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KATARZYNA STALA-SZLUGAJ*

The development of the market of qualified coal fuels in Poland

Introduction

Due to the availability of domestic hard coal deposits, this resource has been the main source of energy used by the small consumer sector in Poland for years. According to the Central Statistical Office of Poland (GUS – Zużycie energii… 2012, 2014), the share of households utilizing this fuel amounted to 41–43%, and the average consumption was in the range of 2.9–3.3 t per year in household. The consumers in this sector consume approx. 12–14 million t of this fuel per year (GUS – Zużycie paliw…2004–2016).

The concern about air quality and low costs of heat generation influence the increase in the popularity of qualified coal fuels and dedicated high-efficiency retort boilers every year.

The aim of this article is to discuss the changes that have been observed on the market of qualified coal fuels over the last few years. These changes are related to the markets of both the producers and the products they offer.

* Ph.D. Eng., The Mineral and Energy Economy Research Institute, Polish Academy of Sciences, Krakow, Poland; e-mail: kszlugaj@min-pan.krakow.pl

1. Overview of the early period of production of qualified coal fuels

Qualified coal fuels are produced from selected lots of high-calorific coal. They are characterized by strictly defined repeatable physico-chemical parameters. Their distinguishing features are: low sulphur content, ash content, and agglomerating capacity, and they are dedicated for use in modern, low-emission retort boilers.

The origins of qualified coal fuels go back to the first half of the 1990s (Zuzelski and Kurczabiński 2007; Korzeniowski et al. 2012). At that time, as a result of raising fuel coal prices by coal mining companies, while low-efficiency coal boilers were being used, with low prices of natural gas and heating oil, the costs of heating households with coal and gas were similar. As a consequence, some households abandoned coal-fired heating in favor of natural gas. Taking into account the concern about air quality, technical solutions were being sought to produce heat at low cost while reducing low emission (the use of low-efficiency coal boilers contributed to increased emissions). Subsequently, automated coal boilers with retort furnace (stoker furnace) were introduced to the market. For the first time, these new generation boilers were launched in Poland within the "EC THERMIE 1993 – Clean Coal Technologies" Program.

In terms of grain class (5–25 (30) mm), these fuels were equivalent to pea coal. At a later time, the name "eco-pea coal" was introduced. (Eco-pea coal is a trade name. The "eco" part was related to low values of parameters responsible for pollution, and "pea coal" was associated with this fuel's grain class). Generally, eco-pea coal is treated as environmentally friendly ecological fuel. However, in order to call a product an ecological fuel, it should be awarded the so-called "ecological safety sign" after proper testing by accredited laboratories.

Due to their design, automatic retort boilers require the right type of fuel. In the first years, the production of qualified fuels was limited to two major coal mining companies: Katowicki Holding Węglowy SA (abbreviated as: KHW) and Kompania Węglowa SA (abbreviated as: KWSA). Modern coal boilers were gaining the small customer market share slowly, and therefore the demand for dedicated fuel wasn't large. For example, in 2003 Kompania Węglowa SA sold 200,000 t of qualified fuels (Miśka et al. 2007), and in 2005 sales increased to 500,000 t. Later on, the group of eco-pea coal producers was joined by another company, Południowy Koncern Węglowy (current name: Tauron Wydobycie SA).

The coal mining companies began production of another type of eco-coal, the so-called "eco-coal fines." Eco-coal fines is a mixture of coal fines and a by-product created while sifting coal to achieve proper eco-pea coal grain size (Mirkowski at al. 2010). In the years 2007–2011 (Fig. 1), the total production of these types of eco-coal by the domestic hard coal mining sector increased to 0.8–1.1 million t/year. Since 2012, there has been a systematic decline in their production by the hard coal mining sector.

One of the reasons for the decline were mild winters during the last few years. Another reason is the growing share of eco-pea coal production by the companies called "fuel de-

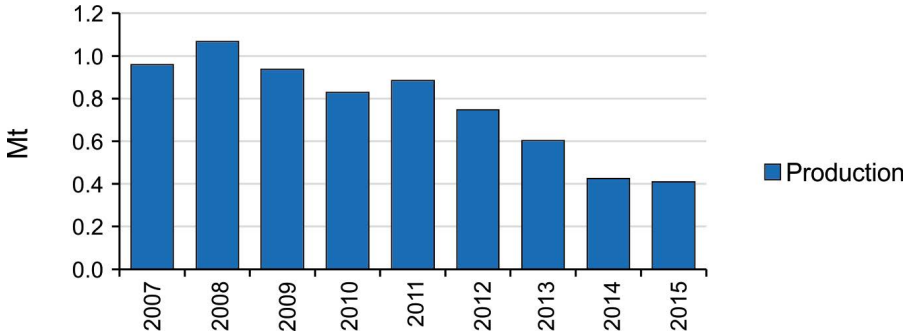


Fig. 1. Hard coal mining sector in Poland – total production of eco-coal
Source: ARP data

Rys. 1. Sektor Górnictwa Węgla Kamiennego w Polsce – produkcja ekosortymentów ogółem

pots" in the article. Initially, sales of eco-pea coal (similarly to other sizes of steam coal for individual consumers) were carried out by Authorized Sellers of coal (abbreviated AS) representing individual coal mining companies. In the years 2015–2016, with growing demand for this kind of fuel, an increase in the number of fuel depots was noted (especially ones owned by major Authorized Sellers of coal mining companies). These companies began producing their own blends of eco-pea coal as well as restricted products under licenses from certain coal mining companies. In addition, the more entrepreneurial companies, seeing potential increase in profits from the sale of eco-pea coal, invested in their own machinery park and started producing eco-pea coal on their own, under their own brands. However, there is no available statistics of qualified coal fuels produced by companies other than domestic coal mining enterprises.

In terms of quality parameters, eco-coal produced by the domestic hard coal mining sector is characterized by constant parameters (Fig. 2). In the years 2007–2015, the calorific

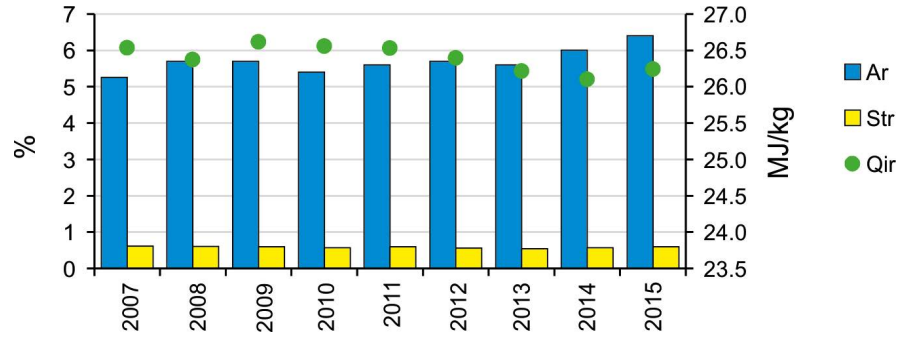


Fig. 2. Hard coal mining sector in Poland – quality parameters of qualified coal fuels
Source: ARP data

Rys. 2. Sektor Górnictwa Węgla Kamiennego w Polsce –
parametry jakościowe kwalifikowanych paliw węglowych

value of these fuels was in the narrow range of 26.1–26.5 MJ/kg, the ash content did not exceed 6.4% A_i^r, and the sulphur content was in the range of 0.5–0.6% S_i^r.

2. Producers of qualified coal fuels

Currently (as of the end of 2016), hard coal supply to Polish customers is ensured by both domestic and foreign producers. On the basis of multiannual observations of the market, five groups of producers of eco-pea coal have been identified, broken down by the origin of utilized coal (Fig. 3).

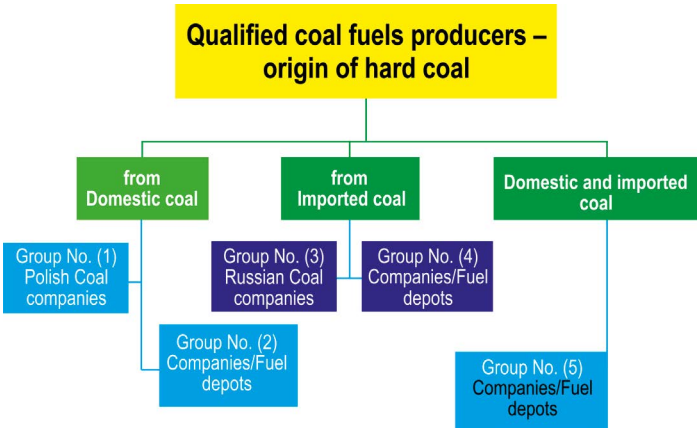


Fig. 3. Producers of qualified coal fuels broken down by the origin of hard coal
Source: own study

Rys. 3. Podział producentów kwalifikowanych paliw węglowych wg źródła pochodzenia węgla kamiennego

Group No. (1) represents the first and oldest producers of qualified coal fuels based on domestic resources. At the end of 2016, this group was represented by coal mining companies such as: Polska Grupa Górnicza (previously: Kompania Węglowa SA), Katowicki Holding Węglowy, Tauron Wydobycie, and Węglokoks Kraj. Eco-pea coal produced by these companies has a well-established position in the Polish market of qualified coal fuels, and some of them have trademarks registered in the Patent Office. It should be noted that Katowicki Holding Węglowy, in the absence of own coal with proper quality parameters, supplemented its product with coal from other (including foreign) producers.

Group No. (2) includes fuel depots or companies which also produce eco-pea coal on the basis of domestic coal. This group is most often represented by companies that are Authorized Sellers of domestic coal producers. They now produce their own eco-pea coal blends as well as products under licenses from coal mining companies. These products often have

their individual names. Some of them have trademarks as well. It has also been noted that some companies changed their focus of operations from selling different coal sizes produced by domestic coal mining companies to producing and selling their own brands (mainly eco-pea coal). This group is represented by companies such as: Chudak, Ecocarbo, Imex-Piechota, PH Janina, Prestige, Polski Węgiel Dystrybucja, Rastar, SAM-BUD-ROL, Uniban, etc.

The two following groups, (3) and (4), consist of companies that base their eco-pea coal production on imported coal. Group No. (3) includes coal mining companies controlled by Russian coal producers with offices in Poland, i.e.: KTK Polska and SUEK Polska. Group No. (4) consists of companies which import coal as a part of their operations, e.g. Barter Coal (a subsidiary of Barter), Energo, and Chemicals.

The last group includes companies whose products are based on both domestic and imported coal. These are companies such as: Atex, Bartex, Ekogroszek Centrum, Synenergio Groups, Tani Opał, etc. Producers included in this group often offer a wide variety of qualified coal fuels with different quality parameters.

The above breakdown is based on multiannual analyses of the small customer market in Poland. It shows data as of the end of 2016 and is based on publicly available information published by individual companies.

The quality of eco-pea coal offered by different groups of producers of qualified coal fuels also varies. The diagrams in Fig. 4 show variations in calorific value (Q_i^r) in terms of ash content (A_i^r) (Fig. 4a) and sulphur content (S_i^r) (Fig. 4b).

In terms of calorific value (Q_i^r), almost all of the producer groups mainly offer eco-pea coal with values in the range of 24–26 MJ/kg. The most commonly available eco-pea coal's ash content ranges between 5% and 10% A_i^r (Fig. 4a). In terms of sulphur content, the offered eco-pea coal usually contains 0.4–1.0% S_i^r (Fig. 4b).

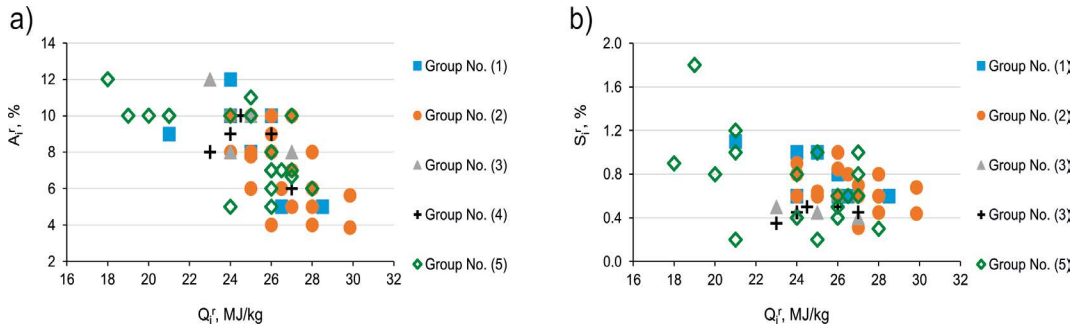


Fig. 4. Comparison of quality parameters of eco-pea coal broken down by producer group
a) Q_i^r and A_i^r, b) Q_i^r and S_i^r
Source: own study on the basis of multiple sources

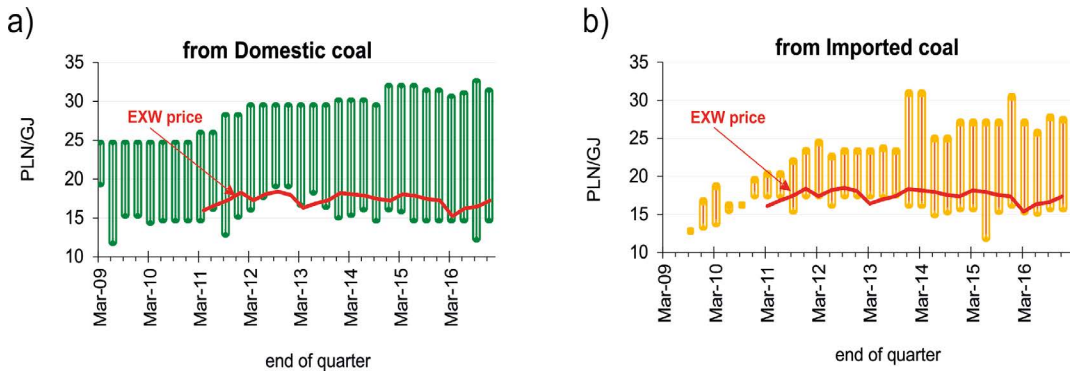
Rys. 4. Porównanie parametrów jakościowych ekogroszków według grup producenckich
a) Q_i^r i A_i^r, b) Q_i^r i S_i^r

3. Price offers of eco-pea coal in Poland

For many consumers, one of the most important criteria for purchasing a particular coal fuel is its price. Fig. 5 shows the price range (net–excl. VAT and excise tax) of eco-pea coal types offered at fuel depots. The price level is given for the end of each quarter. Due to the varied quality of offered fuel, prices have been converted to prices per energy unit. The variations in calorific values of offered pea coal in each quarter are shown in Fig. 6.

The price offers of eco-pea coal based on domestic coal in the individual quarters of the years 2009–2016 ranged from 12 to 33 PLN/GJ. By mid-2013, the difference between minimum and maximum price of eco-pea coal was usually around 10 PLN/GJ. In the following quarters, the price range of eco-pea coal widened. The prices of eco-pea coal are strongly correlated with the prices of domestic steam coal which in turn depend on the situation on international coal markets and on other energy resource markets (e.g. Grudziński 2012; Lorenz 2014). The increasing price spread of these fuels can be linked to the growing number of fuel depots that produce their own qualified fuels.

Additionally, red lines on the diagrams indicate selling prices (ex-mine) of coarse grain sizes for the entire hard coal mining sector. These prices apply to coal offered to the group defined as "other domestic customers" by Authorized Sellers, and does not include shipping costs to the buyer. The "other customers" group consists of individual consumers (households), agricultural and horticultural holdings, small-scale industry, state administration, healthcare, and a number of undefined consumers. Compared to the prices of coarse grain size (ex-mine), the price offers for eco-pea coal are usually higher by a dozen or so PLN.



EXW price – sales price (ex-mine) of coarse grain sizes offered to other domestic customers by Authorized Sellers

Fig. 5. Qualified coal fuels prices on fuels depots in Poland, years 2009–2016
a) from Domestic production, b) from imported coal
Source: own study on the basis of the data of fuel depots and ARP – Ceny… 2012–2017

Rys. 5. Ceny kwalifikowanych paliw węglowych w Polsce, lata 2009–2016
a) z produkcji krajowej, b) z węgla z importu

The price offers of imported eco-pea coal compared to the prices of domestic products for average consumers are much more attractive. In the years 2009–2016, they varied in the range of 12–31 PLN/GJ. Compared to the maximum price of domestic eco-pea coal, imported products were usually cheaper by a few PLN.

However, it should be borne in mind that average individual customers are largely guided by prices expressed in PLN/t rather than per energy unit. With such approach to fuel prices, customers often choose the cheapest offer at a given fuel depot.

By looking into the distribution of calorific values of offered eco-pea coal (Fig. 6), it can be noted that it reflects the quality of original coal. In the case of domestic coal, the prevalence of offers of coal with calorific value within the range of 24–26 MJ/kg is related to the fact that the producers of qualified fuels purchase coal mainly from Katowicki Holding Węglowy and Kompania Węglowa. The offers of eco-pea coal with calorific value around 21 MJ are mostly related to a type of eco-pea coal offered by Tauron Wydobycie.

Imported eco-pea coal with calorific value over 23 MJ/kg is associated mainly with resources imported from the Russian Federation and Colombia (ARP data). On the other hand, fuels with calorific value of 19–21 MJ/kg are based on coal imported from the Czech Republic.

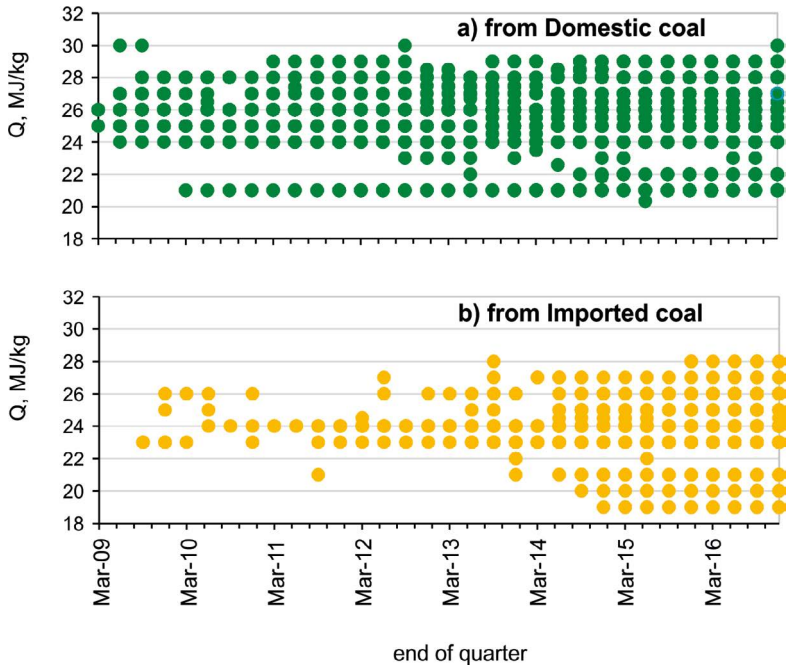


Fig. 6. Calorific value of qualified coal fuels on fuel depots in Poland, years 2009–2016
a) from Domestic coal, b) from Imported coal
Source: own study on the basis of the data of fuel depots and ARP data

Rys. 6. Wartość opałowa kwalifikowanych paliw węglowych na składach opałowych w Polsce, lata 2009–2016;
a) z produkcji krajowej, b) z węgla z importu

4. Sales of qualified coal fuels

Currently (as of the end of 2016), the sale of coal, including qualified coal fuels, is being carried out in several ways.

The first and most popular one is purchasing a particular fuel directly at a fuel depot. Both domestic coal mining companies and enterprises which import coal from abroad have networks of their authorized representatives. These networks are distributed irregularly, focusing mainly around major cities in Poland (Fig. 7).

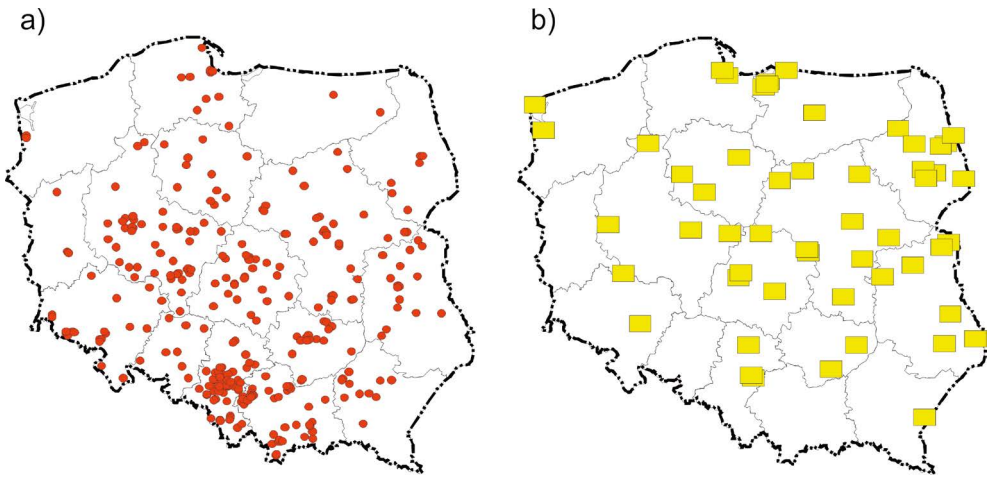


Fig. 7. Networks of authorized coal sellers of domestic coal mining companies (a) and importers (b)
Source: Stala-Szlugaj 2016, supplemented

Rys. 7. Sieć autoryzowanych sprzedawców węgla krajowych spółek węglowych (a) oraz importerów (b)

In the case of domestic producers, the largest accumulation of authorized sellers is located near the Silesian mines. On the other hand, the largest number of distribution centers for imported coal is located in the north-eastern part of Poland. In the cases of the latter ones, it can be linked to coal imports by rail. Geographically, the largest stream of imported coal crosses the border at railway crossings in this part of the country (e.g. Stala-Szlugaj 2012, 2013, 2014a–b, 2016).

Another form of eco-pea coal trade is online sales. The growing popularity of shopping for any products online has caused that coal dealers have also adapted to the market's needs. Over the past two years, a growing number of fuel depots' offers has also been observed where products are sold at a single price for any customer regardless of their location. (The producers include the cost of delivery in the offered price.) These offers come from companies trading in imported eco-pea coal (as well as other coal sizes) as well as those selling products based on domestic resources. In the second half of 2016, an option to purchase eco-

pea coal online was introduced by the two leading producers of these fuels, i.e. Katowicki Holding Węglowy (July 2016) and Kompania Węglowa (September 2016).

Yet another form of trading involves sale of eco-pea coal at retail construction, gardening, and agricultural stores, or even at gas stations. The last form–the most traditional one–is the possibility of purchasing these fuels directly at a mine owned by a domestic producer.

5. Solid fuel boilers market in Poland

When discussing the market for qualified coal fuels, it is impossible not to mention the market of coal boilers. For an average household user, boilers can be traditional (with manual fuel feeding) or with automatic feeder (almost maintenance-free) (Matuszek 2006). However, when taking into account the combustion process, the direction of fuel and air flow is relevant (low and high combustion boilers). In the case of retort boilers with automatic fuel feeder (i.e. those in which eco-pea coal discussed in this article is used), both fuel and air are fed from the same side (the so-called high combustion). Thanks to such organization of the combustion process, degassing products containing heavy hydrocarbons are directed to a zone where the conditions allow them to burn completely.

According to a poll conducted by the Institute of Environmental Economics (IES – Efektywność… 2016), out of 3.8 million coal stoves in Poland, 80% are hand-fired boilers. The share of automatic retort boilers is estimated at 18.5% (approx. 700 thousand units).

The boiler market in Poland is developing dynamically. On the basis of the data from the heating equipment market including manufacturers belonging to the Association of Manufacturers and Importers of Heating Appliances (SPIUG), covering over 90% of such companies, a diagram has been prepared to illustrate the boiler market in Poland in the years 2010–2015 (Fig. 8).

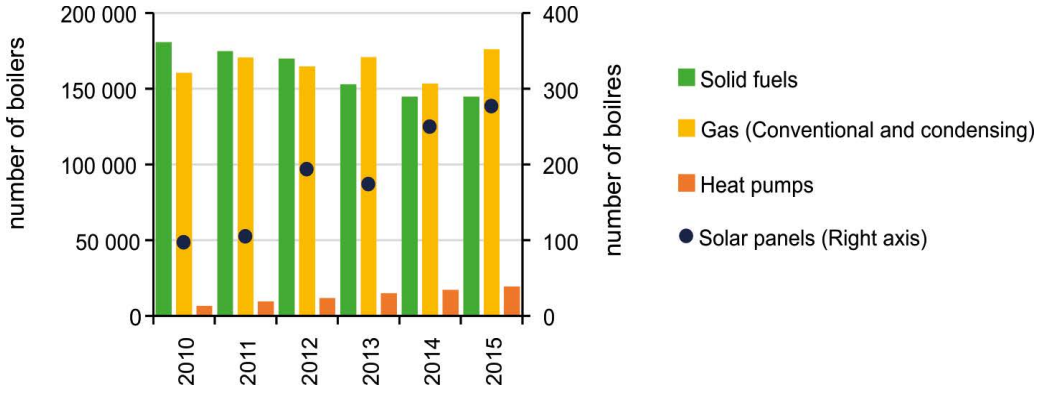


Fig. 8. Small boiler market in Poland for various energy carriers, 2010–2015
Source: own study on the basis of multiple sources (Ile i jakich…2016)

Fig. 8. Rynek małych kotłów w Polsce na różne nośniki energii, lata 2010–2015

In the years 2010–2015, the annual sale of solid fuel boilers (including coal-fired ones) in Poland was in the range of 145–181 thousand units. This number includes the total sales of boilers of all types. The share of solid fuel boilers in the total number of boilers sold on Polish market was approx. 49–52%. The stabilization of sales of solid fuel boilers since 2014 is associated with warmer winters. Mild winters contributed to fewer failures of operated heating appliances, thus delaying the need to purchase new boilers. In the opinion of SPIUG regarding solid fuel boilers, in the following years an increase should be expected in the sales of biomass boilers and low-emission coal-fired boilers.

The EU Commission Regulation No. 2015/1189 sets out the requirements for launching sales and use of solid fuel boilers with rated thermal capacity of 500 kW or less. The values presented in this regulation correspond to the EU Ecolabel criteria for class 5 (the highest class) boilers. In the case of Poland, they must comply with the PN-EN 303-5: 2012 standard. In Poland, in 2016, a regulation of the Minister of Development on the requirements for solid fuel boilers with a capacity of maximum 500 kW was proposed (Projekt 2016/09/23). This draft has already undergone public consultation and has been submitted for further discussions. The regulation specifies emission limit values that must be met by solid fuel boilers and that comply with the PN-EN 303-5:2012 standard. The proposed regulation is set to enter into force on October 1, 2017. Therefore, in the coming years, an increase in the demand for qualified coal fuels can be expected.

The so-called "anti-smog law", an amendment to the Law on Environmental Protection (Ustawa… 2015), may cause a certain in the demand for qualified coal fuels. The decision to restrict or ban the use of solid fuel burning appliances is taken by local authorities. The first voivodeship which has already adopted a resolution on the introduction of restrictions and bans on the operation of fuel combustion plants was Małopolskie Voivodship (Uchwała... 2017a), the second one – Śląskie Voivodship (Uchwała... 2017b). In the case of Małopolska one of the assumptions is the ban on the use of stoves and fireplaces that do not meet certain emission standards. In the case of Silesia – the resolution does not prohibit the burning of coal and wood and under certain conditions allows smoking in fireplaces.

Summary

Qualified coal fuels were created as a result of a research for technologies allowing for cheap heat generation with minimized low emission. In the process of coal combustion, a number of pollutants can be created due to the presence of polluting components in coal (e.g. Klojzy-Karczmarczyk and Mazurek 2013; Dziok et al. 2015; Klojzy-Karczmarczyk et al. 2016a, 2016b; Kosa and Kicinska 2016).

Currently, the production of qualified coal fuels (the so-called "eco-pea coal") in Poland is not limited to domestic coal mining companies. In response to the growing demand for these fuels, smaller businesses (mostly dedicated to trading coal from major coal mining companies) have also engaged in production of eco-pea coal under licenses from large

coal mining companies, and some of them created their own blends as well. In the years 2007–2015, the whole hard coal mining industry's eco-coal production was in the range of 0.4–1.1 million t/year. The low level of production of eco-pea coal in the years 2014–2015 should be associated with the aforementioned growing production by smaller entrepreneurs.

Among the current producers of eco-pea coal in Poland, five groups can be identified, differing in the origin of utilized coal. The growing number of eco-pea coal producers contributes to the increase in these fuels' price range. The difference between maximum and minimum price offer is a dozen or so PLN/GJ. In the years 2009–2016, the prices of eco-pea coal produced on the basis of domestic coal were changing within a range of 12–33 PLN/GJ, and for the product based on imported raw material–between 12 and 31 PLN/GJ.

The European Union pays special attention to the broadly understood environmental protection, and–as a result–the member states focus on activities such as ecological education, reclamation of post-mining areas, and wildlife protection (e.g. Pawul and Sobczyk 2011; Sobczyk at al. 2012). Rising ecological awareness of the society makes the consumers more often pay attention to the quality parameters of coal. High-quality qualified coal fuels combusted in high-efficiency retort boilers can be a way to reduce low emission in Poland. The proposed regulation (Projekt 2016/09/23) of the Minister of Development on the sale of class 5 solid fuel boilers may also contribute to the increase in popularity of and demand for qualified coal fuels.

The so-called "anti-smog law" (Ustawa… 2015) may affect the amount of consumption of solid fuels, including qualified coal fuels. The decision to restrict or prohibit the use of these fuels is dependent on local authorities, and they do not need to ban the burning of solid fuels and especially coal.

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ROZWÓJ RYNKU KWALIFIKOWANYCH PALIW WĘGLOWYCH W POLSCE

Słowa kluczowe

kwalifikowane paliwa węglowe, ekogroszek, gospodarstwa domowe, ogrzewanie

Streszczenie

Celem artykułu jest omówienie zmian jakie zaobserwowano na przestrzeni ostatnich kilku lat na rynku kwalifikowanych paliw węglowych (tzw. ekogroszków). Zmiany te odnoszą się zarówno do rynku producentów, jak również oferowanych przez nich produktów.

Kwalifikowane paliwa węglowe powstają z wyselekcjonowanych partii wysokokalorycznego węgla. Cechują się ściśle określonymi, powtarzalnymi parametrami fizykochemicznymi (niską zawartością: siarki, popiołu oraz zdolności spiekania) oraz dedykowane są nowoczesnym, niskoemisyjnym kotłom retortowym.

Na podstawie wieloletnich obserwacji wyróżnionych zostało pięć grup producentów kwalifikowanych paliw węglowych, zróżnicowanych pod względem źródła pochodzenia węgla. Początkowo produkcja ekogroszków w Polsce ograniczała się tylko do rodzimych spółek węglowych. Jednakże w odpowiedzi na rosnące zapotrzebowanie na te paliwa, produkcją omawianych paliw zajęli się także mniejsi przedsiębiorcy (najczęściej zajmujący się handlem węglem głównych spółek węglowych). Część z nich zajęła się produkcją ekogroszków na licencji dużych spółek węglowych, a niektórzy z nich – także własnych mieszanek.

W latach 2007–2015 produkcja ekosortymentów całego sektora GWK mieściła się w zakresie 0,4–1,1 mln ton/tok. Pod względem wartości opałowej prawie we wszystkich wyróżnionych grupach producentów, dominuje oferta ekogroszków mieszczących się w zakresie 24–26 MJ/kg. Pod względem zawartości popiołu przeważają ekogroszki z zawartością 5–10% A_i^r oraz 0,4–1,0% zawartością siarki.

Ceny ekogroszków oferowanych na składach opałowych zróżnicowane są regionalnie i zbliżone do ofert cenowych sortymentów grubych. Rosnąca liczba producentów ekogroszków przyczynia się do wzrostu rozpiętości cenowej tych paliw. Różnica między maksymalną a minimalną ofertą cenową wynosi kilkanaście zł/GJ. W latach 2009–2016 ceny ekogroszków powstałych na bazie rodzimego węgla zmieniały się od 12 do 33 zł/GJ, a na bazie importowanego surowca – od 12 do 31 zł/GJ.

THE DEVELOPMENT OF THE MARKET OF QUALIFIED COAL FUELS IN POLAND

Keywords

qualified coal fuels, eco-pea coal, households, heating

Abstract

The aim of this article is to discuss the changes that have been observed on the market of qualified coal fuels (the so-called eco-pea coal) over the last few years. These changes are related to the markets of both the producers and the products they offer.

Qualified coal fuels are produced from selected lots of high-calorific coal. They are characterized by strictly defined repeatable physico-chemical parameters (low sulphur content, ash content, and agglomerating capacity) and they are dedicated for use in modern, low-emission retort boilers.

On the basis of multiannual observations, five groups of producers of qualified coal fuels have been identified, broken down by the origin of utilized coal. Initially, the production of eco-pea coal in Poland was limited to domestic coal mining companies only. However, in response to the growing demand for these fuels, smaller businesses (mostly dedicated to trading coal from major coal mining companies) have also engaged in production of these fuels. A part of them started producing eco-pea coal under licenses from large coal mining companies, and some of them created their own blends as well.

In the years 2007–2015, the whole hard coal mining industry's eco-coal production was in the range of 0.4–1.1 million t/year. In terms of calorific value, almost all of the producer groups mainly offer eco-pea coal with values in the range of 24–26 MJ/kg. The ash content of the offered eco-pea coal is usually 5–10% A_i^r, and sulphur content–in the range of 0.4–1.0%.

The prices of eco-pea coal at fuel depots vary by region and are close to the price offers of coarse grain sizes. Compared to sales prices (ex-mine) of coarse grain sizes intended for the market of other domestic customers, they are usually higher by a dozen or so PLN/GJ. The growing number of eco-pea coal producers contributes to the increase in these fuels' price range. The difference between maximum and minimum price offer is a dozen or so PLN/GJ. In the years 2009–2016, the prices of eco-pea coal produced on the basis of domestic coal were changing within a range of 12–33 PLN/GJ, and for the product based on imported raw material–between 12 and 31 PLN/GJ.