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## Households in Poland vs. energy carriers: one year after Russia's February 2022 invasion of Ukraine

**ABSTRACT:** Russia's use of one of its energy resources as a tool of political pressure in 2021 destabilized the economies of many European countries. The energy crisis was exacerbated by the outbreak of Russia's war with Ukraine in February 2022, when many countries, including those of the EU, responded by imposing sanctions on energy resources from Russia. The situation also affected Polish households. Until then, Russia had been Poland's main supplier of coal and natural gas. It is estimated that 3.8 million households were threatened by the uncertainty of hard-coal supplies for the 2022/2023 heating season. The article presents an analysis of the supply and demand of the main fossil energy resources consumed by Polish households for heating purposes. Discussing the supply of a given raw material, both domestic production and imports are presented. The inability to increase domestic coal production for households in the short term (it is a long-term process) resulted in the introduction of intervention imports. In the case of imports, attention was paid to the need to change suppliers as well as import routes. The article also analyzes the prices of major energy carriers for domestic households from January 2018 to March 2023. Rapidly rising prices of hard coal at fuel depots in the third and fourth quarters of 2022 were higher than natural gas prices for households by PLN 13–16/GJ and amounted to PLN 81–101/GJ. By comparison, natural gas prices were then in the range of

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65–88 PLN/GJ. In the first quarter of 2023, the prices of these two energy carriers had already reached a similar level (in the order of 80 PLN/GJ).

KEYWORDS: households, coal, natural gas, Russian-Ukrainian war in 2022, Poland

## Introduction

Households in Poland are an important group of users of many energy carriers. In 2018–2021, they consumed (according to CSO data 2019–2022) 771–952 PJ/year. Some of the most important energy carriers consumed by this group of consumers are fossil energy resources, especially hard coal and natural gas (Fig. 1). The share of hard-coal consumption has been declining in recent years from 32 to 24%, and the share of natural gas (combined: high-methane and nitrogenous) is at a relatively constant level: 18–20%. When analyzing the data (Eurostat 2023), it can be noted that in 2018–2020 the share of solid fossil fuels (including hard coal) consumed by households for heating purposes decreased from 45 to 40%, and the share of natural gas fluctuated in the range of 15–17% (Fig. 2). The fluctuation in global coal and natural gas flows triggered by the policy of the Russian Federation (hereafter referred to in the article as Russia) towards natural gas supplies to the European Union and the start of the Russian-Ukrainian war in 2022 threatened to secure the supply of major energy resources for Polish households.

The purpose of this article is to analyze the supply and price formation of hard coal and natural gas for households in Poland one year after Russia’s February 2022 invasion of Ukraine. It should be mentioned that domestic households use de facto hard coal for energy purposes (steam coal). In many publicly available national statistics (for example, those kept by the Central Statistical Office, Agencja Rynku Energi SA), the heading for households often includes the name hard coal.

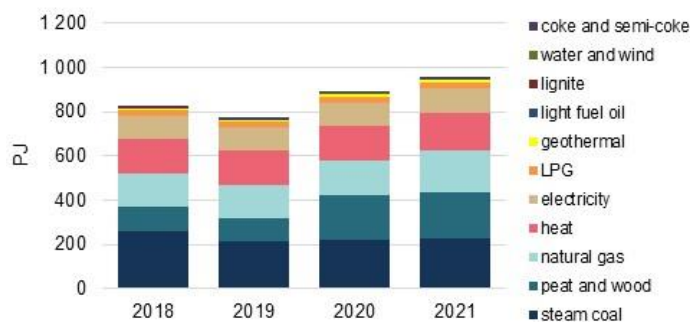


Fig. 1. Consumption of energy carriers by households in Poland, 2018–2021  
Source: prepared by (Stala-Szlugaj 2023) based on (CSO 2019, 2023a)

Rys. 1. Zużycie nośników energii przez gospodarstwa domowe w Polsce, lata 2018–2021

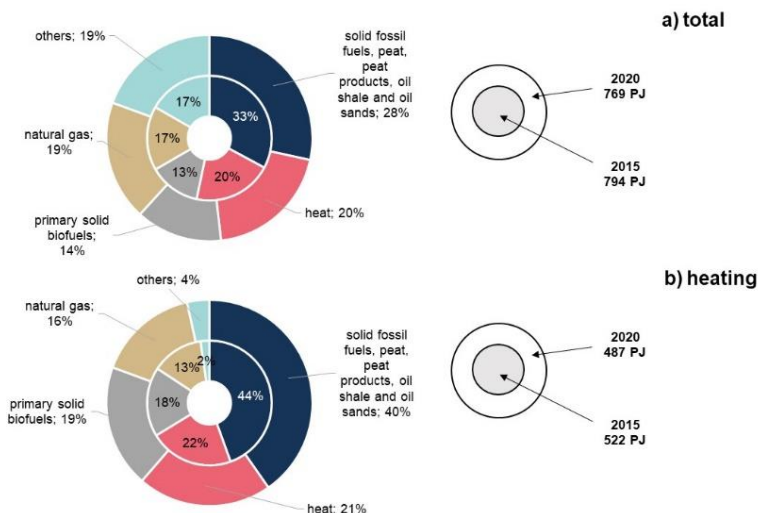


Fig. 2. Structure of final consumption of energy carriers by households in Poland in 2015 and 2020  
a) total, b) for heating purposes

Source: prepared by (Stala-Szlugaj 2023) based on (Eurostat 2023)

Rys. 2. Struktura końcowego zużycia nośników energii przez gospodarstwa domowe w Polsce w latach 2015 i 2020  
a) ogółem, b) w celach grzewczych

## 1. Energy carriers on the EU market in 2021–2022

To understand the gravity of the circumstances, it is necessary to take a closer look at the global economy in 2021. The world was beginning to recover from the COVID-19 pandemic and the turmoil in natural gas supplies from Russia to Europe had a very strong impact on the international coal trade. Rising natural gas prices in Europe, with declining volumes in storage in many Western European countries, contributed to the strong increase in gas prices observed since April 2021 (Stala-Szlugaj 2023). Between April and October 2021, spot prices (spot market – short-term supply market) for the delivery of natural gas to the TTF gas hub (TTF – Title Transfer Facility in the Netherlands) increased by more than 300%, and spot prices for steam coal at the Amsterdam-Rotterdam-Antwerp ports (so-called ARA ports) increased by more than 200%. High spot gas prices resulted in coal-fired power plants being restarted in many Western European countries. As a result, the demand for this raw material increased, and this was reflected in higher coal prices on the international market.

In response to Russia's invasion of Ukraine in February 2022, sanctions on Russian raw materials were imposed by the European Union, the US and Japan. The situation has severely rattled the economies of many countries. Ukraine has so far been a major global exporter of, among

other goods, grains, oil crops, iron ore, steel products and ferroalloys, and other non-energy raw materials (including to Poland) (Nita et al. 2021; Lewicka et al. 2022). Meanwhile, the outbreak of the aforementioned war broke the supply chains of many raw materials. A windless summer and the onset of autumn in 2022, provided another boost to spot coal prices, which contributed to a decline in the share of wind power in the power mix of many Western European countries. In Germany, in June, July and September 2021, the share of wind power in the country's electricity generation fell to 12–15%, with the average in January 2021–June 2022 being 24% (Stala-Szulgaj 2023). In Spain, the average share of wind power in electricity generation was 23%, falling to 16–19% between June and September 2021. As a result, additional demand for hard coal for electricity generation was created over a relatively short period of time. The increased demand stimulated an increase in coal prices on the European market. Russia's February 2022 war with Ukraine further exacerbated the energy crisis.

## 2. Hard coal for households in Poland

Households are one of the most important consumers of hard coal (steam coal), consuming about 9 million tons per year (according to data: CSO 2019–2022) in 2018–2021. According to MSA (2023, the number of households in Poland consuming hard coal at the beginning of Russia's conflict with Ukraine was estimated at 3.8 million, and such a number of customers was threatened by difficulties related to the availability of this energy carrier.

For years, the supply of hard coal for households in Poland has mainly been provided by domestic production. By analyzing the data (CSO 2019–2022, IDA 2019–2023a,b), it can be estimated that in the years 2018–2021, domestic sales provided 42–58% of the demand of this group of customers. The minimum (42%) was in 2020, when domestic mines experienced numerous lockdowns due to the COVID-19 pandemic, and the maximum (58%) was in 2021. At the time of writing, statistics for 2022 consumption were not yet available.

As mentioned in the first section, in response to Russia's invasion of Ukraine in February 2022, Poland, along with the rest of the European Union, imposed sanctions on Russian coal, among other things. Since domestic mines could not immediately increase coal production for households (increasing production is a long-term, staggered and costly process), there was a need to increase coal imports. For the purposes of comparison, in 2021, Poland imported 9.3 million tons of steam coal (IDA data 2019–2023a), 86% of which came from Russia. There was therefore a need to change the direction of coal supplies. The purchase of imported coal to Poland (referred to as intervention imports in government documents (MSA 2023)) from July 2022 was handled by two companies: PGE Paliwa Sp. z o.o. and Węglokoks SA. A total of 13.9 million tons of hard coal were imported from July to December 2023, 90% of which was thermal coal. In total, for the whole year of 2022, 20.2 million tons of hard coal was imported, of which 17.1 million tons was steam coal (Fig. 3). However, the supply structure of steam coal has changed: 20%

came from South Africa, 18% from Kazakhstan, 16% from Colombia, 12% from Australia, and imports from Russia dropped to 14%. After the first three months of 2023, imports of steam coal to Poland amounted to 9.3 million tons (28% from Colombia, 18% from Kazakhstan, 17% from South Africa, 14% from Indonesia and 10% from Australia), up 4.1 million tons year-on-year. It should be noted, however, that the first quarter 2023 result was affected by, among other things, the execution of previously concluded contracts (e.g., as late as 2022), so that the full view will only be obtained at the end of a given calendar year. By comparison, in the first quarter of 2022, as much as 73% of imported steam coal was from Russia, 12% from Kazakhstan and 8% from Colombia.

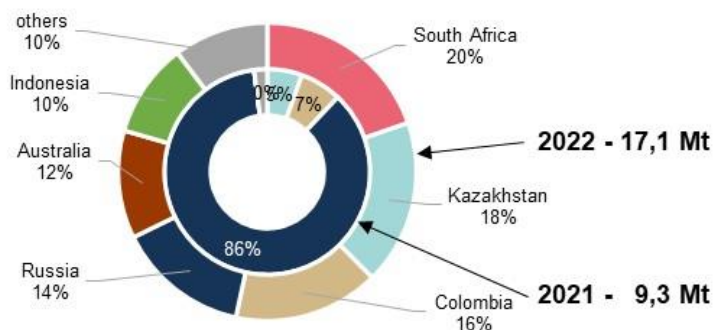


Fig. 3. Structure of steam coal imports to Poland, 2021–2022

Source: own elaboration based on data: (IDA 2019–2023a)

Rys. 3. Struktura importu węgla energetycznego do Polski, lata 2021–2022

With the change in the direction of imported coal supplies came the reorganization of the established trade and distribution routes. The previous dominance of imports from the eastern direction by rail resulted in the main transshipment centers of importers being concentrated near railroad border crossings in northeastern Poland. The search for coal suppliers other than Russia in overseas markets resulted in a change in the distribution directions of imported coal. As imports by sea began to dominate, the need arose to distribute coal from seaports to inland customers.

In the context of the redirection of imported coal, it should be noted that the international market trades in fines with a grain class of 0–50 mm. The need also arose to organize the sorting of imported coal consumed by households into coarse and medium grades (according to MSA 2023, they were obtained at about 30%). The remaining coal fines were directed to power and heating plants. For this purpose, some of these duties were mainly performed by seaports, while others were performed at selected distribution centers.

### 3. Natural gas for households in Poland

The annual consumption of natural gas by Polish households is at the level of 4.2–5.3 bcm (2018–2022), and can be roughly estimated to be covered by domestic production (Fig. 4). Imports (14.9–17.5 bcm/year) are the primary source of this resource. In the past, the leading supplier of natural gas to Poland was the eastern direction (Fig. 5). In 2018, supplies from this direction accounted for 64% of total imports (ME 2019), and from 2019 onwards, they were lower by several percent, amounting to 54–56% (ME 2020; MCE 2021; MCE 2022).

In order to reduce its dependence on gas supplies from the eastern direction, in 2018–2022, Poland made investments related to the expansion of the LNG terminal in Swinoujscie, the construction of the Baltic Pipe pipeline and interconnections with Lithuania and Slovakia. A marine infrastructure project related to the construction of a Floating Storage Regasification Unit (FSRU) terminal in the Gulf of Gdansk (Baltic Sea) is underway. In 2021, the project was included in the list of PCIs (PCI – Projects of Common Interest), which are crucial to the implementation of European energy and climate policy (Gaz System 2023). Increasing the diversification of gas fuel supplies has grown in importance since the outbreak of Russia's war with Ukraine in 2022 (when the sanctions on Russian raw materials were imposed).

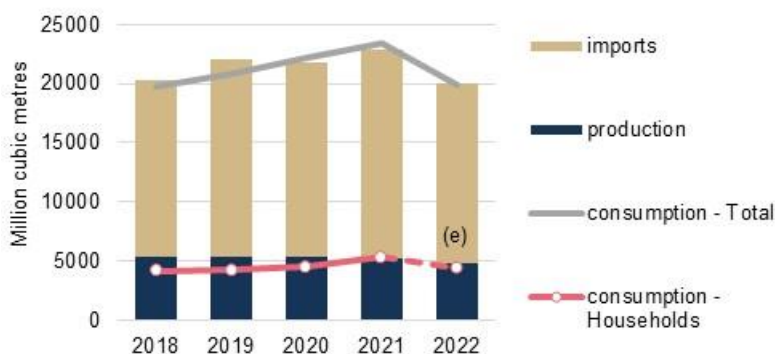


Fig. 4. Natural gas supply and demand in Poland, 2018–2022; e – estimate  
Source: own compilation based on data: (CSO 2019–2022; ARE 2018–2023a)

Rys. 4. Podaż i popyt na gaz ziemny w Polsce, lata 2018–2022; e – szacunek

In general, the volume of natural gas consumption by Polish households (in addition to the price factor in relation to other energy carriers and the weather factor) is also affected by the availability of natural gas transmission and the distribution network. This network is irregular, and does not cover the entire area of Poland. It is mainly concentrated in urban areas. According to records (CSO 2023b), in 2018 the number of households receiving natural gas was 7.8 million, and in 2021, it increased by 0.7 million households. The share of customers heating their homes with gas in 2018 was 28%, and in 2021 it increased by 8 percentage points (to 3.1 million custo-



Fig. 5. Natural gas imports to Poland by exporting country, 2018–2022

Source: own compilation based on data: (ME 2019, 2020; MCE 2021, 2022; Management 2022; ARE 2018–2023a)

Rys. 5. Gaz ziemny – import do Polski według krajów eksporterów, lata 2018–2022

mers). As in the case of hard coal, at the time of writing this article, statistics on gas consumption by households in 2022 were not yet available.

## 4. Prices of major energy carriers for households

Turmoil from the international natural gas market in 2021 was also felt by domestic households. Natural gas prices in the third quarter of 2021, compared to the previous quarter, increased by 21% to PLN 58/GJ (Fig. 6). Hard-coal prices at fuel depots also began to rise, reaching PLN 42/GJ.

The heavily strained coal market was further affected by the introduction of sanctions on Russian raw material. The lack of coal supplies from Russia (until then, the largest exporter of steam coal to the Polish market) strongly affected both the supply of domestic and imported coal and coal prices at fuel depots. In Q2 2022, the prices of domestic coal offered at fuel depots in some provinces rose to PLN 100/GJ (Stala-Szlugaj 2023), with the average for the whole country being PLN 65/GJ (Figs 6 and 7). The tense situation from international markets spilled over into the domestic market, stirring up uncertainty about securing coal supplies for households fueled by the media. This situation was taken advantage of by some coal sellers, who raised their coal sales prices in the very short term. In an effort to calm this tense situation, the government passed a law in June 2022 (Act 2022a), which set the guaranteed price of coal for each apartment/household at PLN 996.60 gross. At most, 3 tons of hard coal could be purchased at this price. A household could take advantage of this support, provided it documented that the heating source it was using had been reported to the Central Register of Building Emissions. In August 2022, Poland's most important producer of heating coal unified the selling price of individual coal grades, which

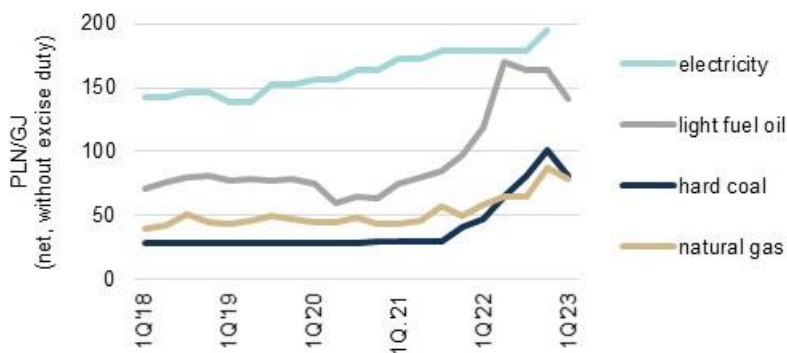


Fig. 6. Average selling prices (net, excluding excise taxes) of the main energy carriers for households in Poland, 2018–2023 (quarterly data)

Source: Stala-Szlugaj 2023 (supplemented, data: ARE 2018–2023b)

Rys. 6. Średnie ceny sprzedaży (netto, bez akcyzy) głównych nośników energii dla gospodarstw domowych w Polsce, lata 2018–2023 (dane kwartalne)

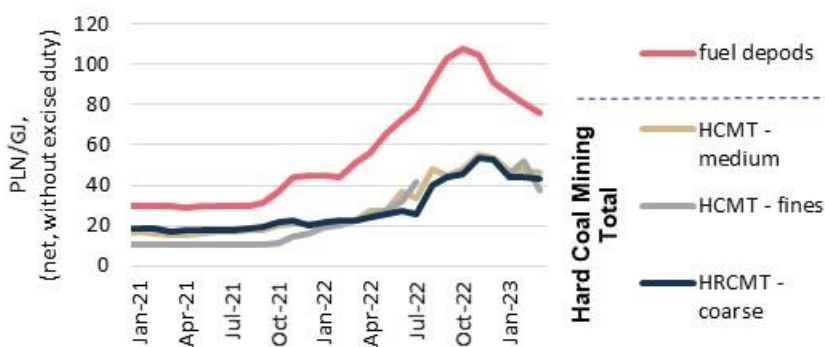


Fig. 7. Average prices (net, excluding excise taxes) for sales of thermal coal grades to other domestic customers; HCMT – hard-coal mining total

Source: Stala-Szlugaj 2023 (supplemented, data: ARE 2018–2023b)

Rys. 7. Średnie ceny (netto, bez akcyzy) sprzedaży sortymentów węgla energetycznego dla Pozostałych Odbiorców Krajowych; HCMT – Hard Coal Mining Total

averaged PLN 1,200/tonne (PGG 2022a). This contributed to slowing down the increase in coal sales prices by domestic producers (Fig. 7).

Despite the guaranteed purchase price of coal and the unified price of coal introduced by one domestic producer, the following months brought a strong increase in the price of this commodity at fuel depots. Customers encountered difficulties in purchasing coal. The sale of coal carried out by the online store of Poland's largest coal company, encountered many problems (PGG 2022b). Among other problems, there were (PGG 2022b; Wojsa 2023) hacker attacks, shopping bots and fake websites of this store, which introduced even more chaos.



In order to facilitate the distribution of domestic and imported coal, the sale of coal according to the law ([Act 2022b](#)) could also be taken over by municipalities. According to this law ([Act 2022b](#)), the sales price (gross) of coal for households under preferential purchase could not be higher than PLN 2,000 / tonne.

A total of 99% of municipalities, or 2,450 municipalities, participated in the coal distribution system ([MSA 2023](#)). A total of more than 2 million tons of imported coal and 1.3 million tons of domestic coal were distributed to municipalities and intermediary coal entities ([MSA 2023](#)).

Despite the measures, coal prices at fuel depots peaked in the fourth quarter of 2022, at which time, coal was sold at an average of PLN 101/GJ. After the market saturated, in the first quarter of 2023, coal sales prices at fuel depots fell by 20% and speculative price increases were halted.

In the case of natural gas prices for households, the government (as part of the inflation shield) introduced 0% VAT until the end of 2022 ([MF 2023](#)). In January 2022, a law came into force ([Act 2022c](#)), which included the introduction of tariff protection for households against natural gas price increases. As a result, the price increase for this fuel observed in 2021 was halted in 2022 ([Fig. 6](#)). In December 2022, a similar law ([Act 2022d](#)) was also passed to protect natural gas consumers in 2023. This translated into a continuation of the downward trend in natural gas prices for households in the first quarter of 2023.

Comparing hard coal and natural gas prices in 2022, it can be seen that the third and fourth quarters of 2022, hard-coal prices at fuel depots were rising at a rapid pace and were higher than natural gas prices by PLN 13–16/GJ, and amounted to PLN 81–101/GJ ([Fig. 7](#)). In comparison, natural gas prices were then in the range of 65–88 PLN/GJ. In the first quarter of 2023, the prices of these two energy carriers had already reached a similar level of around 80 PLN/GJ.

## Summary and conclusions

The turmoil from the energy commodities market, which prevailed in 2021 and 2022 mainly as a result of Russian policy, strongly affected Europe, including Polish households. Polish households felt the biggest price shock in 2022. The greatest acceleration of hard-coal price increases at fuel depots was especially observed in the summer months, when some sellers began to artificially drive up prices. Rapidly rising hard-coal prices caused panic among buyers, who started looking around for winter fuel earlier than usual. The tense situation and chaos was further conquered by hacker attacks, shopping bots and fake store websites from one of the country's coal producers.

As a result of the uncertainty of hard coal and natural gas supplies, some domestic households have decided to switch to another energy carrier. Among other things, this is evident in applications submitted for subsidies to replace old low-efficiency stoves. Under the clean air priority program, the number of applications submitted for subsidies for heat pumps (including both air and ground) increased 2.3 times in 2022 ([CP 2023](#)) compared to 2021. After the

first half of 2023, 46,600 applications were submitted, and the number increased by 40% in comparison with the first half of 2022. For applications submitted for photovoltaic installation in 2022, the number increased year-on-year by 40% (to 42.1 thousand applications), and in the first half of 2023, it increased year-on-year by 20% (to 28.1 thousand applications). Thus, Russia's triggering of the energy crisis has accelerated the change in the structure of heating boilers in Polish households.

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## Gospodarstwa domowe w Polsce a nośniki energii: rok po inwazji Rosji na Ukrainę z lutego 2022

### Streszczenie

Wykorzystanie przez Rosję jednego z surowców energetycznych jako narzędzia nacisku politycznego w roku 2021 zdestabilizowało gospodarki wielu państw europejskich. Kryzys energetyczny został pogłębiony wybuchem wojny Rosji z Ukrainą w lutym 2022 r., kiedy w odpowiedzi m.in. państwa UE wprowadziły sankcje na surowce energetyczne z Rosji. Sytuacja ta wpłynęła także na polskie gospodarstwa domowe. Rosja do tego czasu była głównym dostawcą węgla kamiennego i gazu ziemnego do Polski. Sza-

cuje się, że niepewnością dostaw węgla kamiennego na sezon grzewczy 2022/2023 zagrożonych zostało 3,8 mln gospodarstw domowych. Artykuł przedstawia analizę popytu i podaży głównych kopalnych surowców energetycznych zużywanych przez polskie gospodarstwa domowe w celach grzewczych. Omawiając podaż danego surowca, zaprezentowano zarówno jego produkcję krajową, jak również import. Niemożność zwiększenia krajowej produkcji węgla kamiennego dla gospodarstw domowych w krótkim okresie czasu (jest to proces długofalowy) skutkowało wprowadzeniem importu interwencyjnego. W przypadku importu zwrócono uwagę na konieczność zmiany dostawców, jak również dróg importu. W artykule przeprowadzono także analizę cen głównych nośników energii dla krajowych gospodarstw domowych w okresie od stycznia 2018 do marca 2023 r. Szybko rosnące ceny węgla kamiennego na składach opałowych w III i IV kwartale 2022 r. były wyższe od cen gazu ziemnego dla gospodarstw domowych o 13–16 PLN/GJ i wyniosły 81–101 PLN/GJ. Dla porównania ceny gazu ziemnego zawierały się wówczas w zakresie 65–88 PLN/GJ. W I kwartale 2023 r. ceny tych dwóch nośników energii uzyskały już zbliżony poziom (rzędu 80 PLN/GJ).

**SŁOWA KLUCZOWE:** gospodarstwa domowe, węgiel, gaz ziemny, wojna rosyjsko-ukraińska w 2022, Polska

