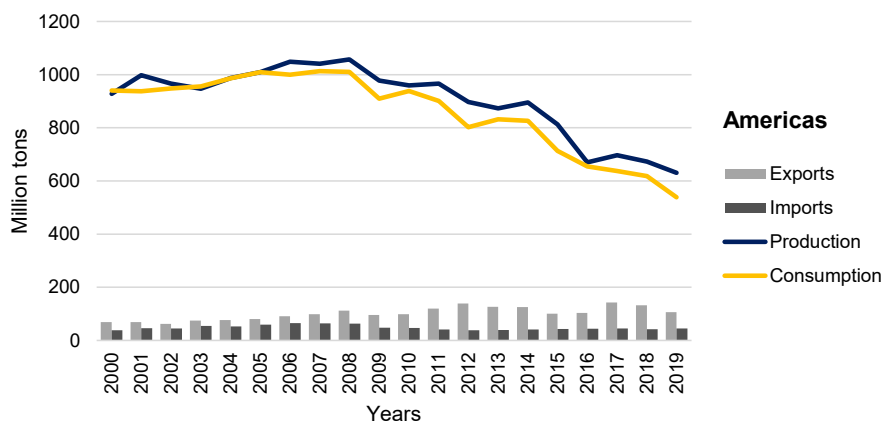


Fig. 15. Comparison of steam coal trade, production and consumption in the Americas, 2000–2019
Source: own study based on data from [Coal Information 2013–2020](#)

Rys. 15. Porównanie handlu węglem energetycznym oraz jego produkcji i zużycia w Amerykach, lata 2000–2019

Projections for the Americas ([WEO 2040](#)) show that, similarly to Europe, both coal demand from coal-fired power generation and total final consumption (TFC) will decline (each) at an average rate of 4%/year between 2019 and 2040 (see Figure 16). Coal-fired electricity generation will decline by 75% to 301 TWh (representing only 1% of coal-fired electricity globally).

Table 7. Dynamics of changes in production, consumption, exports and imports of steam coal in the Americas, 2000–2019 (%)

Tabela 7. Dynamika zmian produkcji, zużycia, eksportu i importu węgla energetycznego w Amerykach, lata 2000–2019 [%]

Americas	Production	Consumption	Exports	Imports
CAGR 2005/2000	2	1	3	9
+/-2005/2000	9	7	16	55
CAGR 2010/2005	-1	-1	4	-4
+/-2010/2005	-5	-7	22	-20
CAGR 2015/2010	-3	-5	1	-2
+/-2015/2010	-15	-24	3	-9
CAGR 2019/2015	-6	-7	1	1
+/-2019/2015	-22	-24	6	4
CAGR 2019/2000	-2	-3	5	-1
+/-2019/2000	-32	-43	139	-17

Source: own study.

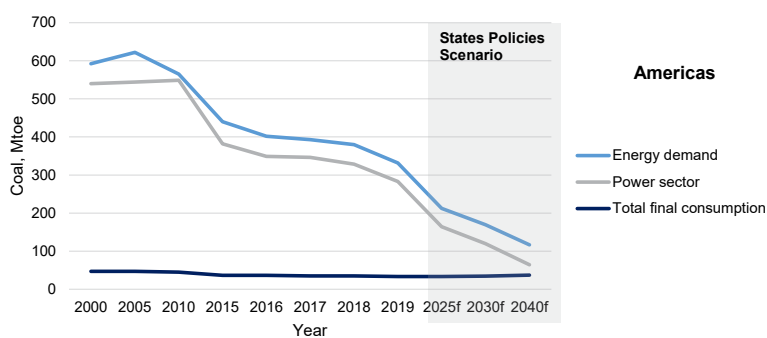


Fig. 16. Coal demand forecast in the Americas over the period to 2040

Source: own study based on data from [WEO 2020](#)

Rys. 16. Prognoza zapotrzebowania na węgiel w Amerykach w perspektywie 2040 r.

3.4. Africa

Between 2000 and 2019, Africa had the least impact on global steam coal flows. As in the case of the American continents, the African steam coal trade is also dominated by

the export direction. The main and also the most important global exporter from this part of the world is South Africa. The convenient geographical location of this exporter means that, depending on demand, it can send coal to customers in both the Atlantic and Pacific regions.

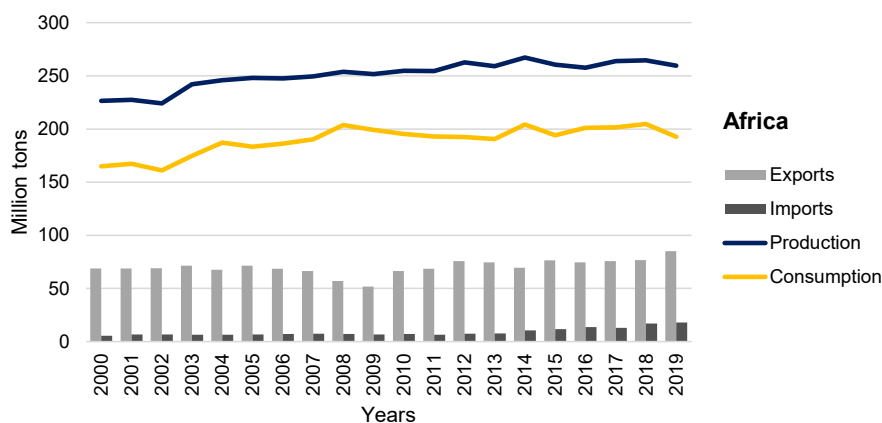


Fig. 17. Comparison of steam coal trade, production and consumption in Africa, 2000–2019
Source: own study based on data from [Coal Information 2013–2020](#)

Rys. 17. Porównanie handlu węglem energetycznym oraz jego produkcji i zużycia w Afryce, lata 2000–2019

Table 8. Dynamics of changes in steam coal production, consumption, exports and imports in Africa, 2000–2019 (%)

Tabela 8. Dynamika zmian produkcji, zużycia, eksportu i importu węgla energetycznego w Afryce, lata 2000–2019 [%]

Africa	Production	Consumption	Exports	Imports
CAGR 2005/2000	2	2	1	4
+/-2005/2000	10	11	4	21
CAGR 2010/2005	1	1	-1	1
+/-2010/2005	3	7	-7	6
CAGR 2015/2010	0	0	3	10
+/-2015/2010	2	-1	15	64
CAGR 2019/2015	0	0	3	11
+/-2019/2015	0	-1	11	53
CAGR 2019/2000	1	1	1	6
+/-2019/2000	15	17	24	221

Source: own study.

Between 2008 and 2009 (the effect of the 2007–2009 financial crisis), exports decreased by 9% to 51.8 million tons and between 2013 and 2014 recorded a 7% decrease to 69.6 million tons (Figure 17). Growing demand from developing economies in Asia has resulted in an upward trend over the past five years. Between 2015 and 2019, steam coal exports grew annually at an average rate of 3%. Africa's exports of this commodity amounted to 85.1 million tons in 2019, growing at an average rate of 1%/year between 2000 and 2019 (see Table 8).

Similarly to the trends in Europe and the Americas, for Africa the projections (WEO2040) of demand for both coal-fired power generation and total final consumption will decline. Between 2019 and 2040 they will decline at an average rate of $-0.2\%/year$ and $-1.8\%/year$ respectively (see Figure 18). Coal-fired electricity generation will decline by 23% to 200 TWh (accounting for only 0.5% of global coal-fired electricity generation).

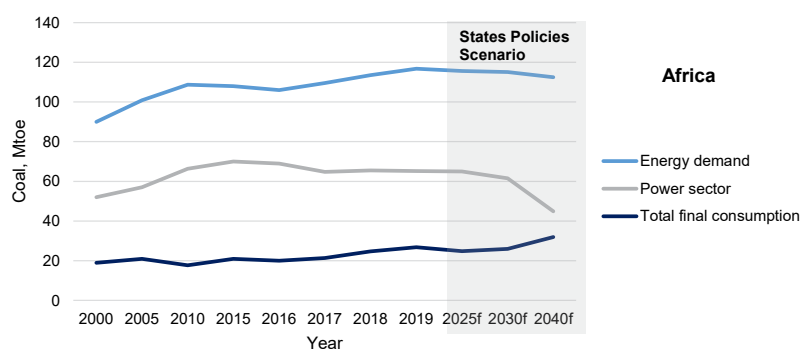


Fig. 18. Africa's coal demand forecast over the period to 2040

Source: own study based on data from WEO 2020

Rys. 18. Prognoza zapotrzebowania na węgiel w Afryce w perspektywie 2040 r.

Conclusion

All the changes in trends in coal production and consumption shown in the course of this analysis in comparison with other energy resources have a very significant impact on global coal trade. In particular, the price factor of coal versus natural gas significantly influences the share of coal-fired power generation in the energy mix of a given country.

For many years, developing Asian economies have been the main consumer of coal on a global scale, while at the same time there has been a shift away from this commodity in economically developed economies (especially in the EU countries); and this is the main factor contributing to changes in global steam coal trade trends. The analysis showed that between 2004 and 2019, the average growth rate of the Pacific market share in seaborne steam coal trade was 6.6%, while the Atlantic basin declined at a rate of $-0.7\%/year$.

Globally, the overall upward trend in steam coal flows between 2000 and 2019 has been disrupted on two occasions: by the effects of the 2007–2009 financial crisis and the ongoing uncertainty of the global economy, as well as by the significant slowdown in the economic growth of developing countries in 2014–2016.

Forecasts of coal's share in global demand are not optimistic for many regions of the world (Europe, Africa, the Americas). Only in Asia-Pacific is it expected to increase by 2% overall. In addition, coal-fired power generation will be concentrated in this part of the world and as much as 92% of global demand for coal-fired electricity generation will come from there.

However, it cannot be excluded that new markets will emerge in the future, particularly in Asia and the Mediterranean, which will cause coal flows to change.

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WORLD STEAM COAL MANAGEMENT

Keywords

steam coal, trade, exports, imports

Abstract

The article analyzes trends in steam coal flows (exports and imports) linked to production and consumption volumes. The analysis carried out in the article took the years from 2000 to 2019 into consideration. Coal is the second most important energy carrier. Its share in the structure of global consumption amounts to 27% and its production has an upward trend despite its decreasing share. The overall global upward trend of steam coal flows was disrupted twice over the period 2000–2019: by the effects of the 2007–2009 global financial crisis and the ongoing uncertainty of the global economy, as well as by the significant slowdown in the economic growth of developing countries (2014–2016). The European Union has seen large decreases in coal consumption over recent years, reflecting an accelerating decarbonization policy. The main area of coal trade is the Asia-Pacific basin. The Atlantic market currently accounts for about 20% of global steam coal trade, with seaborne trade covering about 95%. The volume of world trade (exports, imports) in steam coal is approximately one billion (bn) tons per year. The analysis carried out showed the following trend: decreasing coal exports to economically developed countries (mainly concentrated in Europe) and increasing exports to economies of developing countries, concentrated in the Asian part of the world. International Energy Agency (IEA) projections show that by 2040 the global coal production will fall from 5.6bn tons of coal equivalent (3.9bn tons of oil equivalent in 2019) to 5bn tce (3.5bn toe) at an average annual rate of –1.1%. Steam coal production is expected to decline by 10% to 4bn tce (2.8bn toe). Due to the fact that China is the largest producer, user and importer of steam coal in the world, all economic and political decisions taken by its government have strongly influenced international coal trade for years. For the Asia-Pacific basin alone, the IEA's long-term forecasts predict an increase in coal-fired power generation over 2019. Forecasts regarding the coal's share in global demand are not optimistic for many regions of the world (Europe, Africa, the Americas), predicting a significant decline in its demand. Yet, new markets for coal are emerging, especially in Asia and the Mediterranean basin, which may contribute to maintaining at least the current level of coal trade.

GOSPODARKA WĘGLEM ENERGETYCZNYM NA ŚWIECIE

Słowa kluczowe

węgiel energetyczny, handel, eksport, import

Streszczenie

W artykule przeanalizowano trendy przepływów węgla energetycznego (eksportu i importu), które są powiązane z wielkościami produkcji i zużycia. Przeprowadzona w artykule analiza dotyczyła lat 2000–2019. Węgiel jest drugim najważniejszym nośnikiem energii. Jego udział w strukturze zużycia wynosi w świecie 27%, a produkcja, mimo spadków udziałów, ma trend wzrostowy. Ogólny trend wzrostowy przepływu węgla energetycznego na przestrzeni lat 2000–2019 w skali globalnej zakłócony był dwukrotnie: skutkami światowego kryzysu finansowego z lat 2007–2009 oraz trwającej niepewności światowej gospodarki, a także znaczącego spowolnienia tempa wzrostu gospodarczego krajów rozwijających się (lata 2014–2016). W Unii Europejskiej obserwuje się duże spadki zużycia węgla na przestrzeni ostatnich lat, co związane jest z przyspieszającą polityką dekarbonizacji. Głównym obszarem handlu węglem jest rejon Azji i Pacyfiku. Rynek atlantycki obecnie stanowi tylko około 20% światowego handlu węglem energetycznym, a handel drogą morską obejmuje około 95% handlu. Wielkość światowego handlu (eksport, import) węglem energetycznym wynosi około 1 mld ton rocznie. W wyniku przeprowadzonej analizy zaobserwowano następującą tendencję: malejący eksport węgla do państw gospodarczo rozwiniętych (głównie skupionych w Europie), wzrost do gospodarek krajów rozwijających się, skoncentrowanych w azjatyckiej części świata. Prognozy Międzynarodowej Agencji Energii (IEA) pokazują, że w perspektywie 2040 r. światowa produkcja węgla spadnie z 5,6 mld tce (3,9 mld toe w 2019 r.) do 5 mld tce (3,5 mld toe) w średniorocznym tempie $-1,1\%$. Produkcja węgla energetycznego ma się obniżyć o 10% do 4 mld tce (2,8 mld toe). W związku z tym że, Chiny są największym producentem, użytkownikiem oraz importerem węgla energetycznego na świecie, to wszelkie decyzje gospodarcze i polityczne podejmowane przez rząd tego kraju od lat mocno wpływają na międzynarodowy handel węglem. Tylko dla obszaru Azji i Pacyfiku w stosunku do roku 2019 długoterminowe prognozy IEA przewidują wzrost wytwarzania energii elektrycznej z węgla. Prognozy udziału węgla w światowym zapotrzebowaniu dla wielu regionów świata (Europy, Afryki, Ameryk) nie są optymistyczne, przewidują znaczny spadek zapotrzebowania na to paliwo. Jednak zwłaszcza w Azji, jak i w basenie Morza Śródziemnego pojawiają się nowe rynki zbytu węgla, co przyczynić się może przynajmniej do utrzymania obecnego poziomu handlu węglem.