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Analysis of the readiness of Silesian city inhabitants for decarbonisation

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Abstract
Rapidly advancing climate change and environmental degradation are nowadays the key challenges of the modern world and, therefore, a threat to Europe. According to the European Green Deal, by 2050, European Union countries will achieve zero net greenhouse gas emissions, which is directly connected with significantly reducing or completely stopping the use of fossil fuels for energy purposes. Poland, and especially the inhabitants of Silesia, must face a change concerning their cultural heritage and their way of life. The aim of this article is to answer the question of whether the inhabitants of the Silesian agglomeration are ready to resign from coal-based energy. Are they aware of the changes in their closest environment related to decarbonisation. This article presents the results of a survey carried out in order to identify the attitude of Silesian cities' inhabitants towards decarbonisation. The study was carried out by means of an online survey using Google Forms and was addressed to the inhabitants of cities in the central part of the Silesian Voivodeship.

Keywords
decarbonisation, European Green Deal, environmental degradation, energy, society

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Introduction

Decarbonisation is the process of systematic reduction of carbon dioxide (CO_2) emissions into the atmosphere with the aim of eventually stopping these emissions completely. It is a response to the harmful effects of CO_2 on the environment and is related to the environmental policy applied by some countries, especially the European Union countries. It involves a series of measures aimed at reducing greenhouse gas emissions, which are the main cause of global warming. It involves changing social behaviour and transforming the economy to zero- or low-carbon energy sources and technologies (Jankowska, 2016; Cernecky et al., 2015). Therefore, the decarbonisation of Poland seems inevitable, considering progressive climate change and the European Union policy. According to the European Green Deal, by 2050, EU countries will reach zero net greenhouse gas emissions, which is directly related to a significant reduction or complete cessation of the use of fossil fuels for energy purposes. As one of the EU countries with the highest share of fossil fuels in the energy mix, Poland faces a serious challenge related to the energy transition already in progress. In 2021, the government and trade unions signed a social agreement on the phasing out of the hard coal sector in Poland. This process should end in 2049 (Billig, 2022; Kancelaria Senatu, 2020). Analysing the areas of Poland where the effects of the European Green Deal will be most noticeable, the area of the Silesian Voivodeship, with its industrial heritage, will in the near future result in the occurrence of numerous challenges in the economic sphere on a large scale (Midor, Biały, Rogala-Rojek and Matusiak, 2021; Hąbek, 2014). The model of professional activity of the region's inhabitants, many of whom are employed by large employers, such as numerous industrial plants, in particular in the mining, energy and steel industries, will have to be transformed. Breaking the opposition of mining communities to a deep transformation of the sector will therefore be an important factor in facilitating effective transformation (Departament Rozwoju Regionalnego, 2021; Wąsiński, 2018)

Therefore, the aim of this article is to try to answer the basic question of whether the inhabitants of Silesian cities with strong connections to the mining industry are ready to resign from the energy generated from hard coal?

Decarbonisation - global feeling

The contemporary global energy mix is changing from fossil fuels to renewable energy sources. These changes are expected to help develop renewable energy sources, improve energy efficiency, reduce emissions, and improve the quality of life for people around the world (Gawlikowska-Fyk, 2011 and 2020).

The issues of support for climate improvement measures have already been emerging around the world for many years. In 2019, the largest climate protests in history took place. Millions of people marched in the streets, demanding immediate action to counteract climate change and reduce pollution. It is estimated that in 185 countries where demonstrations took place, protesters put pressure on governments and businesses to deal with urgent environmental issues. For instance, rising sea levels in the Solomon Islands, toxic waste in South Africa, air and plastic pollution in India and the expansion of coal mining in Australia (Laville and Watts, 2019). The effect of the 2020 economic shutdown caused by the Covid 19 pandemic has also been noted. In China and India, for example, the sky over industrial centres has cleared for the first time in many years, reflecting the environmental damage and pollution that has become the norm for much of the world's population (Sommer, 2020), (Pathak, 2020). A shift in consumer attitudes can be seen with increasing frequency. More and more companies worldwide are recognising that they need to adopt a strategy of aiming for low emissions not only out of concern for the planet's future but also to increase customer loyalty and thus ensure their long-term profitability. There are increasingly visible shifts in people's feelings. For example, almost three-quarters of business respondents in the United States in a 2020 survey conducted by Deloitte (Deloitte, 2020) confirmed that their customers demand certification that the products they buy are made with the vast majority of energy derived from renewable sources. With a growing global community demanding action on climate change, many government institutions now have a mandate to take concrete action on setting carbon limits and passing green legislation.

The European Green Deal

Stopping progressive climate change requires radical, wide-ranging and large-scale implementation. One of these is the Paris Agreement, signed in 2015 by 194 countries and the European Union, which sets out a global action plan to limit global warming to below 2°C and aim to keep it at 1.5°C. The Paris Agreement became the foundation for the Green Deal (Deloitte, 2021)) policy adopted by the European Commission on December 11, 2019, with the primary goal of achieving a climate-neutral Europe by 2050. The European Green Deal envisages the implementation of a series of measures to transform Europe into a modern, resource-efficient and competitive economy, characterised by: zero net greenhouse gas emissions in 2050, separation of economic growth from resource consumption, and equal living standards in all regions. In the "European Climate Law"

presented by the European Commission on March 4, 2020, legislating for the targets set out in the European Green Deal, Member States were set a legally binding target of achieving zero net greenhouse gas emissions by 2050 and an intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels (Makowska and Wąsiński, 2019).

The European Green Deal includes 7 strategic objectives such as (Deloitte, 2021):

1. Energy efficiency
2. New renewable energy sources for complete decarbonisation of energy
3. Clean mobility
4 Competitive industry and closed-cycle economy
5. Development of infrastructure and connections between countries
6. Development of bio-economy and CO_2 sinks
7. Capture and storage of CO_2

As a member of the European Union, Poland faces an extremely difficult task in meeting the requirements of the European Green Deal regarding the decarbonisation of the economy.

The Silesian Voivodship in the context of decarbonisation

Figure 1 presents a bar chart of the structure of energy consumption in households per capita by individual energy carriers in 2018 in the European Union and in Poland. Analysing the chart, we notice a large discrepancy between the data measured in Poland and the EU. Polish households are dominated by energy generated thanks to hard coal, which is almost the lowest value of all fuels used in EU countries. In the EU countries, the consumption of energy from natural gas definitely dominates.

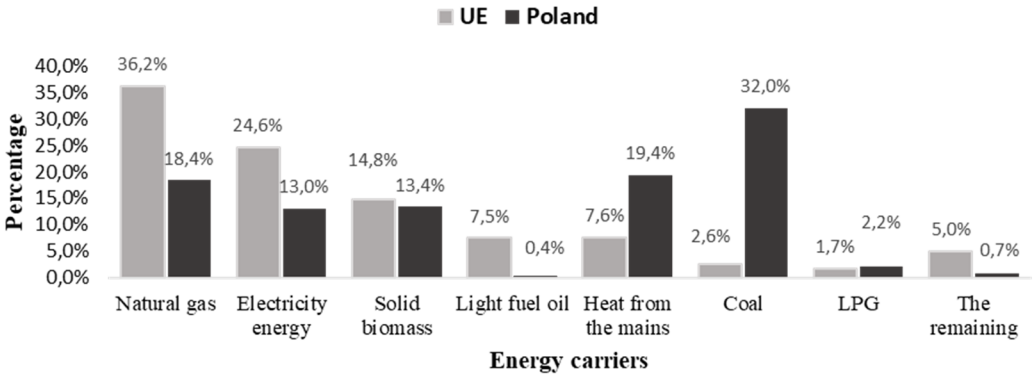

Fig. 1. Structure of energy consumption in households per capita according to individual energy carriers in 2018 in the EU and Poland. Source: (Dane GUS, Eneria, 2020).

The energy system is of key importance for Poland to achieve its climate objectives. Today's energy system is built on parallel value chains that closely link energy resources to specific end-use sectors (e.g. hard coal used for power and heat production). In addition, electricity and gas networks are managed and planned independently of each other. This operating model is technically and economically inefficient and leads to significant losses in the form of waste heat and low energy efficiency. The way forward for an efficient, affordable and profound decarbonisation of the economy is energy system integration, i.e. coordinated planning and operation of the system "as a whole", involving multiple energy carriers, infrastructure and consumption sectors.

Currently, the Silesian Voivodeship holds a high position on the energy map of Poland. In 2019, the region produced 21,556.8 GWh of electricity (3 m. relative to the other voivodeships). However, it should be noted that in most cases, the energy system is based on outdated (built in the 1970s and 1980s) large centrally managed power units. The main source of electricity is still hard coal, while the share of energy production from renewable sources is insignificant (4.4%) (Raport, 2020). Taking this into account, radical action is becoming necessary to change the energy mix in Poland, especially in Silesia (Kuzior, Postrzednik-Lotko and Postrzednik, 2022).

The alternatives to conventional energy sources are renewable sources. The theoretical potential of renewable energy sources in the Silesian Voivodeship results mainly from the geographical and climatic conditions of the region. In the area, the level of insolation is at an average level in comparison with other voivodeships. Conditions for the use of geothermal energy, wind and water energy are also average. In the case of wind conditions, the exceptions are, e.g., Silesian Beskid and Żywiec Beskid. Mountainous terrain also favourably influences the use of energy from rivers and falls. While approaching the issue of energy production from renewable sources, it should also be kept in mind that there are numerous limitations or spatial

impediments affecting the development of this sector in the region, such as, for example, the presence of areas under territorial protection, the presence of culturally and historically valuable areas, the presence of areas requiring reclamation (Departament Rozwoju Regionalnego, 2021).

Moreover, it cannot be forgotten that the model of professional activity of the Silesian inhabitants, in the vast majority, is based on employment by large employers, in particular from the mining, energy or metallurgical industries, which will have to be transformed (Midor, Kuzior, Płaza, Molenda, and Krawczyk, 2021). Breaking the opposition of mining sector groups to a deep transformation of the sector will therefore be an important factor in facilitating effective transformation (Bołoz and Midor, 2018; Brodny and Tutak, 2016).

Research methodology

This article presents the results of research aimed at finding out the attitude of Silesian cities' inhabitants towards decarbonisation. The research was carried out through the use of an online survey using Google Forms. The questionnaire was made available for the period from 09.05. to 22.06.2021 through a social networking service, indicating that it should be filled only by people living in the central part of the Silesian Voivodeship, where Poland's largest hard coal mining centre is currently located. The questions contained in the survey had a closed-form and were either single or multiple choice. The structure of the survey consisted of 7 questions, where the first one was a screening question in order to reach only respondents living in the central area of the Silesian Voivodship. The next questions concerned such issues as what areas of city development should be implemented, what is the origin of the energy source used in the household, what is the preferred energy source taking into account costs, and whether the transition out of fossil fuels is accepted, the direction of development of the region after decarbonisation. The questionnaire also included a metric in which questions about the place of residence and age of the respondent were asked (Świerzko, 2021).

The results of the survey were imported into a Microsoft Office Excel file for analysis of the responses. There were 121 respondents who answered the questionnaire. The place of residence of the respondents is shown in Figure 2. Residents of Gliwice and Chorzów (15%) and Zabrze and Katowice (12%) were the most numerous group. In the vast majority of cases, the questionnaire was filled in by the target group.

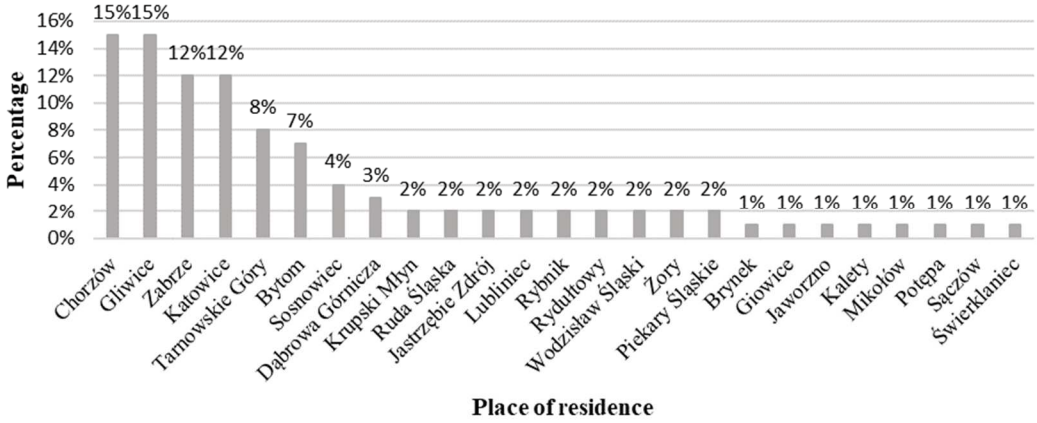

Fig. 2. The place of residence of the research group.
Source: Own elaboration

The age of the respondents is shown in Figure 3. The largest group were people in the age range of 18-24 years – 26%, and the smallest group were people under 18 years of age – 1%.

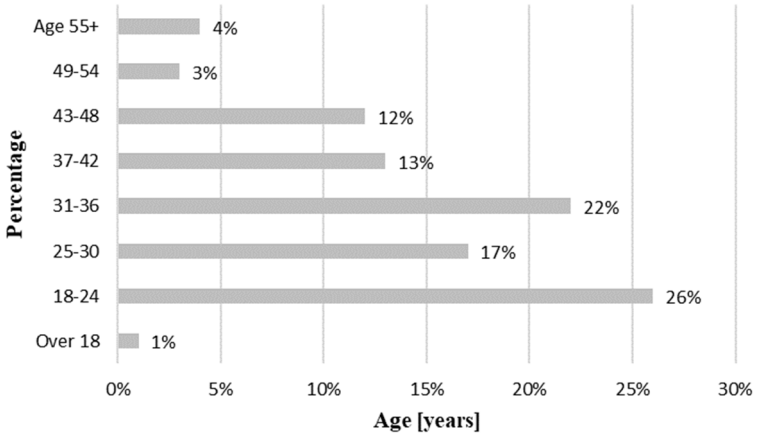

Fig. 3. The age of respondents participating in the survey.
Source: Own elaboration

The respondents taking part in the survey are mainly people of working age, i.e. people who make decisions about their households.

Analysis of the results obtained

The first question in the survey asked about the respondents' preferences for the direction of development of their place of residence. It was a multiple-choice question and degraded on a five-point scale, with 1 being definitely should not be implemented and 5 being definitely should be implemented. The results of the responses are presented in Figure 4.

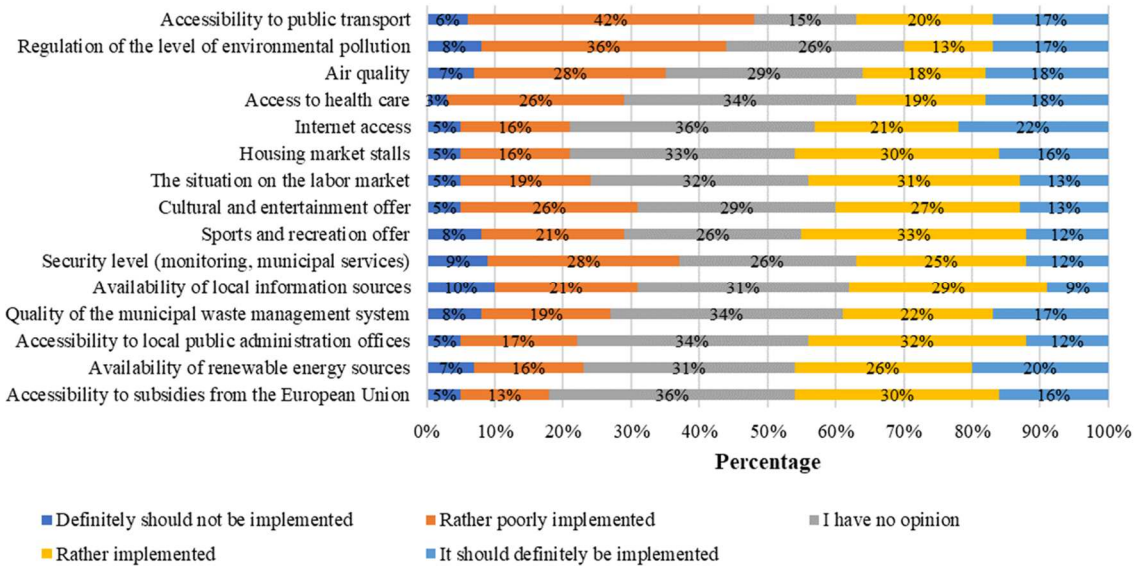

Fig. 4. The respondents' assessment of the need to implement particular areas of city development.
Source: Own elaboration

The analysis of the responses presented in Figure 4 shows that about 30% of the respondents had no opinion as to the types of areas that should be implemented in the city. The greatest need of the respondents is to improve the widely understood quality of life through better access to local public administration, accessibility of renewable energy sources, bigger sports offer, access to the Internet or improvement of housing conditions as well as better accessibility to EU subsidies. It can be seen in this question that all of the proposed areas were supported by those surveyed in terms of the development of their cities.

Next, those taking part in the survey were asked about the type of heat and electricity source used in their household. The results are presented in Figure 5. Most people (33%) still use hard coal and natural gas (27%) in their households. However, it is worth noting that photovoltaic installations are becoming an important source of energy in households. Wind energy currently has the smallest share in energy production at the household level.

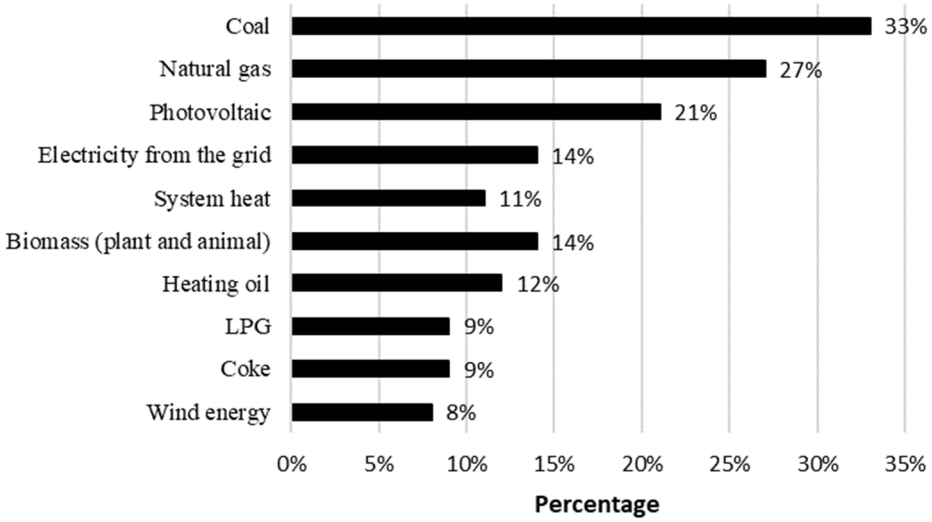

Fig. 5. Types of heat energy sources used by respondents.
Source: Own elaboration

The next question asked respondents what type of energy source they would be willing to switch to, taking into account installation costs. Analysing the answers presented in Figure 6, we can see that the most popular among the respondents are renewable energies, with photovoltaics being the clear favourite, as more than half of the respondents (55%) are willing to switch to this energy source. The analysis of the data leads to the conclusion that the awareness of the respondents concerning the necessity of moving away from traditional energy sources is getting higher and higher.

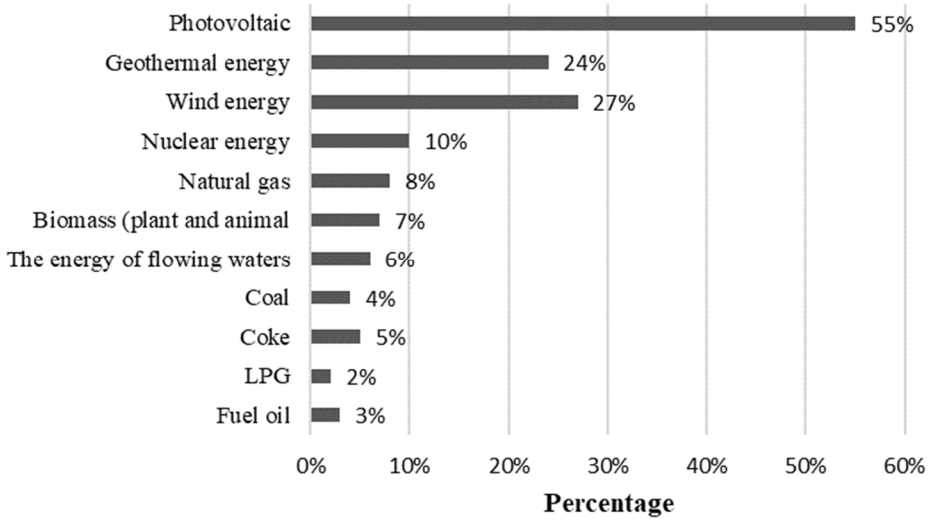

Fig. 6. Types of energy sources in which respondents would be most willing to invest.
Source: Own elaboration

In reference to the previous question of the survey about choosing a new energy source for their household, a question was asked about the amount of money that the respondents would be able to spend on this change. The results have been correlated and presented in Table 1. Analysing the results, we can see that the respondents are able to spend the highest amount of money on the change to photovoltaic panels. 13% of the answers were above 2000 EUR, and 12% of the respondents would pay 1000-2000 EUR. On the other hand, a monetary sum of up to 200 EUR would be spent by 2% of people in the case of coal. This is the lowest result, taking into account that any respondent did not choose higher amounts for this energy source.

The research group was then asked about their attitude towards switching away from coal energy in relation to the development of local and national energy policies. From the answers obtained, we can clearly state that the respondents are in favour of decarbonisation (89%), while only 11% are against it.

Tab. 1. Range of money that respondents would be able to spend on a new energy source in their households.

Source of energy	Selected amount [EUR]			
	Up to 200	200 – 1000	1000 – 2 000	More than 2 000
Photovoltaics	2%	8%	12%	13%
Wind energy	2%	3%	7%	4%
Geothermal energy	0%	5%	7%	3%
Natural gas	2%	3%	2%	1%
Moving water energy	0%	2%	2%	2%
Nuclear energy	2%	2%	2%	0%
Biomass (plant and animal)	0%	2%	2%	0%
Coke	0%	1%	2%	1%
LPG	1%	1%	0%	1%
Hard coal/brown coal	2%	0%	0%	0%
Fuel oil	0%	1%	0%	1%

Source: Own elaboration

The last question of the survey asked about the respondents' opinion on the direction of development of the region of residence in a situation of complete abandonment of the use of coal energy and liquidation of mines. Respondents clearly pointed out the development of their cities in the direction of the clean industry – Fig. 7. Such a choice of the region's development is natural, taking into account the previous character of Silesian cities, culture and way of life.

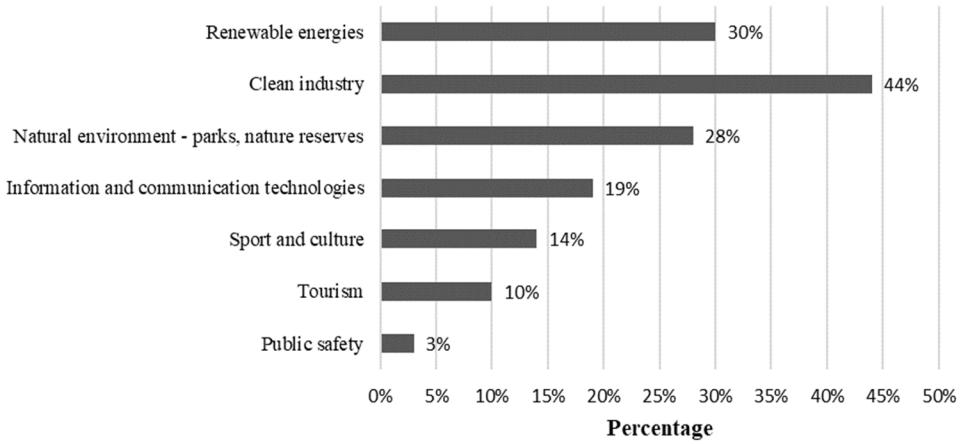

Fig. 7. The development directions of the region of residence in a situation of a complete transition from coal energy and the closure of mines
Source: Own elaboration

Summary

Facing climate change and the demands of the modern world, Poland must move away from fossil fuels in favour of low- and zero-emission sources of energy, striving for climate neutrality. To achieve such a goal, reducing greenhouse gas emissions through a change in the energy mix is necessary. With the complete replacement of coal-fired energy and the complete closure of coal mines, local communities have to look for a new direction. Respondents in the survey strongly favour renewable energy and the clean industry. Analysing the results, we can state that all respondents want their houses to be powered by cleaner, more environmentally friendly energy from natural sources, which is not only an inexhaustible resource but can also provide new jobs for Silesian city inhabitants in much better conditions than coal mines. The inhabitants of Silesian cities are aware of the changes taking place and understand their necessity, taking into account the climate situation or environmental protection. However, without significant assistance from the state and the European Union, such a profound transformation will not be possible.

References

Billig, T. (2022). Dekarbonizacja Polski do 2040 roku. http://www.ichpw.pl/blog/2022/01/20/dekarbonizacja-polski-do-2040-roku/

Bołoz, Ł. and Midor, K. (2018). Process innovations in mining industry and effects of their implementation presented on example of longwall milling heads. *Acta Montanistica Slovaca*, 3/2018.

Brodny, J. and Tutak, M. (2016). Determination of the zone endangered by methane explosion In goaf with caving of longwalls ventilated on "Y" system. *Management Systems in Production Engineering*, 4(24), pp. 247-251.

Cernecky, J., Valentova, K., Pivarciova, E., Bozek, P. (2015). Ionisation impact on the air cleaning efficiency in the interior. In Measurement Science Review, Vol. 15, No. 4 (2015), online, pp. 156-166. DOI10.1515/jee-2015-0008

Dane GUS, Energia (2020). Główny Urząd Statystyczny

Deloitte. (2020). The 2030 decarbonization challenge The path to the future of Energy.

Deloitte. (2021). Europejski Zielony Ład – neutralność klimatyczna Europy do 2050 r. (część I) Jakie wyzwania stoją przed firmami i jak można je sfinansować w formie dotacji? Strefa Ulg i Dotacji, 17/2021. https://www2.deloitte.com/pl/pl/pages/tax/articles/strefa-ulg-i-dotacji/Europejski-Zielony-Lad-neutralnosc-klimatyczna-Europy-do-2050-r.html

Departament Rozwoju Regionalnego. (2021). Potencjały i wyzwania rozwojowe województwa śląskiego w kontekście sprawiedliwej transformacji, Załącznik 1 do projektu Regionalnego Planu Sprawiedliwej Transformacji Województwa Śląskiego 2030, Urząd Marszałkowski Województwa Śląskiego, Katowice.

Gawlikowska-Fyk, A. (2011). Znaczenie polityki energetycznej w procesie integracji europejskiej, Wydawnictwo UMCS, Lublin

Gawlikowska-Fyk, A. (2020). Prawo klimatyczne – powrót do przyszłości, Forum Energii.

Hąbek, P. (2014). Evaluation of sustainability reporting practices in Poland. *Quality & Quantity*, 48(3), pp. 1739-1752.

https://pism.pl/publikacje/Skazani_na_transformacje__strategia_klimatyczna_UE_2050_.

https://www.forum-energii.eu/pl/blog/prawo-klimatyczne-powrot-do-przyszlosci.

Jankowska, E. (2016). Dekarbonizacja europejskich gospodarek w ujęciu przestrzennym. Studia I Prace WNEiZ US, 44/2 2016. DOI:10.18276/sip.2016.45/2-21

Kancelaria Senatu (2020). Polska w Zielonym Ładzie – korzyści, możliwości i ocena SWOT. Biuro Analiz Dokumentacji I Korespondencji, Warszawa. https://www.senat.gov.pl/gfx/senat/pl/senatekspertyzy/5619/plik/oe_307.pdf

Kuzior, A., Postrzednik-Lotko, A. and Postrzednik, S. (2022). Limiting of Carbon Dioxide Emissions through Rational Management of Pro-Ecological Activities in the Context of CSR Assumptions. *Energies*, 15(5), pp. 1-17. https://www.mdpi.com/1996-1073/15/5/1825

Laville, S. and Watts, J. (2019). Across the globe, millions join the biggest climate protest ever. The Guardian. https://www.theguardian.com/environment/2019/sep/21/across-theglobe-millions-join-biggest-climate-protest-ever

Makowska, M. and Wąsiński M. (2019). Skazani na transformację – strategia klimatyczna UE 2050. *Biuletyn PISM* 82(1830).

Midor, K., Biały, W., Rogala-Rojek, J. and Matusiak, P. (2021). The process of designing the post-mining land reclamation investment using process maps. Case study. *Energies,* 14(17), pp. 1-10. DOI: 10.3390/en14175429

Midor, K., Kuzior, A., Płaza, G., Molenda, M and Krawczyk, D. (2021). Reception of the smart city concept in the opinion of local administration officials – a case study. *Management Systems in Production Engineering*, 29(4), pp. 320-326. DOI: 10.2478/mspe-2021-0040

Pathak, S. (2020). With coronavirus lockdown, India's cities see clear blue skies as air pollution drops. https://www.npr. org/sections/coronavirus-live-updates/2020/04/10/831592401/ with-coronavirus-lockdown-indias-cities-see-clear-blue-skies-as-airpollution- dr.

Raport (2020). Energetyka cieplna w liczbach 2019, Urząd Regulacji Energetyki, Warszawa. https://www.ure.gov.pl/pl/cieplo/energetyka-cieplna-w-l/9009,2019.html

Sommer, L. (2020). Why China's air has been clearer during the coronavirus outbreak. https://www.npr.org/sections/goatsandsoda/2020/03/04/811019032/why-chinas-air-has-beencleaner-during-the-coronavirus-outbreak.

Świerzko, A. (2021). Analiza wiedzy i gotowości mieszkańców aglomeracji śląskiej do wprowadzenia idei inteligentnych miast oraz odchodzenia od energii węglowej. Praca magisterska, Politechnika Śląska, Wydział Organizacji i Zarządzania.

Wąsiński, M. (2018). Nie tylko węgiel – perspektywiczne znaczenie branży OZE w polskim eksporcie. *Biuletyn PISM*, 105(1678). https://www.pism.pl/publikacje/Nie_tylko_w_g