

Bernat, Tomasz; Gasior, Aleksandra; Lisowska, Renata; Szymanska, Katarzyna; Zaharia, Razvan

## Article

# Involvement's Barriers of Micro and Small Firms into EU Energy Transition

Amfiteatru Economic Journal

## Provided in Cooperation with:

The Bucharest University of Economic Studies

*Suggested Citation:* Bernat, Tomasz; Gasior, Aleksandra; Lisowska, Renata; Szymanska, Katarzyna; Zaharia, Razvan (2023) : Involvement's Barriers of Micro and Small Firms into EU Energy Transition, Amfiteatru Economic Journal, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 25, Iss. 63, pp. 541-557, <https://doi.org/10.24818/EA/2023/63/541>

This Version is available at:

<https://hdl.handle.net/10419/281717>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by/4.0/>

## INVOLVEMENT'S BARRIERS OF MICRO AND SMALL FIRMS INTO EU ENERGY TRANSITION

Tomasz Bernat<sup>1\*</sup>, Aleksandra Gašior<sup>2</sup>, Renata Lisowska<sup>3</sup>,  
Katarzyna Szymańska<sup>4</sup> and Răzvan Zaharia<sup>5</sup>

<sup>1), 2)</sup> University of Szczecin, Szczecin, Poland

<sup>3)</sup> University of Lodz, Lodz, Poland

<sup>4)</sup> Lodz University of Technology, Lodz, Poland

<sup>5)</sup> Bucharest University of Economic Studies, Bucharest, Romania

### Please cite this article as:

Bernat, T., Gašior, A., Lisowska, R., Szymanska, K. and Zaharia, R., 2023. Involvement's Barriers of Micro and Small Firms into EU Energy Transition. *Amfiteatru Economic*, 25(63), pp. 541-556.

DOI: [10.24818/EA/2023/63/541](https://doi.org/10.24818/EA/2023/63/541)

### Article History:

Received: 30 December 2022

Revised: 12 February 2023

Accepted: 10 March 2023

### Abstract

One of the greatest challenges for modern companies is finding a balance between achieving environmental goals and being competitive on the market. The current situation forces companies to overcome various challenges that contribute to reducing energy consumption. The aim of the article is to try to answer the following question: *What problems can be identified for the smallest business entities in the implementation of environmental standards imposed by legislation?* In search of an answer to this question, the structure of this article was assigned, in which the following was described: the main issues related to energy transformation in the EU, the SME sector was characterised against the background of the economy and energy challenges, the methodology, results, and results of the research conducted on Polish enterprises were presented. The research, based on a structured and standardized survey questionnaire, was conducted with the use of the CATI technique between April and May 2022 among owners of micro and small enterprises operating in Poland. As research has shown, there are various barriers that limit the participation of the surveyed companies in energy transformation.

**Keywords:** micro and small firms, energy transition, barriers for companies, involvements of companies in energy transition process.

**JEL Classification:** Q51, Q56, Q48

\* Corresponding author, **Tomasz Bernat** – e-mail: [tomasz.bernat@usz.edu.pl](mailto:tomasz.bernat@usz.edu.pl)



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. © 2023 The Author(s).

## **Introduction**

In today's era of major climate change, there is a growing need for all businesses to engage in environmental protection by redirecting capital from environmentally damaging investments to greener alternatives. Therefore, a company, regardless of its size, should include environmental, social, and ecological issues in its strategies. The implementation of these goals is an opportunity for business and the entire economy, opening new markets, and securing the development of individual sectors of the economy in the long term. Changing the way businesses operate to save electricity can improve the lives of millions of people. The standards presented in the research by Asif et al. (2010) provide companies with guidance on sustainable production in a concrete and practical way. These standards contribute to the implementation of sustainable development goals and bring real business benefits to companies (Asif et al., 2011).

A characteristic feature of the energy transformation is the occurrence of numerous interactions between various spheres of the economy, resulting in the synergy effect. They are decisive for the creation and dissemination of various transformation projects within the sector of micro and small enterprises. Considering them from the point of view of these companies indicates the need to adopt a broad perspective for the external conditions for the development of processes related mainly to the transfer and financing of technological solutions (Govindan, Shankar and Kannan, 2020). Often, enterprises of this type, due to their limited resource potential, are somehow doomed to supplement material, financial, information, and technological shortages from the external environment in order to strengthen their own position and increase the scope of energy transformation.

However, the environment of these entities becomes a factor that strongly determines the development of energy transformation in these companies. In addition to the external perspective, literature also emphasises the internal dimension of the environment, which remains under the full or potential control of a given entity. It can include a variety of resources used in the management process (financial, human, material, informational), set business goals, management methods used, staff morale and commitment, work environment, company market image, and a number of other factors and components (Battistella et al., 2018). Therefore, the company should strive to build a strong and open organisational culture that is focused on the transformation of energy, both for relationships and for changes. Therefore, it is necessary to permanently inscribe the factors that determine flexibility, entrepreneurship, and innovation in order to implement environmental standards and be competitive in the market (Erdin and Ozkaya, 2020).

It can be concluded that stimulating the participation of energy in micro and small companies is a trend that sets a new quality for their activities. In such a situation, both the role and tasks of the entrepreneurs themselves change. Additionally, it should be noted that in certain unfavourable situations, these conditions can become major barriers that delay the process of technological transformation (Schmidt et al., 2015).

Entities operating on a micro- and small-scale constitute the largest part of any economy. They also have specific ownership and managerial ties due to their scale of operations. As a result, decision making is usually related not only to business goals but also to the approach and personality of decision makers (owner-manager). In connection with the above, it should be stated that there is a research gap, which results from the fact that there is a lot of research on the activities of large companies, and still little in relation to micro and small companies.

Trying to fulfill the gap, it was assumed that the purpose of this study is the question - *what problems can be identified for the smallest business entities in the implementation of environmental standards imposed by the legislation?*

In search of an answer to this question, the structure of this article was assigned, in which the following parts were described: the main issues related to the transformation of energy in the EU, the SME sector was characterised against the background of the economy and the challenges of energy, the methodology, results, and results of the research conducted of companies in Poland were presented.

### **1. The EU energy transition**

The concept of energy transition roots in a much-debated topic related to sustainability (Kemp, 2010), respectively, in the need to identify resources that both support the development goals for the present generation and the future generation's right to fulfill their necessities. Under current constraints related to climate change and the objectives to reduce carbon emissions, the transition to energy is described as a “must-do” for both governments and companies (Maswabi, Chun and Chung, 2021).

Since its beginnings, the European Union has set as its main objective the provision of security to its citizens (avoiding a new war and meeting the conditions for a decent and prosperous life for all citizens). Energy security, in addition to food security, respect for civil liberties and rights, social justice, etc. – represented a permanent concern, which began to be seen in the wider context of ensuring the quality of life, environmental protection, and sustainable economic development. Based on these principles, the European Union has been the main global promoter of measures to mitigate climate change, by reducing the carbon footprint and using renewable energy sources.

In 2014, the European Commission developed the European Energy Security Strategy, with the objective of “the prosperity and security of the European Union hinges on a stable and abundant supply of energy” (European Commission, 2014). In the same document, the EU mentioned its dependence on energy, mostly from Russia, which affirms the preoccupation of the EU to reduce this vulnerability. According to the European Commission (2014), the EU imports 53% of the energy it consumes. The dependence on energy imports is related to crude oil (almost 90%), natural gas (66%), and to a lesser extent to solid fuels (42%) and nuclear fuel (40%)”. Furthermore, in 2013, Russian energy supplies represented 39% of EU natural gas imports or 27% of EU gas consumption, and six member states depend on Russia as a single external supplier for all their gas imports (European Commission, 2014).

In the last 3-4 years, in the context of the COVID-19 pandemic, climate change, and Russia's brutal and unprovoked invasion of Ukraine, the pace of measures taken at the European level has accelerated and the objectives have become more and more ambitious.

Therefore, in 2018, art.3(1) of Directive 2018/2001/EU set that a minimum of 32% of the gross final energy consumption in the EU should be generated based on renewable energy sources (RES) until 2030. In 2021, in the context of the European Green Deal, the proportion increased to 40% (Stroink et al., 2022). In May 2022, the European Commission launched The REPowerEU Plan, which foresees an increase in the share of renewable energy to 45% until 2030, reaching a total renewable energy generation capacity of 1,236 GW (European Commission, 2022).

The latest European Union document on energy security is the REPowerEU Plan. It comprises financial and legal objectives and measures in *three lines of action* (saving energy, producing clean energy, and diversifying energy supplies leading to a new energy system and a new energy infrastructure (European Commission, 2022).

For the first line of action, The European Commission emphasises that “saving energy is the cheapest, safest, and cleanest way to reduce our reliance on fossil fuel imports” and that every citizen, household, or organisation (companies) can make a contribution to the implementation of this objective, through small gestures such as “reducing heating temperatures or using less air-conditioning, using household appliances more efficiently, driving more economically, shifting to more public transport and active mobility, switching off the lights” (European Commission, 2022).

Regarding the second line of action, production of clean energy, the (European Commission, 2022) proposes ambitious goals: “The EU Solar Energy Strategy will increase the rollout of photovoltaic energy. As part of the REPowerEU plan, this strategy aims to bring online more than 320 GW of newly installed solar photovoltaic by 2025, more than twice the level today, and almost 600 GW by 2030. These additional front-loaded capacities exceed the consumption of 9 billion cubic meters of natural gas annually by 2027”.

The third direction of action, diversification of energy supplies, envisages the gradual but rapid abandonment of energy coming from Russia and its replacement with imports of liquefied natural gas (LNG) deliveries from the USA, Canada, Norway, Egypt, and Israel, increasing gas imports from Azerbaijan, Qatar, Australia, and resuming imports from Algeria, explore the export potential of sub-Saharan African countries such as Nigeria, Senegal, and Angola, as well as coordination with gas buyers such as Japan, China and Korea (European Commission, 2022).

The transition process to clean energy is very complex and complicated. A multitude of influencing factors from very diverse fields must be taken into account: technological, social, geostrategic, legal, financial, behavioural, cultural, etc. Every action taken opens the way to new opportunities and the emergence of new risks or barriers. Special attention must be paid to the anticipation of risks and barriers that may appear, and the watchword in this regard is “a holistic policy framework”. It is essential that decision makers analyse all the consequences of the measures they take and take into account all the elements that can intervene in the process of implementing these measures (IRENA, 2022).

It should be noted that the EU policy since 2016, with respect to SMEs concerns energy audits, energy management systems, and exchange mechanisms (European Commission, 2016). These activities consist of the following:

- *Energy audits for SMEs* that include encouragement of energy-intensive companies, provision of implementation support, provision of low-interest capital for investments in recommendations, establishment of one-stop-shops, and participation of key institutions.
- *Energy management for small and medium enterprises* consists of stepwise implementation support, advice, and first certification support, guidance for different branches.
- *Exchange mechanisms for SMEs* involve regular common exchange and follow-up for SMEs, ensuring institutional support, and finally using a mix of approaches.

However, there are many barriers for the energy transition process of companies: lack of knowledge and awareness, lack of trust from consumers, energy illiteracy, technical barriers (there has not been much experience in managing reverse power flows from high photovoltaic (PV) generation in the system and the increasing number of consumers could lead to an increase in overall grid costs increasing), huge financial investment required, unequal participation, engrained patterns of energy consumption behaviours that may be difficult to change, the opaqueness of the energy market, etc. (Hearn and Castaño-Rosa, 2021). Furthermore, the interests of firms involved in the production and distribution of traditional forms of energy can lead some decision-makers to delay this transition, as subsidies granted to the population to cover current energy costs can have a perverse effect, as poorer consumers fear the investment necessary for the transition to new technologies (IRENA, 2022).

Referring to the issues related to the energy transformation that is taking place in the world and in EU countries and the barriers related to its implementation, in particular by enterprises, we want to fulfill the knowledge gap regarding the basic entities building economies, so micro- and small enterprises. Their specificity means that firms face many problems related to the implementation of energy policy solutions. It is more important that the scientific research already conducted mainly concerns large entities or those belonging to the SME sector. Regarding the paper, the subject of research will be precisely defined as micro- and small entities, which usually have the largest statistical share in the activities of economies.

## **2. SME, Economy, and Energy Transition**

In most countries, the enterprises included in the SME sector are treated as a catalyst for economies. This applies to both developed and developing countries (Nguyen Thi, 2022). These economic entities not only represent the greatest potential for sustainable economic growth (Nguyen and Ngo, 2021), but they are also usually the most important pillar of economic development.

SMEs operate in many sectors of the economy, including agriculture, production, and household consumption. In the case of activities such as: services for society, food supply, retail trade or transport, entities belonging to SMEs always play a key role in supporting the development of the economy due to their dominant share in it. According to Eurostat data, in 2022 there were 23.2 million companies in the EU (excluding the financial sector) (Eurostat, 2022). In the structure of all these economic entities, the SME sector accounted for 98.9% of the total. It employed 48.4% of all employees and contributed to the creation of added value in more than 35%. Regarding innovative activities, 46% of small enterprises declare such activities. As the research shows, there are many important factors in the functioning of SMEs in this area to support the development of the economy.

Therefore, the SME sector also contributes significantly to job creation, increased productivity, poverty reduction, improved living conditions, and sustainable development (Nguyen and Ngo, 2021). This is mainly due to the fact that smaller entities have more flexible production capabilities compared to large enterprises, they adapt to changes in demand in a short time, and quickly reach the conditions of full competition (Pimenova and van der Vorst, 2004). In addition, SMEs significantly contribute to the improvement and use of new technologies thanks to their innovative and flexible structures, which allows them to be used as a competitive element even between countries (Erdin and Ozkaya, 2020).

Therefore, the above considerations indicate that SME entities have a positive impact on economic growth (Lestantri *et al.*, 2022). Due to their importance in supporting the national economy, small businesses are projected to continue to grow and challenge large companies (Govindan, Shankar and Kannan, 2020). It should be mentioned, however, that small and medium-sized enterprises (SMEs) encounter obstacles, both internal and external, concerning their growth and thus indirectly their impact on economic changes. As reported by Seddighi and Baharmand (2020) and Kauffman and Naldi (2020), small and medium companies face many challenges related to human resources, capital, and knowledge. Therefore, overcoming this problem is a challenge to the sustainability of SMEs (Battistella *et al.*, 2018). When challenges related to ecology, climate, or economical use of energy are added to this, a picture of the whole problem in this area is drawn.

As indicated above, enterprises in the SME sector are important in every economy as employers and producers (also in the EU) (Južnikrotar, Pamić and Bojnec, 2019). However, SMEs are responsible for 60-70% of all industrial pollution in Europe (OECD, 2018), causing more than 40% of the major industrial pollution in the countries where they operate (Murnaghan, 2009; Chatzistamoulou and Tyllianakis, 2022). Regarding this, it is important to involve entities from the SME sector due to their impact on the environment and their ability to generate and use clean technologies (Koirala, 2018).

The fundamental question in the context of the use of energy in economic activity is: What the basic factors (including barriers) shape the decisions of enterprises in the SME sector? There are quite a large number of studies that try to answer such questions, including those conducted by researchers from the OECE or the EU (Ruth, 2000; Sampaio, Thomas and Font, 2012; Jamali, Lund-Thomsen and Jeppesen, 2015; Lillah and Struwig, 2016; Schaefer, Williams and Blundel, 2020).

According to research, five significant factors can be distinguished among them (Banks, Redgrove and Fawcett, 2012), as follows: 1) decision-making and activities of individuals; 2) interactions between different subcultures within the organisation; 3) the independent "life" of the organisation embedded in its procedures, history, and ethos; 4) the relationships the organisation maintains with other organisations in its supply chain; and 5) the sociotechnical context constructed by the interaction of various factors. Research shows that organisation size, sector, and sub-sector influence energy decisions. However, it is quite complex, because both the size of the company and the sector in which they operate affect each other. Two conclusions are important:

- in organisations where management functions are related to one or more people (small organisational structure) – micro and small companies, individual beliefs and values are important;
- for micro and small companies, time and technical skills are important. The entities of the SME sector do not have enough time and technical skills to fully deal with the possibilities of improving energy efficiency in their activities.

Another conclusion may be the opinion presented by Vickers and coauthors (2009) that the main reason for the weaker involvement of SMEs in solutions related to energy efficiency are: limited resources, limited access to skills and knowledge; organisational culture dominated by the owner-manager; low awareness and reluctance to access advice and support (Vickers *et al.*, 2009).

However, research (Revell, Stokes and Chen, 2010) referring to earlier work presented owners-managers as laggards who downplay the environmental impact of their company and oppose environmental management due to perceived costs. Against this background, the next studies indicate progressive - positive changes in this area. The responses indicate a high proportion of owners-managers actively involved in recycling, energy efficiency, responsible buying and selling, and efforts to reduce carbon emissions. They are motivated to do so not only by legislation, but also by concern for the environment and by potential cost savings, the impact of new clients, greater staff retention, and good publicity for their companies.

The results of the work (Jansson et al., 2017) show that market orientation (MO) and entrepreneurial orientation (EO) are important factors related to the participation of entities in sustainable development. Overall strategic orientations (EO and MO) are better predictors of commitment to sustainable development than management values and sustainable development practices. However, these results should be interpreted as the fact that companies that are less market and/or entrepreneurial oriented are less likely to implement sustainability programmes for their companies.

However, as states Ueasangkomsate and Wongsupathai (2018) in their research conducted on entrepreneurs in Thailand, the main factors related to the implementation of environmental solutions are thinking/perception of such solutions, environmental awareness, and legislation. The level of involvement of SMEs has also been shown to be low.

According to research (Schaefer, Williams and Blundel, 2020) on managers of small and medium enterprises, the fundamental role in the commitment of business to the environment is played by their values. The researchers identified four "ideal types" of SME managers, presenting the values that shape their environmental commitment.

Therefore, to sum up the above considerations, it should be pointed out that there is a large group of factors influencing the participation and knowledge about energy efficiency activities in SMEs. These include regulatory, funding, and administrative burden barriers (García-Quevedo, Jové-Llopis and Martínez-Ros, 2020). Interesting research in this area, along with a comparison to the decisions of large entities, shows Liu (Liu, 2014). He identified 17 barriers to engagement. The most important, from the point of view of small enterprises, include lack of financial incentives to stimulate low-carbon innovation, employment term limits imposed on managers affect long-term low-carbon strategies, and lack of a common definition of low-carbon production. However, for large entities, the most important are uncertainty about the impacts of climate change, which can force adaptation instead of mitigation, and a focus on short-term planning, hierarchical systems that inhibit flexibility and innovation, and the lack of a common definition of low-carbon production.

The next studies by Chatzistamoulou and Tyllianakis (2022) point to the following barriers: complexity of procedures, adaptations of environmental legislation, technical legislative issues, difficulties in choosing the appropriate resource-efficient measure, costs of environmental measures, lack of environmental expertise, lack of supply of required products or services, and lack of need for resource-saving measures.

The research presented above is the basis for setting the goal in this work: *What problems can be identified for the smallest business entities when implementing environmental standards imposed by legislation?* Given that entities operating on a micro and small scale constitute the largest part of the economy and that, due to this scale of activity, they are distinguished by a specific ownership-manager relationship, which means that decision



making is usually related not only to business goals but also to the approach, personality, or other factors, 2 hypotheses were put forward:

*H1. Micro and small-sized enterprises fulfill the basic environmental objectives set by law.*

*H2. The biggest problems that micro and small-sized enterprises face when implementing environmental solutions are the lack of financial resources and the inability to achieve quick benefits.*

### **3. Research methodology and characteristics of the research sample**

The research, based on a structured and standardized survey questionnaire, was conducted with the use of the CATI (*Computer Assisted Telephone Interview*) technique between April and May 2022 among owners of micro and small enterprises operating in Poland. Use of this technique made it possible to collect data in a short period of time, ensured control over the respondent and continuous monitoring of the survey and the quality of the collected data over the research process. The research carried out assumed the acquisition of a representative sample so that it was possible to generalize the results that were obtained to the entire general population from which it was taken. Therefore, the sample should be random, i.e., the probability that an individual will be drawn into the sample is the same for all units of the population and the sample should be sufficiently large.

The sampling frame was the database of the REGON Register of National Economy, considered a complete sampling frame of companies operating in Poland. The sample size was established at 1,750 companies (400 in the basic sample and 1,350 in the reserve sample).

The selection of companies to participate in the study was carried out in the dependent sampling process, which meant that the selected element of the population was not returned to it and therefore did not appear in the sample more than once. Every 30th record was selected from the sampling frame, that is, a numbered list of all entities included in the surveyed population. The selection of the sample within the surveyed groups (micro and small enterprises) was random; that is, for individual sampling units that were part of the population, it was possible to indicate the same probability of being included in the sample.

The substituted sample was used due to the refusal of the respondents to participate in the study and the outdated records in the database. Finally, 407 completed questionnaires were obtained, of which 400 remained after verification due to inconsistency of the data. For the elaboration of the data, the program IBM SPSS Statistics 28 was used.

Due to the large disparities in the number of micro and small companies in Poland, an overrepresentation of small companies was assumed (see Table 1). Due to disproportional sampling, the analyses used post-stratification weighting to adapt the structure of the sample to the population structure from the point of view of employment size. These ex-post weights also included an uneven response rate within the sample. Thanks to the post-stratification weights applied, generalisations for the micro and small business population were carried out with a risk of type I error of not more than 5%.

Table no. 1. Population and sample structure of enterprises by employment size

Description	Number of companies		Percentage of enterprises	
	Poland	Sample	Poland	Sample
Micro (up to 9 employees)	4,670,749	300	97.2	75
Small (10-49 employees)	133,936	100	2.8	25
<b>Total</b>	<b>4,804,685</b>	<b>400</b>	<b>100</b>	<b>100</b>

Source: own elaboration based on the Local Data Bank ([www.stat.gov.pl](http://www.stat.gov.pl)).

The surveyed sample consisted of 400 business entities operating in Poland and included 75% microenterprises that employed fewer than 10 employees and 25% small enterprises employing between 10 and 49 employees. In terms of the type of dominant activity, service and commercial enterprises dominated, accounting for 59% and 22.7%, respectively. Taking into account the range of the company's market operations which dominated in terms of turnover, almost 79% of the surveyed entities operated in the domestic and regional markets (41% and 38%, respectively), and only 6.2% in the international market (see Table 2).

Table no. 2. Characteristics of the surveyed enterprises

Itemisation	Enterprises (in %)		
	Micro	Small	Total
<b>Dominant type of business activity:</b>			
- production	12.7	35.0	18.3
- services	62.0	50.0	59.0
- trade	25.3	15.0	22.7
<b>The dominant scope of the company's market activity:</b>			
- local	18.3	4.0	14.8
- regional	41.7	27.0	38.0
- national	38.3	49.0	41.0
- international	1.7	20.0	6.2
<b>Enterprise development phase:</b>			
- setting up	0.3	0.0	0.3
- dynamic growth	19.7	19.0	19.5
- stabilization	77.7	81.0	78.4
- declining	2.3	0.0	1.8

Source: own elaboration

The respondents also evaluated the stage of development of their companies at the time. Analysis of the results obtained shows that more than 78.4% of the surveyed entities indicated the maturity phase characterised by a good reputation of the company and the position of the market, as well as a constant level of economic and financial results. Only 19.5% of the companies were in the dynamic growth phase, while start-up companies recorded the lowest share of 0.3%. The structure of the microenterprises was almost the same as that of the entire population. On the other hand, in the case of small businesses in relation to the population, there were considerably fewer entities in the phase of dynamic growth and many more in the phase of decline and renewal.

**4. Results**

In the first stage of the analysis of the data obtained during the survey, the compliance of the company's operations with the environmental requirements resulting from the Regulation of the European Parliament (EU) was assessed. According to these regulations, qualifying for sustainable economic activity must provide a significant contribution to at least one of the six environmental objectives of Regulation (defined as: (1) climate change mitigation, (2) climate change adaptation, (3) sustainable use and protection of water and marine resources, (4) the transition to a circular economy, (5) pollution prevention and control add (6) the protection and restoration of biodiversity and ecosystems.

Respondents evaluated the degree of compliance of their operations with these goals on a five-point Likert scale, where 1 - no compliance, 2 - compliance to a small extent, 3 - medium degree of compliance, 4 - compliance to a large extent, and 5 - compliance to a very large extent (see Table 3).

**Table no. 3. Evaluation of the degree of conformity of the activities of the enterprise with environmental objectives**

Environmental objectives	Assessment				
	1 - no compliance	2 - compliance to a small extent	3 - medium degree of compliance	4 - compliance to a large extent	5 - compliance to a very large extent
<b>Climate change mitigation</b>	22.8%	16%	23.8%	15.2%	22.2%
<b>Climate change adaptation</b>	20.2%	18.2%	30.3%	18.5%	12.8%
<b>Sustainable use and protection of water and marine resources</b>	36.3%	28.5%	26.5%	8.2%	0.5%
<b>The Transition to a Circular Economy</b>	12.2%	18.3%	33.5%	18.5%	17.5%
<b>Pollution Prevention and Control</b>	7.2%	16.8%	28.7%	30.0%	17.3%
<b>The protection and restoration of biodiversity and ecosystems</b>	26.2%	18.3%	46%	9%	0.5%

*Source: own elaboration*

Interpreting the results of the evaluation obtained, it can be assumed that the activities of the micro and small enterprises surveyed are most compatible with the following environmental goals: mitigation of climate change (assessed by respondents – 22.2% as compatible to a very large extent and 15.2% as compatible to a large extent), pollution prevention and control (assessed by respondents – 17.3% as compatible to a very large extent and 30% as compatible to a large extent) and the transition to a circular economy (assessed by respondents – 17.5% as compatible to a very large extent and 18.5% as compatible to a large extent). However, the least compatible with environmental objectives are the activities of micro and small enterprises in the areas of sustainable use and protection of water and marine resources (respondents' evaluation - 36.3% as not compatible and 28.5% as compatible to a small

extent) and the protection and restoration of biodiversity and ecosystems (respondents' assessment – 26.2% as not compatible and 18.3% as compatible to a small extent).

Then, the state of implementation of solutions in response to these environmental goals in the surveyed company was assessed. The analysis shows that these were mainly activities such as energy-efficient machinery and equipment, selective waste collection at the production stage, and the transition from paper documentation to electronic documentation. These solutions were mainly related to reducing environmental pollution, changes in the production process, efficient use of resources, and waste management. However, solutions related to improving energy efficiency have only been implemented very rarely, such as the use of hybrid/electric cars, the generation of energy from renewable sources, and the implementation of energy management systems. The reasons for this state of affairs should be sought in the barriers that limit the participation of micro and small businesses in the transformation of the energy of the EU, which is also confirmed by the indications of the respondents. The barriers indicated most frequently were the lack of financial resources for the introduction of solutions aimed at improving energy efficiency and the long waiting time for the benefits of implemented solutions to improve energy efficiency (40.8% and 38.5%, respectively) (Table 4).

**Table no. 4. Barriers limiting the participation of companies surveyed in the energy transformation (% of indications)**

Barriers	Enterprises		
	Micro	Small	Total
<b>Lack of financial resources to introduce solutions aimed at improving energy efficiency.</b>	32.3	73.0	40.8
<b>Low level of awareness of management and employees about the use of solutions to improve energy efficiency</b>	0.7	7.0	2.3
<b>Long waiting time for the benefits of implemented solutions to improve energy efficiency</b>	48.7	8.0	38.5
<b>Lack of knowledge in the company about solutions to improve energy efficiency</b>	1.0	2.0	1.3
<b>The nature of our business does not require solutions related to improving energy efficiency</b>	2.3	3.0	2.5
<b>Lack of access to external sources of knowledge</b>	1.7	2.0	1.8
<b>Lack of qualified personnel</b>	1.0	2.3	3.0
<b>Lack of technical infrastructure to implement solutions related to improving energy efficiency</b>	0.0	1.0	0.8
<b>Lack of access to external sources of financing</b>	12.3	1.7	9.3

*Source: own elaboration*

Barriers limiting the participation of companies surveyed in energy transformation varied due to the size of the company. In the case of microenterprises, the barriers indicated the most frequently were the long waiting time for the benefits of implemented solutions to improve energy efficiency and the lack of financial resources for the introduction of solutions aimed at improving energy efficiency (48.7% and 32.3% of responses, respectively), while in the case of small enterprises, the long waiting time for the benefits of implemented solutions to improve energy efficiency was mainly in the case of 73% of responses. This was also confirmed by the Fisher test, the results of which ( $F=104.21$ ;  $p<0.001$ ) clearly indicate that there is a statistically significant positive relationship between barriers to the

transformation of the company's energy and the size of the company. The strength of this relationship, measured by Kendall's tau-c coefficient, is moderate (0.37).

In turn, the dependencies between the barriers limiting the participation of the surveyed companies in the transformation of energy and other variable metrics (dominant type of activity, range of market activity, and stage of development of the enterprise) turned out to be statistically insignificant, which was confirmed by the Fisher test results, with a test probability of  $p > 0.001$ .

### Conclusions

The process of energy transformation continues around the world. In all developed economies, work is underway to popularise these activities. One of their elements is the activity of companies. Importantly and worth noting, the scale of economic entities' activity is important when undertaking specific environmental activities. As we know, large entities, on the one hand, can take actions related to the energy transformation on a larger scale than small ones. On the other hand, they are also individually more responsible for pollution, high energy consumption, or various types of inefficiency in operations. In contrast to them, micro- and small entities, although individually they are not as energy inefficient compared to large ones, in their huge number, however, they can jointly contribute to significant problems.

Against this background, we set the question of *what are the biggest problems faced by the smallest business entities when implementing environmental standards imposed by legislation?* We also presented 2 hypotheses on micro- and small enterprises in Poland:

*H1. Micro and small-sized enterprises fulfill the basic environmental objectives set by law.*

*H2. The biggest problems that micro and small-sized enterprises face in implementing environmental solutions are the lack of financial resources and the inability to achieve quick benefits.*

The aim of the work has been achieved and the hypotheses have been verified, although the degree of their verification is not the highest, and in places ambiguous. This also allows for partial filling of the research gap for the surveyed group of micro and small entities.

First of all, it should be noted that the smallest companies in Poland, their owners and managers, see the need to engage in environmental goals related to energy efficiency. However, against this background, problems arise that these entities have to deal with. These research results allow us to conclude that the goal has been achieved and that knowledge about the problems faced by the surveyed companies has been obtained.

Then, it should be pointed out that hypothesis 1 was positively verified, although not for all elements of the analysis, measures programmed by the EU. The largest group of Polish entrepreneurs indicated two environmental goals as those that are taken into account in their activities. These are pollution prevention and control, as well as the transition to a circular economy. Two of the environmental goals are neutral (slightly more negative responses): climate change mitigation and climate change adaptation. It should also be mentioned that respondents do not consider two of all environmental goals at all: the sustainable use and protection of water and marine resources and the protection and restoration of biodiversity and ecosystems. What is the cause of this situation? One of the factors may be the very

recognition of the topic, pollution control, and the transition to the circular economy, which are relatively recognisable by entrepreneurs and easy to indicate as those with whom they identify in the activities of their companies. Others may be perceived as unavailable for implementation at the level of enterprises (especially regarding climate change) and as those that have no connection with the functioning of the company, regarding water, ecosystems, or biodiversity.

The verification of the second hypothesis provided basic information about what entrepreneurs are most afraid of in connection with energy transformation. The biggest barriers mentioned by companies include the lack of financial resources for the introduction of solutions aimed at improving energy efficiency and the long waiting time for the benefits of implementation. This was indicated by approximately 40% of the entrepreneurs who participated in the survey. Other possible obstacles listed in the study did not receive significant indications. The biggest one is the lack of access to external sources of funding. Enterprises operating on a micro- and small-scale are therefore most afraid of the fact that they will not have access to financing activities (including external sources). Furthermore, even if they manage to implement such actions, they will look at the return of these decisions with great concern. Every business decision, especially in the smallest business entities, is made considering the possibility of financial return. This is primarily due to the scale of operations of such companies, as well as their specificity (small, independent entities operating without employees, often family businesses). These entities must be able to ensure the continuity of their operations, that is, the return on invested funds in a short period of time. All this allows for an unequivocal verification of Hypothesis 2.

The research presented shows how micro- and small enterprises are involved in the energy transformation. Unfortunately, this is not a positive picture. Not all goals are pursued in direct activity. Entrepreneurs also see many barriers to the implementation of the solutions proposed by the European Commission. The size of the company plays an important role here. SMEs can offer greater flexibility and better customer service, while large companies can achieve global solutions. Small entities must calculate all costs in the short term and expect relatively quick returns, whereas for large companies, this is not always a decision requirement.

The results of the research shall be applied to the everyday practice of economy. Taking into consideration the scale of the problem: the energy transition we want to indicate the importance and the utility of the results for the business, academic environments, and public institutions in the energy sector. The energy sector is generally consisting of big companies. This is becoming from a technological solution. The SME firms are subcontractors or nowadays innovators in the technology solutions. So, the SME companies are highly important in this sector. The main way of the research utilisation is to have an awareness of the energy transitions and inevitable changes. Independently of current opinion, the companies must be prepared for new challenges, even if it will cost additionally. The university and the research results must provide some knowledge how to prepare for changes. Academics know the rules of energy transition and the opinions of SME authorities, so they must concentrate on the preparation and the dissemination of practical ways of dealing with coming situation. Finally, public institutions working around energy must be prepared to more efficient way of convincing the environment – business, society other actors, to accept the new solutions. This is especially important regarding the resistance of SME firms and the potential financial burden the companies have to cover in close future.

The presented studies have limitations. They concern, in particular, the number of respondents participating in the presented considerations. Another is the set of questions that were asked during the study. They could probably have covered a different or wider range of entrepreneurs' statements. Such a development would allow us to obtain a full scale of the study, enabling the representativeness of the results. It would also be a good idea to conduct them on an international scale, which would allow comparisons to be made and additional conclusions to be drawn.

## References

- Asif, M., Searcy, C., Garvare, R. and Ahmad, N., 2011. Including sustainability in business excellence models. *Total Quality Management & Business Excellence*, 22(7), pp.773-786. <https://doi.org/10.1080/14783363.2011.585784>.
- Banks, N., Redgrove, Z. and Fawcett, T., 2012. What are the factors influencing energy behaviours and decision-making in the non-domestic sector? A rapid evidence assessment. [online] Available at: <[https://www.researchgate.net/publication/301890029\\_What\\_are\\_the\\_factors\\_influencing\\_energy\\_behaviours\\_and\\_decision-making\\_in\\_the\\_non-domestic\\_sector\\_A\\_rapid\\_evidence\\_assessment](https://www.researchgate.net/publication/301890029_What_are_the_factors_influencing_energy_behaviours_and_decision-making_in_the_non-domestic_sector_A_rapid_evidence_assessment)> [Accessed 8 March 2023].
- Battistella, C., Cagnina, M., Cicero, L. and Preghenella, N., 2018. Sustainable Business Models of SMEs: Challenges in Yacht Tourism Sector. *Sustainability*, 10(10), article no. 3437. <https://doi.org/10.3390/su10103437>.
- Chatzistamoulou, N. and Tyllianakis, E., 2022. Commitment of European SMEs to resource efficiency actions to achieve sustainability transition. A feasible reality or an elusive goal? *Journal of Environmental Management*, 321, article no. 115937. <https://doi.org/10.1016/j.jenvman.2022.115937>.
- Erdin, C. and Ozkaya, G., 2020. Contribution of small and medium enterprises to economic development and quality of life in Turkey. *Heliyon*, [online] 6(2), article no. e03215. <https://doi.org/10.1016/j.heliyon.2020.e03215>.
- European Commission, 2014. *Communication from the commission to the European Parliament and the Council European Energy Security Strategy*. [online] European Commission. Available at: <<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330&from=EN>> [Accessed 20 February 2023].
- European Commission, 2016. *A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems*. [pdf] European Commission. Available at: <[https://energy.ec.europa.eu/system/files/2016-10/eed-art8-implementation-study\\_task12\\_report\\_final-approved\\_0.pdf](https://energy.ec.europa.eu/system/files/2016-10/eed-art8-implementation-study_task12_report_final-approved_0.pdf)> [Accessed 2 March 2023].
- European Commission, 2022. *REPowerEU: affordable, secure and sustainable energy for Europe*. [online] European Commission. Available at: <[https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en)> [Accessed 20 February 2023].
- Eurostat, 2022. *Key figures on European business, Edition 2022*. [pdf] Publications Office of the European Union. Available at: <<https://theshiftnews.com/wp-content/uploads/2022/08/KS-06-22-075-EN-N.pdf>> [Accessed 22 February 2023].

- García- Quevedo, J., Jové- Llopis, E. and Martínez- Ros, E., 2020. Barriers to the circular economy in European small and medium- sized firms. *Business Strategy and the Environment*, [online] 29(6), pp.2450-2464. <https://doi.org/10.1002/bse.2513>.
- Govindan, K., Shankar, K.M. and Kannan, D., 2020. Achieving sustainable development goals through identifying and analyzing barriers to industrial sharing economy: A framework development. *International Journal of Production Economics*, 227, article no. 107575. <https://doi.org/10.1016/j.ijpe.2019.107575>.
- Hearn, A.X. and Castaño-Rosa, R., 2021. Towards a Just Energy Transition, Barriers and Opportunities for Positive Energy District Creation in Spain. *Sustainability*, 13(16), article no. 8698. <https://doi.org/10.3390/su13168698>.
- IRENA, 2022. *RE-organising power systems for the transition*. [online] International Renewable Energy Agency. Available at: <[https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jun/IRENA\\_Organising\\_Power\\_Systems\\_2022.pdf?rev=9c979df4adda4fe19cce18ab02f86e9c](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jun/IRENA_Organising_Power_Systems_2022.pdf?rev=9c979df4adda4fe19cce18ab02f86e9c)> [Accessed 20 February 2023].
- Jamali, D., Lund-Thomsen, P. and Jeppesen, S., 2015. SMEs and CSR in developing countries. *Business & Society*, 56(1), pp.1-12. <https://doi.org/10.1177/0007650315571258>.
- Jansson, J., Nilsson, J., Modig, F. and Hed Vall, G., 2017. Commitment to Sustainability in Small and Medium-Sized Enterprises: The Influence of Strategic Orientations and Management Values. *Business Strategy and the Environment*, 26(1), pp.69-83. <https://doi.org/10.1002/bse.1901>.
- Južnikrotar, L., Pamić, R.K. and Bojnec, Š., 2019. Contributions of Small and Medium Enterprises to Employment in the European Union Countries. *Economic Research-Ekonomska Istraživanja*, 32(1), pp.3296-3308. <https://doi.org/10.1080/1331677X.2019.1658532>.
- Kauffman, R.J. and Naldi, M., 2020. Research directions for sharing economy issues. *Electronic commerce research and applications*, 43, article no. 100973. <https://doi.org/10.1016/j.elerap.2020.100973>.
- Kemp, R., 2010. The Dutch energy transition approach. *International Economics and Economic Policy*, 7(2), pp.291-316. <https://doi.org/10.1007/s10368-010-0163-y>.
- Koirala, S., 2018. *SMEs: Key Drivers of Green and Inclusive Growth*. [pdf] Environment Directorate, OECD. Available at: <[https://www.oecd.org/greengrowth/GGSD\\_2018\\_SME%20Issue%20Paper\\_WEB.pdf](https://www.oecd.org/greengrowth/GGSD_2018_SME%20Issue%20Paper_WEB.pdf)> [Accessed 22 February 2023].
- Lestantri, I.D., Janom, N.B., Aris, R.S. and Husni, Y., 2022. The perceptions towards the digital sharing economy among SMEs: Preliminary findings. *Procedia Computer Science*, 197, pp.82-91. <https://doi.org/10.1016/j.procs.2021.12.121>.
- Lillah, R. and Struwig, M., 2016. Factors Influencing Business Implementation of Environmental Management Systems. *Journal of Economics, Business and Management*, [online] 4(4), pp.272-279. <https://doi.org/10.18178/joebm.2016.4.4.403>.
- Liu, Y., 2014. Barriers to the adoption of low carbon production: A multiple-case study of Chinese industrial firms. *Energy Policy*, 67, pp.412-421. <https://doi.org/10.1016/j.enpol.2013.12.022>.
- Maswabi, M.G., Chun, J. and Chung, S.-Y., 2021. Barriers to energy transition: A case of Botswana. *Energy Policy*, 158, article no. 112514. <https://doi.org/10.1016/j.enpol.2021.112514>.



- Murnaghan, C., 2009. *Small and Medium-Sized Enterprises (SMEs): Understanding and Promoting Pro-environmental Behaviour Change*. [pdf] Environment Agency. Available at: <[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/290998/scho0209bpjq-e-e.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290998/scho0209bpjq-e-e.pdf)> [Accessed 12 January 2023].
- Nguyen Thi, N., 2022. SMES survival and knowledge in emerging economies: evidence from Vietnam. *Heliyon*, 8(11), p.e11387. <https://doi.org/10.1016/j.heliyon.2022.e11387>.
- Nguyen, N.H. and Ngo, M.N., 2021. The Role of Knowledge on ASEAN Economic Community in Enhancing the Performance of Vietnamese Enterprises. *The Journal of Asian Finance, Economics and Business*, 8(8), pp.47-56. <https://doi.org/10.13106/JAFEB.2021.VOL8.NO8.0047>.
- OECD, 2018. *Environmental Policy Toolkit for SME Greening in EU Eastern Partnership Countries*. [online] Available at: <<https://www.oecd-ilibrary.org/content/publication/9789264293199-en>> [Accessed 14 January 2023].
- Pimenova, P. and Van Der Vorst, R., 2004. The role of support programmes and policies in improving SMEs environmental performance in developed and transition economies. *Journal of Cleaner Production*, 12(6), pp.549-559. <https://doi.org/10.1016/j.jclepro.2003.07.001>.
- Revell, A., Stokes, D. and Chen, H., 2010. Small businesses and the environment: turning over a new leaf? *Business Strategy and the Environment*, [online] 19(5), pp.273-288. <https://doi.org/10.1002/bse.628>.
- Ruth, H. ed., 2000. *Small and Medium-Sized Enterprises and the Environment: Business Imperatives*. 1st ed. Routledge. <https://doi.org/10.4324/9781351282840>.
- Sampaio, A.R., Thomas, R. and Font, X., 2012. Small business management and environmental engagement. *Journal of Sustainable Tourism*, 20(2), pp.179-193. <https://doi.org/10.1080/09669582.2011.602193>.
- Schaefer, A., Williams, S. and Blundel, R., 2020. Individual Values and SME Environmental Engagement. *Business & Society*, 59(4), pp.642-675. <https://doi.org/10.1177/0007650317750134>.
- Schmidt, R., Möhring, M., Härtling, R.-C., Reichstein, C., Neumaier, P. and Jozinović, P., 2015. Industry 4.0 - Potentials for Creating Smart Products: Empirical Research Results. In: W. Abramowicz, ed. *Business Information Systems*. [online] Cham: Springer International Publishing, pp.16-27. [https://doi.org/10.1007/978-3-319-19027-3\\_2](https://doi.org/10.1007/978-3-319-19027-3_2).
- Seddighi, H. and Baharmand, H., 2020. Exploring the role of the sharing economy in disasters management. *Technology in Society*, [online] 63, article no. 101363. <https://doi.org/10.1016/j.techsoc.2020.101363>.
- Stroink, A., Diestelmeier, L., Hurink, J.L. and Wawer, T., 2022. Benefits of cross-border citizen energy communities at distribution system level. *Energy Strategy Reviews*, 40, article no. 100821. <https://doi.org/10.1016/j.esr.2022.100821>.
- Ueasangkomsate, P. and Wongsupathai, C., 2018. Environmental Management Systems in Thai Small and Medium-Sized Manufacturing Firms. In: *2018 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*. [online] Bangkok: IEEE. pp.695-699. <https://doi.org/10.1109/IEEM.2018.8607371>.
- Vickers, I., Vaze, P., Corr, L., Kasparova, E. and Lyon, F., 2009. SMEs in a low carbon economy: final report for BERR enterprise directorate. [online] Available at: <[https://www.researchgate.net/publication/277841480\\_SMEs\\_in\\_a\\_low\\_carbon\\_economy\\_final\\_report\\_for\\_BERR\\_enterprise\\_directorate](https://www.researchgate.net/publication/277841480_SMEs_in_a_low_carbon_economy_final_report_for_BERR_enterprise_directorate)> [Accessed 14 January 2023].