



The Role of Coal in the Polish Economy

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Abstract

The paper shows the structure of primary energy production and consumption in Poland over the last ten years, i.e. between 2010 and 2019. The authors focused in particular on energy raw materials, especially on steam coal being the basic raw material used to produce electricity and heat. The diagrams show energy production and consumption in the analysed period in Petajoule (PJ), then the consumption per capita is shown providing some indication of the living standard of the population. The structure of fuel production in Poland in the years 2010, 2015 and 2019 displays the dominant role of solid fuels, especially steam coal with its nearly 40% share in 2010. In the following years, its share decreased, but still amounts to almost 30%. The remaining solid fuels such as coking coal and lignite are less relevant in this structure, although they are very important for Polish economy. In various years, the share of coking coal ranged from 8.6 to 10.0%, and that of lignite from 9.3 to 13.0%. Liquid and gaseous fuels are produced in Poland in small quantities, and the varying percentage level depends on the volume of solid fuels produced in particular years.

Keywords: hard coal, primary energy, production, consumption

Introduction

Since the Second World War, hard coal and lignite have been the basic raw material for producing electricity and heat in Poland. It is safe to say that the country built its position in Europe and in the world thanks to the development of the mining industry which, in the times of the previous system, used to bring financial benefits, and Poland used to be one of the leading exporters of these raw materials. The shift in global trends and increasing share of renewable energy reduce each year the share of coal in the energy mix; nevertheless, it is still the most important energy raw material for the country. What is more, the draft Poland's Energy Policy by 2040 (Draft 2019) assumes a 60% share of coal in electricity generation by 2030. The percentage is significantly less compared to previous years, but it is still a dominant share. In the long term, there are plans to further develop renewable energy sources which are to reach 21% of gross final energy consumption in 2030. In 2033, the first nuclear unit is to appear in Poland and this will undoubtedly further reduce the importance of coal in the country's energy mix. However, the draft has not yet been approved by Parliament and is not a binding document; it can only serve as an auxiliary material for predicting how energy policy and the consumption of raw materials will develop in Poland in the coming years.

Primary energy

Primary energy is the energy produced from natural resources i.e. hard coal and lignite, oil, natural gas, nuclear fission fuels and fusion energy; but it also means renewable energy carriers such as solar, wind, biomass, geothermal, to name a few.

Figure 1 shows the production and consumption of primary energy in Poland between 2010 and 2019.

Attention should be drawn to the fact that primary energy production in Poland has decreased. In 2010, it was 2,742 PJ

and over the next three years it increased to 2,975 PJ (2013), which was the highest value in the period under review. In the following year, primary energy production fell slightly, but still in 2015 it was very high and reached 2,964 PJ. From that moment, the volume was constantly decreasing and fell to 2,494 PJ in 2019. The graph showing primary energy consumption during that period looks very interesting. Between 2011 and 2012 the consumption decreased from 4,163 PJ to 3,963 PJ and remained stable for the next three years; although domestic demand remained largely unchanged. This demonstrates increased imports in those years. In turn, between 2012 and 2015, when energy production was at its highest level, its consumption decreased significantly, which demonstrates increased exports. Between 2015 and 2018, primary energy consumption continuously increased from 3,984 PJ to 4,408 PJ with only a slight drop to 4,301 PJ in 2019. It is also worth looking at the difference between production and consumption. It turns out that the smallest difference happened between 2012 and 2015, when the production was at its highest and the consumption was at its lowest. Starting from 2015, the difference between production and consumption grew systematically from 1,020 PJ in 2012 to 1,823 PJ in 2018. In turn, the year 2019 was characterised by lower consumption, but the production also fell significantly; however, the difference was still large and amounted to 1,807 PJ. The current situation due to the COVID-19 pandemic and the resulting economic lockdown of several weeks will result in a further decrease in primary energy production and consumption, although the extent of the decline is currently difficult to estimate.

The per capita consumption of primary energy in Poland looks very interesting and its development is shown in Figure 2.

Over the last ten years the per capita consumption of primary energy in Poland varied widely, from 103.3 GJ in 2014 to 115.6 GJ in 2018. In the first five years of the analysed period,

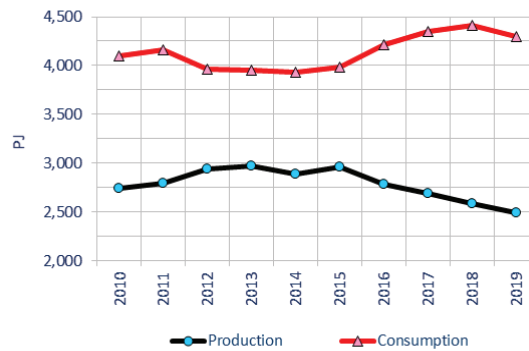


Fig. 1. Primary energy production and consumption in Poland, 2010–2019. Source: Own study based on the National Energy Balances, ARE (ARE 2011–2020)

Rys. 1. Pozyskanie oraz zużycie energii pierwotnej w Polsce w latach 2010–2019

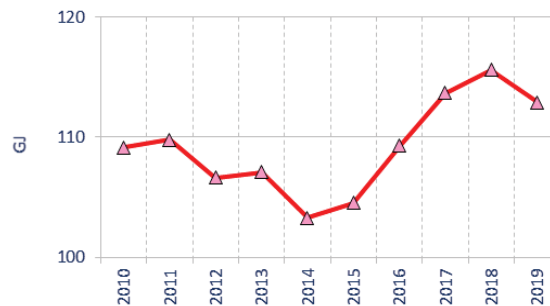


Fig. 2. Primary energy consumption in Poland per capita, 2010–2019. Source: Own study based on BP 2020 (BP 2020)

Rys. 2. Zużycie energii pierwotnej w Polsce per capita w latach 2010–2019

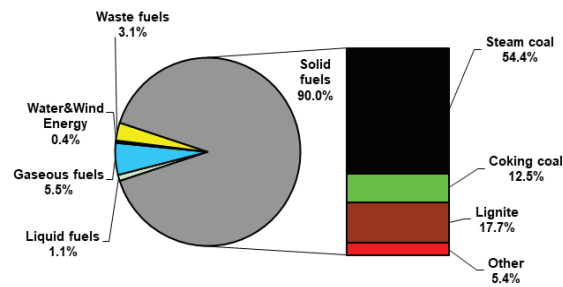


Fig. 3. Fuel production in Poland, 2010. Source: Own study based on ARE data (ARE 2011–2020)

Rys. 3. Struktura pozyskania paliw w Polsce w 2010 roku

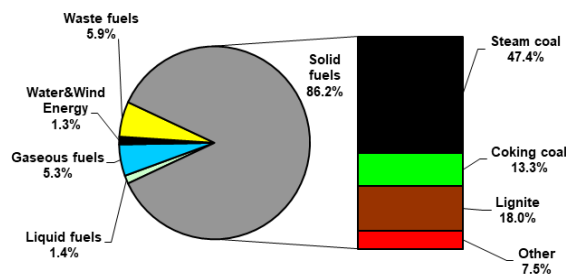


Fig. 4. Fuel production in Poland, 2015. Source: Own study based on ARE data (ARE 2011–2020)

Rys. 4. Struktura pozyskania paliw w Polsce w 2015 roku

a decreasing trend is clearly visible while the next four years are a period of rapidly growing consumption due to the economic development of the country. The year 2019 was marked by a decline in consumption both globally and per capita.

Production of fuels in Poland

Figures 3 to 5 show the structure of fuel production in Poland in 2010, 2015 and 2019.

The above three graphs show the decreasing share of solid fuels in primary energy production in Poland. Still in 2010, solid fuels had a 90% share to reach 86.2% in 2015, and only 83.0% in 2019. When it comes to the most important solid

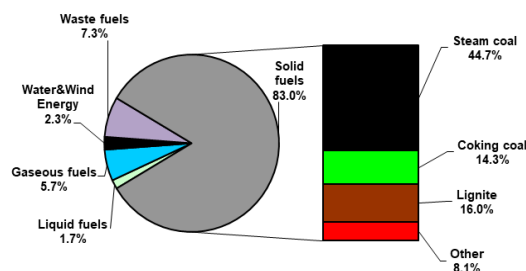


Fig. 5. Fuel production in Poland, 2019. Source: Own study based on ARE data (ARE 2011–2020)
Rys. 5. Struktura pozyskania paliw w Polsce w 2019 roku

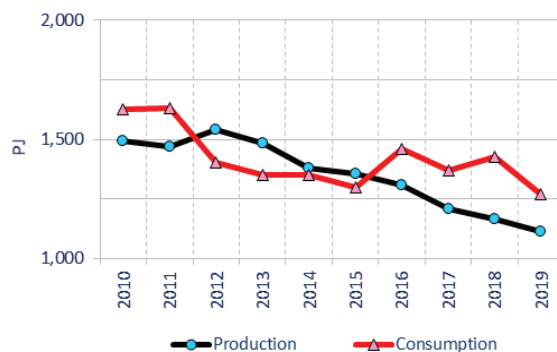


Fig. 6. Steam coal production and consumption in Poland, 2010–2019. Source: Own study based on the National Energy Balance Sheets, ARE (ARE 2011–2020)

Rys. 6. Pozyskanie oraz zużycie węgla energetycznego w Polsce w latach 2010–2019

fuel, i.e. steam coal, its share in 2010 production amounted to 54.4%, in 2015 fell to 47.4% and in 2019 to 44.7%. The share of coking coal varied from 12.5% in 2010, 13.3% in 2015 to reach 14.3% in 2019. Thus, a clear increase in the share of energy production is visible when comparing this raw material to other fuels. In the case of lignite, the values were 17.7% in 2010, 18.0% in 2015 and 16.0% in 2019.

As far as gaseous fuels are concerned, their production in 2010 accounted for 5.5% of total primary energy production in Poland; in 2015 this share increased to 5.3%, and in 2019 reached 5.7%. The share of liquid fuels in primary energy production was 1.1% in 2010, 1.4% in 2015 and 1.7% in 2019. So in this case, again, a slight percentage increase was noticed. It should be born in mind, however, that the production in absolute terms did not increase because we do not have the possibility of doing so; an increased percentage share is the effect of decreasing production of solid fuels.

Steam coal

Figure 6 presents the production and consumption of steam coal in Poland between 2010 and 2019.

The production of steam coal has declined over the last decade, although this trend can clearly be seen only from 2012. The year 2012 was the last year in the analysed period when primary energy produced from this fuel exceeded 1,500 PJ, and precisely 1,539 PJ. Starting from that year, the production of steam coal decreased steadily. As far as consumption is concerned, the downward trend is not so evident in this respect. After a marginal decrease between 2012 and 2015, coal consumption clearly increased to 1,461 PJ in the following year. In 2017, there was a significant drop in coal con-

sumption, and although it increased in 2018, the year 2019 saw its very sharp fall to 1,269 PJ, the lowest in the last decade.

Coal prospects in Poland

The prospects for coal in Poland depend mainly on government policy, and this policy is closely linked to that of the European Union. Widespread slogans about the decarbonisation of the economies of EU Member States do not allow to be optimistic about the development of this industry in our country. The lack of an energy policy does not make it possible to predict exactly what direction the mining industry will take and how long coal will be the fundamental raw material for energy production in Poland. The share of renewable energy which is increased every year, the announcements regarding the introduction of nuclear energy into the energy mix will undoubtedly change the structure of both energy production and consumption in Poland.

Today, the basic document, although not approved by Parliament, is the draft Poland's Energy Policy by 2040 (PEP2040). It sets out the main directions of development of the sector which so far has been based mainly on coal. Therefore, it is worth taking a closer look at the provisions contained in this document.

Poland currently consumes around 4,400 PJ of primary energy, most of which is hard coal and oil. The most important players in the end-use energy consumption are households and transport. While energy consumption in households is decreasing due to improved efficiency, the consumption of energy in transport is increasing due to its ever growing importance in creating GDP.

Annex 2 to PEP2040 provides details of the historical va-

Tab. 1. Domestic production forecast by fuel, ktoe. Source: PEP2040-Annex 2

Tab. 1. Prognoza produkcji krajowej z podziałem na paliwa, ktoe

	2005	2010	2015	2020	2025	2030	2035	2040
hard coal	45 736	35 302	32 136	29 367	27 433	22 615	18 831	16 210
coking coal	9 948	8 216	9 155	9 339	8 809	8 668	8 588	8 564
coke	5 721	6 701	6 666	7 160	7 174	7 192	7 241	7 323
lignite	12 736	11 559	12 299	10 637	11 110	11 095	5 971	3 761
oil	840	681	922	1 000	1 000	1 000	1 000	1 000
natural gas	3 884	3 693	3 683	3 595	3 627	3 653	3 675	3 694
nuclear fuel	0	0	0	0	0	0	0	0
biofuels	117	446	936	1 100	1 133	1 042	1 006	972
solid biomass	4166	5 866	6 268	7 356	8 385	9 753	9 986	10 193

Tab. 2. Forecast of fuel consumption in Poland by 2040, ktoe. Source: PEP2040-Annex 2

Tab. 2. Prognoza zużycia paliw w Polsce do 2040 roku, ktoe

	2005	2010	2015	2020	2025	2030	2035	2040
hard coal	37 669	39 241	31 205	28 707	24 284	19 436	15 731	13 181
coking coal	7 884	8 694	9 488	9 396	8 957	8 891	8 874	8 906
coke	2 314	2 154	2 266	2 563	2 415	2 299	2 235	2 219
lignite	12 726	11 576	12 283	10 651	11 124	11 110	5 979	3 766
oil	18 017	22 633	25 930	27 247	27 227	26 784	26 861	26 754
petroleum products	22 338	26 856	25 338	31 280	31 225	31 060	30 817	30 510
natural gas	12 235	12 805	13 776	16 547	17 290	18 121	19 677	20 662
coke-oven gas	1 480	1 744	1 704	1 676	1 651	1 641	1 642	1 651
blast furnace gas	885	526	632	576	532	489	454	428
other gaseous fuels	161	149	162	88	76	76	75	75
solid biomass	4 166	5 866	6 774	7 896	9 023	10 522	10 778	11 004
biogas	54	115	229	284	318	352	388	425
biofuels	54	868	782	1 497	1 542	1 418	1 369	1 322
nuclear fuel	0	0	0	0	0	0	4 624	6 936
municipal and industrial waste	157	400	564	1 047	1 251	1 329	1 417	1 499

lues for 2005, 2010 and 2015 as well as the expected domestic production volumes by fuel (see Table 1).

The forecast shows that hard coal production will be steadily decreasing throughout the entire period covered by the analysis. Nevertheless even in 2040 it will be a dominant fuel in the production structure of fuels in Poland. The document states that the „fall in demand for coal in the industrial sector is mainly due to the process of modernisation of manufacturing processes. Households and services – in the framework of the fight against smog in cities – will gradually replace inefficient boilers with those meeting the highest environmental standards (with high energy conversion efficiency) and replace coal technologies with more environmentally friendly ones (district heating, RES, natural gas)”. Coking coal production will decrease slightly while the production of lignite – considered to be the most harmful fuel for the environment – will fall almost threefold. Oil production will increase slightly while biofuels will grow in importance, and biomass production will more than double.

The document also forecasts fuel consumption by 2040 presented in Table 2.

The projection foresees a decrease in domestic hard coal and lignite consumption as a result of the implementation of the existing energy and climate policy and the reduction of coal consumption in households. The decline in coal consumption in the power and heating sectors will intensify significantly between 2030 and 2040. A slight fall in the consumption of oil and petroleum products is expected between

2020 and 2040. The driving force behind maintaining demand in this sector is economic growth, but the inhibiting factor is the improvement in efficiency resulting from technological progress, measures taken to improve the organisation of transport services and the development of transport infrastructure (networks of motorways and expressways). The growing use of natural gas will result from an increase in the use of this fuel in power generation, mainly as a regulatory and back-up capacity, and from the desire to improve air quality, given that it is a fuel with a lower carbon footprint than coal.

The latest estimates of July 2020 forecast the closure of several mines, which will make it necessary to increase coal imports in order to meet the needs of the power sector. Coal imports have been present since Poland joined the European Union. Previously, only coking coal was imported, and since 2004, steam coal has also been imported. In 2011, imports of hard coal to Poland increased by more than 500% compared to 2004 (Stala-Sługaj 2014). A change in the trend in Polish coal trade could already be seen earlier. In 2008, for the first time in history, coal imports exceeded exports (Olkuski 2010). The prospects for coal in Poland depend not only on the decisions of Polish government, but also on international arrangements. In May 2019, a draft National Energy and Climate Plans (NECPs) was presented, which shows how EU countries plan to use coal for electricity generation in the 2030 perspective. Out of the 21 countries using coal in the EU, only seven gave specific dates for their total coal phase-out (Olkuski, Grudziński 2019). Other countries declare they are ready

to reduce the use of coal in the energy sector, but do not specify deadlines for the complete phase-out of this raw material. Poland is also in this group. The reduction of domestic coal mining will also depend on its supply and demand on international markets, as well as on its price (Grudziński 2018; Stala-Szlugaj 2018). An important aspect of the future usage of coal will be the possibility of reducing its harmful impact on the environment and thus on human health (Steel-Service 2018a, b). This mainly involves eliminating low emissions from the burning of solid fuels in households and reducing CO₂ emissions (Grudziński, Stala-Szlugaj 2015; Stala-Szlugaj 2017).

Conclusion

Fossil fuels, i.e. steam coal, coking coal and lignite, are the most common source of primary energy in Poland. Their position is the result of the economic development of the country based on fossil raw materials. Poland does not have sufficient oil and natural gas resources to be able to develop its economy based on these fuels. This is the reason why in the period that immediately followed World War II, an economic model was chosen which is still valid today. Undeniably, the role of hard coal in the national economy is no longer as important as in previous years, but it is still dominant. The European Union's energy policy aimed at developing renewable energy sources together with rapidly progressing decarbonisation create pressure for changes in our country as well. This can be seen clearly from the announcements of government representatives on the development of offshore wind energy, or support for photovoltaics. As a result, the share of coal in

the primary energy production will decrease. The share of coal will also decrease in the primary energy consumption, at the expense of imported gas or imported oil for the transport sector. The absence of the "Poland's Energy Policy" Act does not allow for an unambiguous determination of what the consumption of particular energy raw materials and energy will be in the future. However, it can be concluded from the projects which are being developed and submitted for public consultation that Poland will strive, as Western European countries do, to introduce the green deal - although this process in Poland will be slower than in the countries of the so-called 'old Union'.

In the next few years the consumption of fossil fuels, coal included, will depend on the policies of the world's powers. The United States has already withdrawn from the Paris Agreement; earlier Canada withdrew from the emissions reduction arrangements. Now the United Kingdom is leaving the European Union, and it is not clear whether the former will continue to support EU climate policy (Olkuski 2019). So far, the role of coal in the Polish economy has been enormous and even its gradual reduction each year does not mean that Poland will entirely phase out this raw material because it is simply impossible in the coming years.

The closure of the Ministry of Energy and the establishment of the Ministry of Climate clearly shows the direction in which Polish energy policy will be heading in the coming years.

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Rola węgla w polskiej gospodarce

W artykule przedstawiono strukturę pozyskania oraz zużycia energii pierwotnej w Polsce na przestrzeni ostatnich dziesięciu lat, czyli w okresie 2010–2019. Skupiono się zwłaszcza na surowcach energetycznych, a szczególnie na węglu energetycznym będącym podstawowym surowcem wykorzystywanym w produkcji energii elektrycznej i ciepła. Na wykresach pokazano pozyskanie energii w analizowanym okresie w PJ jak również jej zużycie, także w PJ. Pokazano również zużycie w przeliczeniu na mieszkańca, co daje pewien pogląd na poziom życia społeczeństwa. Przedstawiono również strukturę pozyskania paliw w Polsce w latach 2010, 2015 i 2019. Widać z niej dominującą rolę paliw stałych w tej strukturze, a zwłaszcza węgla kamiennego energetycznego, którego udział w 2010 roku wyniósł prawie 40%. W następnych latach jego udział spadał, ale nadal wynosi prawie 30%. Pozostałe paliwa stałe, czyli węgiel koksowy i węgiel brunatny, mają w tej strukturze mniejsze znaczenie, choć są bardzo ważne dla gospodarki kraju. Węgiel koksowy w różnych latach stanowił od 8,6–10,0% udziału, a węgiel brunatny 9,3–13,0%. Paliwa ciekłe i paliwa gazowe pozyskujemy w Polsce w niewielkich ilościach, a zróżnicowany poziom procentowy zależy od wielkości pozyskiwania paliw stałych w poszczególnych latach.

Słowa kluczowe: węgiel kamienny, energia pierwotna, pozyskanie, zużycie