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Social Dimension of Poland's Sustainable Energy Transition as Assessed by Residents of the Silesian Region

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Abstract: Sustainable development is a key concept that has been formulated over many years and is currently transforming our world. Decisions made in its spirit are influencing the economic and legal order and the daily lives of people in Europe and around the world. In Poland, achieving sustainable development requires a number of difficult decisions, and one of them is to transform the energy system toward low carbon. Poland's energy transition is not an easy task in a country where, for many years, the dominant energy resource in terms of availability, resources and price has been coal. In view of such conditions, the Polish energy system has been based on coal, which in Polish conditions is still of strategic importance in meeting energy needs. For this reason, Poland's planned move away from coal raises many controversies and concerns, especially in areas where mines operate. At the same time, it should be remembered that the mining industry, in addition to mining companies, brings together a large group of mining-related companies working for the benefit of mining. Due to the fact that it is in the territory of the Upper Silesian Coal Basin that about 80% of the documented balance resources of Polish hard coal are located, it was justified to conduct a survey among the residents of the Silesian Province as the group most likely to be affected by this decision. The aim of the survey was to find out the target group's opinion on Poland's transition away from coal. In turn, the main research problem was an attempt to answer the question of what percentage of households in the Silesian Province are opposed to Poland's transition away from coal and what are the most significant factors influencing their opinion. Hence, this study presents the results of an empirical survey conducted among a randomly selected group of residents of the Silesian Province. The size of the research sample was 385 people. The study took into account factors such as age, place of residence, income, the square footage of the dwelling and the method of heating it, as well as respondents' professional affiliation with the mining, mining-related, gas or energy industry. The results of the survey and analyses show that the vast majority of Upper Silesian residents are against the departure from coal, which is being planned in Poland's energy transition. In addition, the most significant factors influencing respondents' opinion on Poland's move away from coal were identified and evaluated, revealing two social groups with differing views: one group opposes the move away from coal, prioritizing energy independence, energy security, energy prices and jobs over environmental issues; the other group advocates for the transition mainly for environmental reasons.

Keywords: just transition; sustainable energy transition; energy security; climate policy; decarbonization; public opinion; socio-economic impacts of energy

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1. Introduction

The European Union (EU) energy policy was initially geared toward the security of supplies of energy resources. However, over time and with the evolution of the international environment, there has emerged a need to also take into consideration environmental and social aspects [1]. On the one hand, rapid technological progress and industrial development triggered, among other effects, rising energy demand [2], resulting in environmental pollution and depletion of resources [3,4]; on the other hand, growing awareness of people regarding the need to reduce CO_2 [5] prompted countries around the world to take various measures in order to alleviate the conflict between environmental protection and economic growth, in line with the concept of sustainable development [6–9].

Sustainable development is one that meets the basic needs of all people and preserves, protects and restores the health and integrity of the earth's ecosystem without jeopardizing the ability to meet the needs of future generations and without exceeding the long-term limits of the earth's ecosystem capacity [10]. In other words, sustainable development is a concept that seeks to improve the quality of life for both present and future generations through proper management of economic, human and natural capital [11]. According to this definition, economic growth should entail not only raising the quality of the environment but also increasing social cohesion, including, in particular, reducing social stratification and leveling the playing field. The key here, therefore, is to maintain a balance between economic growth, social inclusion and environmental protection [12]. In order to achieve sustainable development, many difficult decisions must undoubtedly be made, among which the transformation of the EU's energy system toward low carbon is crucial. Sustainable energy transition aims to change the way energy is produced and used to reduce greenhouse gas emissions into the atmosphere and adapt to the philosophy of sustainable development.

Therefore, in order to improve the quality of the environment, hard coal has been identified as an extremely environmentally critical fuel because of its chemical properties, resulting, during its extraction and combustion, in the release of harmful gaseous substances, as well as in generating solid waste [13]. In Europe, a strategy has therefore been adopted in order to shift from this energy carrier, with EU guidelines [14–17]—mainly the European Climate Law, the European Green Deal [18–20] and the 'Fit for 55' [21,22] legislative package for climate and energy [23,24], containing more than a dozen related updated laws, as well as new climate and energy bills—being the main factors accelerating the modification of the energy mix structure in member countries. In turn, among other measures, various types of environmental taxes are being introduced in order to accelerate the achievement of environmental goals, the idea of which began as early as the beginning of the 20th century [25–28].

According to the climate targets set by the EU, greenhouse gas emissions should be reduced by 55% by 2030 compared to 1990. By 2050, in turn, the EU plans to achieve net zero emissions and become the first climate-neutral continent [19,29]. Climate neutrality is based on achieving a balance between emitted and absorbed CO_2 [30]. In order to achieve this goal, the primary aim is, as mentioned before, to eliminate coal from the energy mixes of member countries and replace it with renewable energy sources (RES). However, it is necessary to pay attention to the problems that are implied by the departure from coal. Its rapid elimination and a growing share of RES in the energy production structure lead to instability in the EU energy systems. This is due to the fact that it is still necessary to support renewable energy sources with fossil fuels, mainly due to the lack of power storage capability for energy produced only during certain climatic conditions [31]. In addition, the total elimination of coal from member states' energy mixes could increase energy prices in the EU and hamper economic competitiveness [13]. Hence, natural gas has been chosen to serve as a transitional fuel for the energy transformation period of EU member states, as its combustion generates about 50% less CO_2 than coal combustion, which is more favorable from the perspective of greenhouse gas emissions [32–35]. Nevertheless, in times of growing global energy demand and the limitations of other energy sources, such as renewable energy, the option of continuing the use of coal, while reducing its negative environmental impact, is also worth considering. And while the transition to renewable energy sources is being promoted in the EU, clean coal technologies are receiving steady interest around the world, as can be seen in the number of publications on the subject [13]. Clean coal technologies include a variety of solutions applied in the entire coal and energy distribution chain. Currently, EU countries are applying them in different variants, scopes and quantities, some of which are already developed, mature technologies, while others are still evolving [36]. The implementation of clean coal technologies could stabilize the share of coal in the energy mixes of member states, particularly those whose economies are mainly based on coal, such as Poland. Moreover, the use of such solutions could contribute to the achievement of the EU's goals related to the reduction in greenhouse gas emissions while enabling a sustainable and safe energy transition [13].

As can be clearly seen, attempts to minimize the negative impact of the development of civilization on the environment is undoubtedly a difficult mission [37–39]. In addition, it is also worth noting here that countries around the world are challenged to ensure energy security for their citizens [40]. In a big picture, energy security means the uninterrupted availability of energy sources at an affordable price [41,42]. However, over the years, the definition of energy security has undergone numerous transformations, incorporating an increasing number of factors, such as ensuring the supply of energy carriers [43], energy prices or environmental protection [44–47]. From the perspective of national security, energy security has always been an invariably important aspect of state functioning [48–52]. However, the hostilities in Ukraine in 2022 made energy security one of the most important issues in Europe, right after military security [53–58]. These events have shown that the overdependence of EU member states on imported fossil fuels, especially of Russian origin [59–61], can cause an energy crisis, which in turn can result in an economic crisis, which, after a longer period of time, is likely to have a direct negative impact on the military security of EU countries [62]. Therefore, in order to meet the energy needs of EU member states, it is necessary to review and modify the strategy that is currently adopted [63–65], taking into account the prices of energy resources, which are generating problems due to the restriction of access to cheap energy for end users [66].

With internationally significant solid fuel resources, Poland's energy sector is based mainly on coal. It has been mined primarily in Silesia since at least the 17th century [67], and this is a direct consequence of the rich coal deposits located in this geographic area of Poland. In addition, Poland does not have significant reserves of natural gas and oil; their extraction is not able to cover current demand, which results in the need for imports, which is why for many years, coal has been the core of Poland's energy security. Due to the mandatory decarbonization of the energy sector, arising from EU regulations, it will also be necessary to replace coal power sources with zero-emission sources in Poland. Of course, various measures are being taken in this direction; nevertheless, in addition to the typical problems associated with the rapid elimination of coal and the growing share of renewable energy sources in the energy production structure, which were mentioned earlier, in Poland, there are many other factors that may negatively affect the energy transition. To begin with, one of the country's fundamental problems is a lack of nuclear power plants to replace large-scale coal-based power generation. Although nuclear power is included in PEP2040 [68], and the government's Nuclear Power Development Program (NPDP) Program rozwoju energetyki jądrowej (PPEJ) [69], updated in 2020, says that the first reactor will be commissioned in 2033, it must be taken into account that, under the most optimistic scenario, the energy generated using this method will appear in the system in 15–20 years and will meet only a few percent of the country's demand for electricity [70]. Secondly, yet another factor with a negative impact on transformation is the lack of sufficient natural gas and oil reserves that can meet domestic demand. As events in Ukraine have shown, excessive reliance on imports of these raw materials can negatively affect the country's energy security. Thirdly, despite the sizable potential (28.0 GW [71] of the total estimated potential of offshore wind farms (OWFs) in the Baltic Sea is the capacity of Polish offshore areas, i.e., Exclusive Economic Zones (EEZs)) and a dedicated support system (Poland allocated 3600 km^2 (12% of the EEZ) of OW areas for a total of around 17.2 GW, out of which 8.4 GW is already under administrative procedure in nine projects [72]), as well as a considerably high number of applications submitted (i.e., more than 240) for location permits for offshore wind farms, there is still not a single operating offshore wind farm in Poland [73]. In addition, the lack of a marshalling harbor for OWFs, the liability of investors to connect OWFs to the National Electricity System (NES), the low flexibility of the national electricity grid due to the predominance of conventional generating units, the weak development of transmission networks, the small number of large energy consumers in northern Poland and poorly developed cross-border interconnections can also have a negative impact on the success of OWF investments [74]. In addition, the construction of onshore wind farms in Poland has been blocked since 2016 by the law introducing the 10H rule [75,76]. Fourthly, in the case of photovoltaics, the most important factor slowing investment appears to be the current capacity, availability and state of grid infrastructure, as well as the hampering of the development of energy storage, which de facto serves to reduce the load on the grid. Years of negligence in this regard have resulted in the fact that today, many applications for RES connection to the grid are being turned down [77,78]. This is, unfortunately, an important problem, as investments in the development of the electric power transmission grid are highly complex projects; therefore, one cannot expect it to be solved quickly. At the same time, equally important is the need to amend the legislation, so that when the installation's impact on the grid is evaluated, the storage discharge capacity is not added to the installation's capacity.

The EU's adopted plans to move away from coal and ongoing negotiations in the EP on regulations governing the issue are causing concern in the Polish mining industry, as there are fears that the new solutions could bury Polish mining and negatively affect the energy security of Poland [79]. This is because of the Polish energy sector's heavy reliance on coal and the unsuitability of the electricity grid for such rapid changes in the energy mix. As noted earlier, one of the key and multi-faceted challenges of the concept of sustainable development—which undoubtedly should be pursued—is a just transition that includes the transformation of the economy toward zero carbon. However, this process must be closely linked to the reduction, avoidance and minimization of the social costs that result from a green approach to development. It is important that this transformation should be carried out in a sustainable manner, considering the needs of both the environment and society. In the Polish reality, equitable transformation is often confused with energy transformation, also known as green transformation or green revolution. Sometimes, the two terms are used interchangeably, leading to a mistaken identification of just transition with energy transition. In Poland, just transition is wrongly seen as a way to restructure the mining and conventional energy sectors. It is also attributed a key role in EU policies that force changes in the Polish raw materials and energy sector. It is important to remember that the goal of a just transition is to provide new jobs for those who will leave or lose their jobs in mining, conventional energy and related industries. In turn, there is no doubt that the transformation of the economy to zero carbon will cause significant shifts in the labor market and in the production structures that form value chains with conventional industries. This will particularly affect coal regions, where the concentration of such activities is greatest. This entails the emergence of negative social effects, and in coal regions, it may even cause changes in cultural identity, which stems from the more than 150-year history of socio-economic development in these areas [80]. Accordingly, it was identified as extremely important to check how the current situation affects public feelings among the residents of Silesia, the group for whom the planned changes are of the utmost importance. This aspect has not been explored in previous publications, making the results of this survey likely to provide unique and valuable information on social reactions to change. For this purpose, a survey was conducted among randomly selected residents of the Silesian region.

The choice of the inhabitants of Silesia as respondents to the survey is based on two main factors. The first is the fact that about 80% of coal production in Poland is carried out in the Silesian Province; therefore, it can be assumed that the indicated decline in coal mining will primarily affect the mining communes in the region [81]. In addition, it should be remembered that the mining industry provides a source of employment for a significant group of local population. It is also worth noting here that the mining industry, apart from the mining companies, concentrates a large group of mining-related enterprises working for the mining industry. These enterprises create a large number of jobs, and their future largely depends on the condition of the mining companies, since their activities are closely linked [82]. According to various estimates, the number of employees in mining-related ventures can range from about 57,000 to more than 100,000 [83,84], which, even de facto, exceeds the number of people directly employed in mining. Hence, the phasing out of operations of a large part of mines in the region will entail a number of consequences both for product and service suppliers and for coal customers. Therefore, it can be expected that this will cause difficulties in their continued operation, resulting in a reduction in employment and even in their decommissioning. Considering the number of jobs both in the mining plants themselves and in companies in the mining-related industry, the phasing out of mining may therefore lead to a significant increase in unemployment in Silesia.

The second factor stems from the fact that the centuries-old mining tradition has shaped the distinctive character of this region, not only in economic terms but also in terms of social structures, culture, traditions and identity. Therefore, in view of the above, it seems that the planned energy transition, which assumes the departure of Poland from coal, will affect the Silesia region to the greatest extent, and therefore, the opinion of this very community on the changes will be crucial and of greatest interest.

2. Materials and Methods

Scientific research is a staged process, involving a variety of activities aimed at providing impartial, accurate and reliable knowledge of a specified part of cultural, social and natural reality, and its result is an established understanding of the analyzed reality [85]. The determined scientific research must have its sources. They are mainly governed by, among other things, the personal predilection of the researcher, the current social demand, as well as the context underlying the problem.

2.1. Subject of the Study

When carrying out a research study, it is necessary to define the problem, which determines the obstacles encountered, as well as the potential way to eliminate them [86]. Thus, the first part of the research process is considered to be the formulation of the purpose and object of the research. This results in the presentation of the main research problems and the intention of the researcher [85]. The subject of the research is a meticulously formulated piece of socio-natural reality, which is the point of cognitive interest of the relevant scientific discipline [85].

In the present study, the subject of the research was the public sentiment of the residents of the Silesian Province related to the process of Poland's departure from coal, and the purpose of the research was to learn about their opinion on Poland's departure from coal and the factors that influence this opinion.

2.2. Research Problem and Hypotheses

The foundation of research is the definition of the research problem, which is a central question or a set of questions, and the purpose of the study undertaken is to solve these questions. The research problem is complex; therefore, the necessary step to clarify it is to pose specific questions, which also serves to simplify the analysis of the study being conducted [86]. The main problem of this study was to seek an answer to the following question: What percentage of households in the Silesian Province are against Poland's departure from coal?

Based on it, the following specific problems were specified:

1. What factors and to what extent influence the respondents' opinion on Poland's departure from coal?
2. Do demographic and social factors, such as age, place of residence, type of housing, income, square footage and method of heating the house, as well as employment in mining, mining-related and energy companies, determine the opinion of Silesian residents about Poland's departure from coal?

The point of all research is to test the set hypotheses derived from the research problem as well as from specific questions that were posed. In scientific research, any hypothesis is a presumed assumption, whose consistency or inconsistency with reality should be proven during research activities [86].

In the present study, the main hypothesis is set as follows:

H1. *The percentage of households in the Silesian Province that are against Poland's departure from coal is greater than 50%.*

Specific hypotheses:

H2. *The percentage of households that object to Poland's departure from coal in which one household member is employed by a mining or mining-related company is greater than 50%.*

H3. *The percentage of households that object to Poland's departure from coal where coal is used for heating is greater than 50%.*

In scientific research, variables are an attempt to indicate their most important object, which is the research problem, to approach its solution and to confirm or reject hypotheses. These are divided into two groups: dependent and independent. The subject of the study is the dependent variable, the relationship of which with others should be determined. The dependent variable is the subject of the study. Accordingly, it must be measured in the study. Its value depends on the value of the independent variable [85].

In this study, the independent variables are age, income, place of residence, type of housing, square footage of housing, main source of heating, professional ties to the energy industry and subsidies for the method of heating the house.

The dependent variables are an assessment of the public sentiment of the residents of the Silesian Province with regard to the process of Poland's departure from coal (answering the question of whether they are in favor of quitting coal, as well as indicating the factors that influence their decision), the perceptions of the residents of Silesia about electricity prices and the perceptions of the residents of Silesia about gas prices.

2.3. Research Tool

Contemporary surveys, which are the best known empirical means of social research, use a tool in the form of a questionnaire in order to collect the information obtained from respondents. They can provide a basis for validating or rejecting the hypothesis of the verification study being carried out. Diagnostic research, on the other hand, establishes the features or principles of the course of a particular fragment of reality. Thus, the choice of the method of survey research depends on the problem that the researcher themselves are willing to solve. Survey research in diversified scientific work is usually carried out to study public opinion, as well as in marketing research, market research and for gaining knowledge about economic or social life [87–90]. Both qualitative and quantitative research is conducted through a survey. Qualitative research is performed with the intention of deepening the researcher's knowledge of a specific topic and discovering the substance of the problem [91]. The information gathered from the analyses is presented in a descriptive manner, taking into account a significant number of citations in the study. Quantitative studies, using charts and tables, focus on numerical values. By virtue of their method of determination, a much richer range of statistical methods are available for their analysis, thus affecting the increased scope of interpretation of the obtained results. An important aspect is usually the complimentary relationship that exists between the two aforementioned surveys that comprises a comprehensive survey [87].

Undertaking an in-house study, quantitative research was used to assess the public sentiment of the residents of the Silesian region in relation to the process of Poland's departure from coal. For the purpose of this study, a diagnostic survey method was chosen: a survey technique using a survey questionnaire as a research tool.

The survey method is a form of gathering knowledge concerning functional and structural attributes and expansion of social phenomena, views or opinions across the identified communities, as well as the escalation and directions of their development. The type of survey research is almost always based on the identification of educational and social phenomena and the study of a purposely defined representative group for the population in general. The researcher has the task of selecting an appropriate research group, so that it can reflect the most reliable picture of all the parameters for the population being analyzed [92,93]. In other words, the research sample is the number of people who will participate in the study. This sample must be representative, i.e., it must describe in some approximation the population under study [94].

The minimum sample size is determined according to the size of the population. In statistics, a distinction is made between a finite population and an infinite population. In practice, we very rarely deal with an infinite population. However, when the general population is very large, and the sample size is small relative to the total set, then the formula for an infinite population is applied. Therefore, in the present study, the formula for the minimum sample size for an infinite population is employed.

$$n = \frac{Z_{\alpha}^{2} pq}{d^{2}} \quad (1)$$

where

z_{α}—1.64 for $\alpha = 0.10$; 1.96 for $\alpha = 0.05$; 2.28 for $\alpha = 0.01$,
p—expected order of magnitude of the estimated fraction,
q—$(1 - p)$,
d—acceptable error of estimation of fraction p (given as a decimal fraction).

For the calculations assumed

1. confidence factor $1 - \alpha = 0.95$, thereby $z_{\alpha} = 1.96$,
2. maximum error (statistical) d = 5%,
3. p = 0.5.

Based on the assumptions made and the calculations performed, it was determined that the survey should be conducted in 385 households.

The next stage of methodological development in the survey process is the determination of the area of research activities. This sets both the area and the typology of issues and characteristics to be studied, tracing them in the defined area, in the relevant systems, social phenomena or groups [86]. The study used a random sampling method to ensure that the study population was representative. The sample consisted of 385 residents of Silesia. The selection criteria included age, place of residence, type of dwelling, square footage of the dwelling and the level of per capita income in the household to obtain a diverse study group that reflects the demographic diversity of the region. The research was conducted anonymously in the Silesian region using a proprietary survey questionnaire. The survey was conducted both online and on paper to ensure broad access to the study. The data collection process lasted from May to June 2024. Paper surveys were distributed to participants at various locations, such as libraries, community centers and workplaces.

Online, the surveys were available on Google's platform for a limited time. The survey was designed based on previous literature research and consultations with experts in the fields of energy and sociology. It consisted of 13 closed-ended and semi-open-ended questions designed to gather both quantitative and qualitative data on the opinions of Silesian residents about Poland's move away from coal. The questions were worded clearly and understandably to minimize the risk of interpretation errors. To ensure respondents were residents of Silesia, the survey also included an open-ended question about the postal code of the respondent's place of residence.

The survey yielded 385 complete questionnaires correctly completed by respondents, who were representatives of households diversified by age group, knowledge of the study's flagship topic and social status.

2.4. Analysis Methods

The purpose of the analysis was to test previously described hypotheses H1, H2, H3 and to identify the factors among survey results that would have a significant impact on respondents' opinion on Poland's departure from coal. Based on the analysis, an attempt was made to describe the phenomenon under study using a model.

The hypotheses were verified using a chi-square test. The significance level of all statistical tests in this analysis was set at $\alpha = 0.05$.

To build a model to determine which independent variables have a significant influence on the dichotomous dependent variable, logistic regression was used. Such a model allows us to describe the influence of several variables $X_1, X_2, \ldots, X_k$ on the dichotomous variable Y based on a logistic function in the following form:

$$P(Y = 1 \,|X_1, X_2, \ldots, X_k) = f(z) = \frac{e^z}{1 + e^z} = \frac{1}{1 + e^{-z}} \tag{2}$$

where $P(Y = 1 \,|X_1, X_2, \ldots, X_k)$ is the probability of adopting the distinguished value (1) under the condition of obtaining specific values of independent variables, while *z* is most often expressed as a linear relationship in the following form:

$$z = \beta_0 + \sum_{i=1}^{k} \beta_i X_i \tag{3}$$

where $X_1, X_2, \ldots, X_k$ are the independent explanatory variables, and $\beta_0, \beta_1, \beta_2, \ldots, \beta_k$ are the parameters.

The logistic function ranges in value from 0, when x goes to minus infinity, to 1, when x goes to plus infinity.

When building the model, it is important to remember to meet certain conditions concerning the lack of collinearity of the independent variables and random sampling, in which the number of observations should be at least ten times greater than or equal to the number of estimated parameters. In addition, it is important to properly code the dependent variable (the logistic regression model calculates the probability that the dependent variable takes the value of 1) to include all relevant variables and to exclude all irrelevant variables from the model. Importantly, logistic regression is sensitive to the presence of outlier points; therefore, they should be removed before starting the analysis, for example, using residual analysis.

Based on the coefficients, the unit odds ratio for each independent variable in the model can be calculated, which is a measure of the chance of the value (1) occurring when the independent variable increases by 1 unit:

$$OR_i = e^{\beta_o} \tag{4}$$

where $X_1, X_2, \ldots, X_k$ are the independent explanatory variables, and $\beta_0, \beta_1, \beta_2, \ldots, \beta_k$ are the parameters. The interpretation of this indicator is as follows:

1. $OR > 1$—a stimulating effect of the independent variable under study on obtaining the highlighted value (1);
2. $OR < 1$—a destimulating effect of the independent variable studied on obtaining the distinguished value (1);
3. $OR \approx 1$—no influence of the independent variable studied on obtaining the distinguished value (1).

The statistical significance of individual variables in the model (odds ratio significance) was verified using the Wald chi-square statistic, which tests the significance of the regression parameters (the statistic is the basis for the significance test of regression coefficients and is based on the asymptotic normality of the maximum likelihood estimate).

The selection of explanatory variables for the model was carried out using backward stepwise regression [95,96].

The quality of the model built was evaluated using the following:

- Hosmer–Lemeshow test—a statistical test for goodness of fit and calibration for logistic regression models. It compares the observed incidence counts of the distinguished value and the predicted probability. If these values are close enough, then it can be assumed that a well-fitting model has been built [97];
- Analysis of the ROC curve—a graph built based on the value of the dependent variable and the predicted probability of occurrence of the dependent variable. This graph also allows the assessment of the ability of the built logistic regression model to classify cases into two groups: (1) and (0). The resulting curve, and in particular, the area under it, illustrates the classification quality of the model. When the ROC curve coincides with the diagonal y = x, then the decision to assign a case to the selected class (1) or (0) made on the basis of the model is as good as randomly dividing the studied cases into these groups. The classification quality of the model is good when the curve is well above the diagonal y = x, that is, when the area under the ROC curve is much greater than the area under the straight line y = x, i.e., greater than 0.5;
- Analysis of a graph of observed values and expected probabilities, showing the results of the predicted probability of occurrence of an event and the true value. If the model

predicts very well, the points will accumulate at the bottom near the left side of the graph and at the top near the right side of the graph.

All statistical analyses were performed using Statistica 13.0.; other calculations were performed in MS Excel.

The logistic regression model was chosen for data analysis in the present study due to the dichotomous nature of the dependent variable [98], its flexibility with a variety of data, not requiring normality of the distribution of residuals [99] and the ability to obtain more intuitive and easily interpretable results by modeling the probability of one of two possible outcomes [100].

Nowadays, logistic regression is widely used in various scientific fields, particularly in medicine but also in the social sciences—in general, wherever factors affecting bivariate outcomes are studied. The popularity of logistic regression is certainly influenced by the ease of interpreting its results, greater resistance to unusual observations compared to linear regression and the ability to simultaneously take into account multiple independent variables, allowing for a comprehensive analysis of various factors affecting the dependent variable.

3. Results

3.1. Characteristics of the Study Group and Descriptive Statistics of Survey Results

The survey was conducted among a randomly selected group of 385 households from the Silesian Province. Based on the postal code provided by respondents, the residency of respondents was verified, and all respondents were found to reside in the study region. Therefore, 385 complete survey questionnaires were admitted for further analysis.

Table 1 presents and examines the distribution of answers to the basic research question about Poland's departure from coal in terms of eight parameters, which characterize the study group.

The analysis of the results obtained from demographic and social aspects indicates that the dominant group in the survey are individuals aged 31–50 (68% of total respondents) residing in a city with a population of 21–200 thousand (57% of total respondents) living in single-family houses (38%) or multi-family houses, i.e., blocks of flats (36%), with varying incomes. The main source of heating for the surveyed households is natural gas (36%), mains network central heating (32%) and coal (18%). In one in three households, at least one person is employed in mining or mining-related industries, and 83% of them receive coal subsidies. The proportion is much lower in case of employment in an energy company, accounting for a mere 6% of respondents, whereas in this group, two-thirds of respondents receive subsidies for electricity.

The data presented in Table 1 show that, out of 385 surveyed households, as many as 261, or 68%, are against Poland's departure from coal. This supports hypothesis H1, which assumes that the percentage is greater than 50%. $\chi^2(1) = 85.76,\ p < 0.001$.

The survey also indicates that 97% of households with at least one household member employed in the mining or mining-related industry are opposed to Poland's departure from coal, which allows us to conclude that there are no grounds on which hypothesis H2, assuming that this percentage is greater than 50%, can be rejected. $\chi^2(1) = 115.49$, $p < 0.001$.

The last hypothesis H3, which assumes that at least 50% of households using coal as a heating source are against Poland's departure from coal, can also be accepted, as the percentage is 91%. $\chi^2(1) = 48.06$, $p < 0.001$.

Table 1. Characteristics of the distributions of responses and variables in the sample by groups of opinions on Poland's departure from coal.

Are You in Favor of the Planned Departure from Coal in Poland's Energy Transition?				
Characteristics	Yes	No	No opinion	Total
Total	88 (22.9%)	261 (67.8%)	36 (9.4%)	385 (100%)
Age				
18–30	34 (38.6%)	55 (21.1%)	10 (27.8%)	99 (25.7%)
31–40	22 (25.0%)	98 (37.5%)	8 (22.2%)	128 (33.2%)
41–50	30 (34.1%)	85 (32.6%)	18 (50.0%)	133 (34.5%)
Over 50	2 (2.3%)	23 (8.8%)	0 (0.0%)	25 (6.5%)
Place of Residence				
City of up to 20,000 inhabitants	10 (11.4%)	30 (11.5%)	6 (16.7%)	46 (11.9%)
City of 21,000–100,000 inhabitants	20 (22.7%)	101 (38.7%)	8 (22.2%)	129 (33.5%)
City of 101,000–200,000 inhabitants	32 (36.4%)	46 (17.6%)	14 (38.9%)	92 (23.9%)
City of more than 201,000 inhabitants	10 (11.4%)	48 (18.4%)	4 (11.1%)	62 (16.1%)
Rural	16 (18.2%)	36 (13.8%)	4 (11.1%)	56 (14.5%)
Building type				
Multi-family apartment buildings	33 (37.5%)	83 (31.8%)	22 (61.1%)	138 (35.8%)
Single-family terraced or semi-detached houses	13 (14.8%)	32 (12.3%)	0 (0.0%)	45 (11.7%)
Detached single-family houses	36 (40.9%)	98 (37.5%)	14 (38.9%)	148 (38.4%)
Multi-family buildings—tenement houses	6 (6.8%)	48 (18.4%)	0 (0.0%)	54 (14.0%)
Income				
Below 3500 PLN	12 (13.6%)	33 (12.6%)	4 (11.1%)	49 (12.7%)
3500.01–4500 PLN	19 (21.6%)	26 (10.0%)	10 (27.8%)	55 (14.3%)
4500.01–5500 PLN	21 (23.9%)	49 (18.8%)	6 (16.7%)	76 (19.7%)
5500.01–6500 PLN	10 (11.4%)	50 (19.2%)	4 (11.1%)	64 (16.6%)
6500.01–7500 PLN	16 (18.2%)	37 (14.2%)	2 (5.6%)	55 (14.3%)
Over 7500 PLN	10 (11.4%)	66 (25.3%)	10 (27.8%)	86 (22.3%)
Size				
Under 60 m^2	22 (25.0%)	104 (39.8%)	10 (27.8%)	136 (35.3%)
60.01–90 m^2	26 (29.5%)	30 (11.5%)	16 (44.4%)	72 (18.7%)
90.01–120 m^2	16 (18.2%)	51 (19.5%)	0 (0.0%)	67 (17.4%)
120.01–150 m^2	14 (15.9%)	50 (19.2%)	2 (5.6%)	66 (17.1%)
Over 150 m^2	10 (11.4%)	26 (10.0%)	8 (22.2%)	44 (11.4%)
Heating source currently used				
Electricity	22 (25.0%)	8 (3.1%)	4 (11.1%)	34 (8.8%)
Natural gas	34 (38.6%)	93 (35.6%)	10 (27.8%)	137 (35.6%)
Coal	6 (6.8%)	64 (24.5%)	0 (0.0%)	70 (18.2%)
Other	8 (9.1%)	8 (3.1%)	4 (11.1%)	20 (5.2%)
From the municipal mains network	18 (20.5%)	88 (33.7%)	18 (50%)	124 (32.2%)
Job				
Mining	2 (2.3%)	118 (45.2%)	0 (0.0%)	120 (31.2%)
Mining-related	2 (2.3%)	9 (3.4%)	0 (0.0%)	11 (2.9%)
Power company	18 (20.5%)	7 (2.7%)	0 (0.0%)	25 (6.5%)
Gas company	2 (2.3%)	0 (0%)	0 (0.0%)	2 (0.5%)
Subsidy				
Electricity	14 (15.9%)	4 (1.5%)	0 (0.0%)	18 (4.7%)
Coal	0 (0.0%)	100 (38.3%)	0 (0.0%)	100 (26.0%)

3.2. Analyzing the Factors Influencing Opinions on Poland's Departure from Coal

The purpose of the survey was also to identify the factors influencing the opinion of Upper Silesian residents regarding Poland's departure from coal. Table 2 contains detailed results, and Figure 1 shows a graphical presentation of the data with a presentation of the opinions obtained. For better visualization of the data, the frequency of responses for households opposed to Poland's departure from coal is presented as negative values.

Table 2. Frequency distribution of factors indicated by respondents by groups of opinions on Poland's move away from coal.

Factor	Yes	No	No opinion	Total
I believe that once we move away from coal, air quality will improve	60 (68.2%)	14 (5.4%)	20 (55.6%)	94 (6.1%)
I'm afraid of an increase in electricity prices after Poland's departure from coal	16 (18.2%)	183 (70.1%)	18 (50%)	217 (14%)
I think we should implement nuclear power in Poland	54 (61.4%)	53 (20.3%)	8 (22.2%)	115 (7.4%)
I believe that nuclear power is not safe	12 (13.6%)	79 (30.3%)	6 (16.7%)	97 (6.3%)
I am in favor of Poland meeting the EU's green requirements	14 (15.9%)	2 (0.8%)	10 (27.8%)	26 (1.7%)
I believe that Poland's move away from coal will have a negative impact on the country's energy security	17 (19.3%)	231 (88.5%)	0 (0%)	248 (16%)
I'm worried about the impact of the closure of many mining and mining-related jobs on the labor market	10 (11.4%)	187 (71.6%)	8 (22.2%)	205 (13.2%)
I believe that currently, Poland cannot afford the energy transition	4 (4.5%)	218 (83.5%)	2 (5.6%)	224 (14.5%)
I believe that after Poland departs from coal, there will be a loss of energy independence	10 (11.4%)	239 (91.6%)	8 (22.2%)	257 (16.6%)
I care about ecology, and coal is not an environmentally friendly resource	44 (50%)	4 (1.5%)	18 (50%)	66 (4.3%)

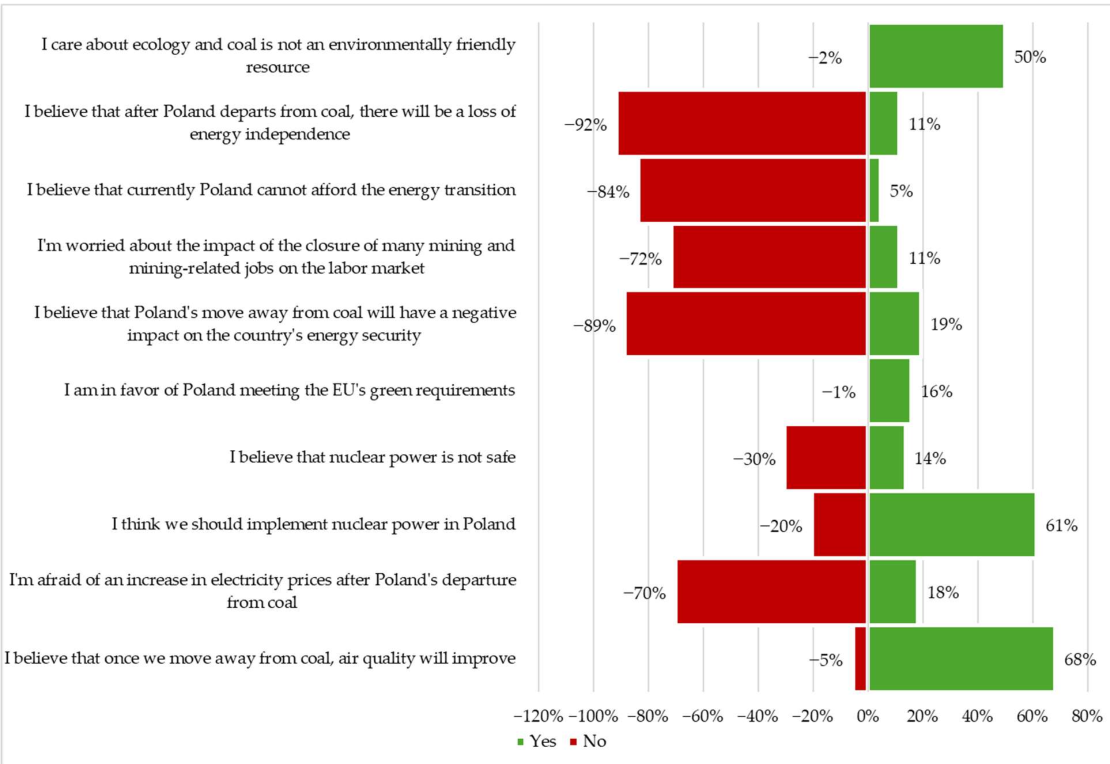

Figure 1. Factors influencing respondents' opinion on Poland's departure from coal.

As can be seen, the factors most often indicated among households in favor of moving away from coal, in order, are improvement of air quality (68%), the need to implement nuclear power in Poland (61%) and environmental aspects (50%). On the other hand, respondents opposed to moving away from coal identified issues related to loss of energy self-sufficiency (92%) and the negative impact on the country's energy security (89%) as the most important, and they also believed that Poland cannot afford the energy transition (84%). A significant percentage of respondents (72%) also indicated concern about the impact of job losses in the mining and mining-related industries. Across the entire group of respondents, the least frequently indicated factor was the requirement for Poland to meet the EU's environmental regulations.

In the survey, people were also asked to give an assessment of the factors that could influence their opinion on Poland's departure from coal using a five-point Likert scale (where 1—strongly disagree, 2—rather disagree, 3—have no opinion, 4—rather agree, 5—strongly agree), and the results were analyzed to answer the main question. Table 3 shows all the results, and Figure 2 graphically presents the results of the analysis according to the difference between persons who are against and in favor of Poland's departure from coal. The graph deliberately uses the intersection of the axis at the value of 3, which in the above scale is a neutral value, allowing the illustration of the distribution of responses of those with different opinions.

Table 3. Distribution and ratings of factors influencing respondents' opinion on Poland's departure from coal.

	Yes	No	No Opinion	Total
Coal is not an environmentally friendly resource	3.55	2.21	3.28	2.62
Air quality will improve after the departure from coal	4.32	1.81	3.89	2.58
Poland's departure from coal is important in meeting EU requirements	3.82	1.68	3.44	2.34
After the departure from coal, Poland's image in the international arena will improve	3.66	1.41	3.22	2.10
Nuclear power plants in Poland should be launched as soon as possible	4.00	2.82	3.00	3.11
Poland's departure from coal will be followed by a loss of energy self-sufficiency	2.68	4.56	2.89	3.98
Poland's departure from coal will have a negative impact on the energy security of the country	2.61	4.54	2.89	3.94

From an analysis of the responses, it can be concluded that among the group of respondents who are in favor of Poland's departure from coal, the highest rated issues were those related to improving air quality (4.32) and the need to launch nuclear power plants in Poland (4.00). According to this group of respondents, Poland's departure from coal is unlikely to have a negative impact on the country's energy security and loss of energy self-sufficiency. The group of respondents opposed to Poland's departure from coal have a different opinion, as it is these two factors—which are the negative impact on the country's energy security and the loss of energy self-sufficiency—that they consider the most important. Meanwhile, they are least likely to agree with statements about improving Poland's image in the international arena (1.41), the need to meet European Union regulations (1.68) and improving air quality (1.81).

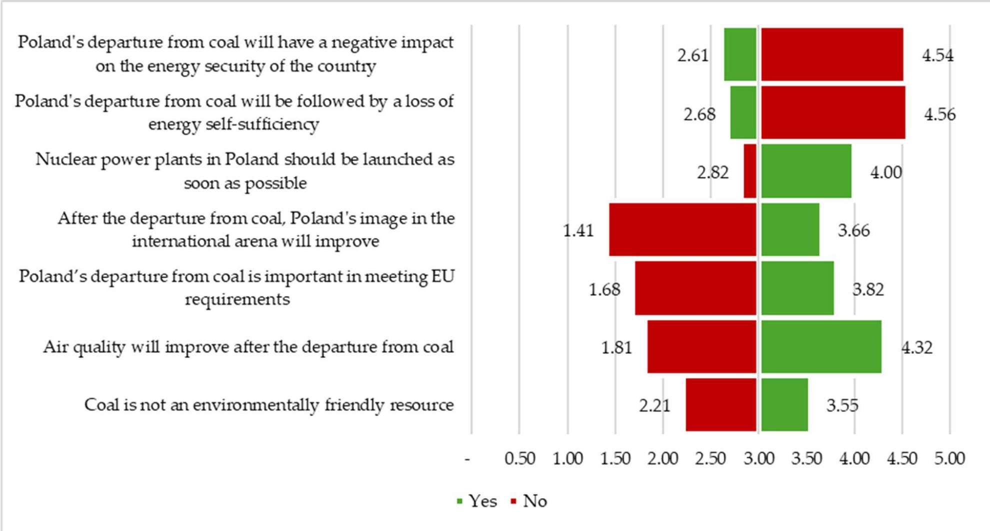

Figure 2. Ratings of the factors influencing respondents' opinion on Poland's departure from coal.

Based on the analysis of the factors, a picture emerges of two social groups with differing opinions: one opposes a move away from coal, prioritizing energy independence, energy security, energy prices and jobs over environmental issues; meanwhile, the other advocates a move away mainly for environmental reasons. The issue of clean air, especially during the heating season, is significant across the country, and many households have made the switch to heating for this very reason. It is also not surprising that this group strongly supports the implementation of nuclear power, which will be able to replace coal in the long term. This division and related opinions largely reflect public sentiment and the arguments cited by both coal supporters and opponents.

The use of two similar questions with regard to the factors influencing the opinion of respondents on the planned departure of Poland from coal, but in a different form, created different interpretation possibilities and allowed us to confirm the validity and reliability of the data obtained, as in both cases, similar results were produced.

3.3. The Evaluation of Factors Influencing Poland's Decision to Depart from Coal

After a preliminary analysis of the results, the key factors influencing Poland's decision to depart from coal were identified and statistically evaluated for the possibility of describing the studied problem with a model. Due to the fact that the dependent variable, defined in a zero–one form, i.e., as a dichotomous type, is the answer to the question on Poland's departure from coal, it was decided to use logistic regression to build a model to determine which independent variables have a significant influence on the decision.

Given the specific nature of the model, a sample of 349 observations was taken to estimate the model parameters, in which the answer to the question about Poland's departure from coal was either positive or negative.

3.3.1. Selection of Variables and Final Model Format

The selection of the optimal set of predictors for the model was carried out using backward stepwise regression, taking into account in the first version of the model all potential predictors, i.e., the eight socio-demographic factors listed in Table 1, and the seven factors that were subject to rating by survey respondents on a scale of 1–5. In subsequent iterations, statistically insignificant variables were eliminated, finally obtaining the final version of the model in the following form:

$$P(x) = \frac{e^{4.418-1.267\cdot \mathrm{age}-0.702\cdot \mathrm{en}_{\mathrm{source}}+1.330\cdot \mathrm{air}_{\mathrm{quality}}-1.142\cdot \mathrm{en}_{\mathrm{independence}}-2.491\cdot \mathrm{work\_mining}}}{1-e^{4.418-1.267\cdot \mathrm{age}-0.702\cdot \mathrm{en}_{\mathrm{source}}+1.330\cdot \mathrm{air}_{\mathrm{quality}}-1.142\cdot \mathrm{en}_{\mathrm{independence}}-2.491\cdot \mathrm{work\_mining}}} \quad (5)$$

The model includes five explanatory variables, whose detailed evaluations are shown in Table 4.

Table 4. Results of the fitted logistic regression model.

N = 349	Constant B0	Age	Energy Source	Air Quality	Energy Independence	Work in Mining
Assessment	4.418	−1.267	−0.702	1.330	−1.142	−2.491
Standard error	1.426	0.285	0.190	0.212	0.206	0.781
Student's *t*-test (343)	3.097	−4.448	−3.693	6.288	−5.550	−3.188
p-value	0.002	0.000	0.000	0.000	0.000	0.002
−95%CL	1.612	−1.827	−1.075	0.914	−1.547	−4.028
+95%CL	7.223	−0.707	−0.328	1.746	−0.737	−0.954
Wald Chi-squared test	9.594	19.788	13.641	39.535	30.808	10.164
p-value	0.002	0.000	0.000	0.000	0.000	0.001
Odds ratio one unit	82.903	0.282	0.496	3.781	0.319	0.083
−95%CL	5.015	0.161	0.341	2.494	0.213	0.018
+95%CL	1370.552	0.493	0.720	5.732	0.478	0.385
Odds ratio—range		0.022	0.060	204.362	0.010	0.083
−95%CL		0.004	0.014	38.696	0.002	0.018
+95%CL		0.120	0.269	1079.275	0.052	0.385

The final value of the loss function was 57.85, while the chi-square goodness-of-fit test value was $\chi^2(5) = 278.45$, and its *p*-value was $p = 0.0000$.

While improved air quality is a factor acting positively on the opinion that Poland should depart from coal, the age of respondents, the source of heating, fear of losing energy independence and working in the mining industry are factors inhibiting such a decision.

3.3.2. Model Evaluation

To assess the quality of fit of the logistic regression model, or more specifically, how well the model predicts the values of the dependent variable and how well it fits the data, the AUC and the Hosmer–Lemeshow test were determined.

The area under the curve (AUC) value of 0.9843 indicates a very high ability of the model to distinguish between classes (Figure 3). AUC values close to 1 signify excellent classification properties, meaning the model is highly effective in distinguishing between positive and negative cases. In practice, an AUC value above 0.9 is considered excellent.

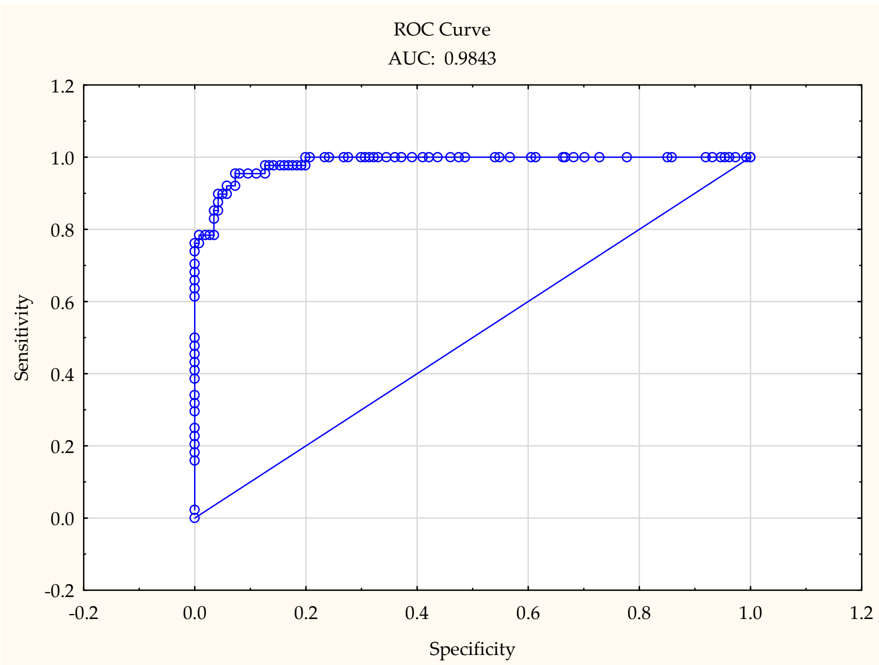

Figure 3. ROC curve of the fitted model.

The Hosmer–Lemeshow test result of 5.4427 and a p-value of 0.709382 (non-significance of this test is desirable) suggest that there is no reason to reject the null hypothesis. This means that the model fits the data well. A p-value greater than 0.05 indicates no significant differences between the observed and predicted values of the dependent variable, suggesting a good model fit.

The classification of cases and the odds ratio (shown in Table 5), calculated as the ratio of the product of correctly classified cases to the product of incorrectly classified cases, also indicate a good accuracy of the model.

Table 5. Classification of cases.

Odds Ratio: 131.118881 Log of Odds Ratio: 4.876104	Predicted: Yes	Predicted: No	Correct (%)
Observed: Yes	75	13	85%
Observed: No	11	250	96%

On the other hand, based on the graph of observed and predicted values (Figure 4), we can see that the model predicts very well because on the left side of the graph, the points accumulate at the bottom, while on the right side of the graph, they accumulate at the top, which is a desirable feature.

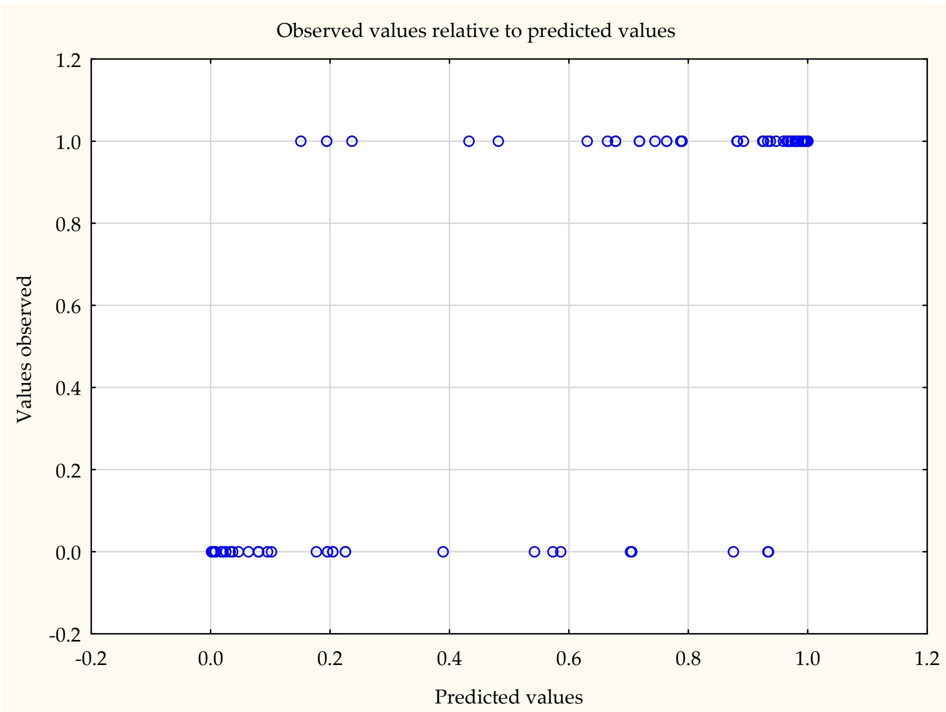

Figure 4. Observed and predicted values.

4. Discussion

The survey allowed us to verify the research hypotheses; therefore, it is necessary to look at the obtained results with some greater insight. The first hypothesis was accepted because as many as 68% of the households participating in the survey were against departure from coal; therefore, we should consider what could have influenced this result. The survey included 131 households in which at least one person worked for a mining or mining-related company, accounting for 34% of total respondents. It is worth noting at this point that the size of the entire group of households opposed to departure from coal was 261, which means that the number of households affiliated and not affiliated with the mining industry was spread practically in two halves. The high percentage of households opposed to Poland's departure from coal may therefore indicate that the opinion of Silesian residents is influenced by the centuries-old mining tradition, which has shaped the region's specific economic, social and cultural heritage, as well as its traditions and identity. In addition, the skeptical attitude of Silesian residents to the planned changes may be due to concerns about energy security and the loss of Poland's energy independence, as well as the negative impact of the phasing out of coal mining on the labor market in the province. It should be recalled that the territory of the Upper Silesian Coal Basin contains as much as ca. 80% of the documented reserves of Polish hard coal, and for many years, mining companies have been a significant employment source for the local community. Moreover, in addition to mining companies, the mining industry concentrates a large group of mining-related enterprises serving the mining industry. It is estimated that the loss of 1 job in mining entails the loss of 1.3–1.5 [84,101] jobs in a mining-related company and up to 3–4 jobs [102,103] in its environment. Hence, the liquidation of mines will result directly and indirectly in a significant increase in unemployment in the region, and this could undoubtedly also have a negative impact on the entire labor market in Silesia.

Another hypothesis refers to this group of respondents whose professional life is associated with the mining industry. The hypothesis assumes that the percentage of households opposed to Poland's departure from coal in which one of the household members is employed by a mining or mining-related company is greater than 50%. Analysis of the questionnaires showed that as many as 97% of households in which at least one member is employed in a mining or mining-related company are opposed to Poland's departure from coal, which allows us to conclude that there are no grounds to reject the hypothesis. Such a high percentage results primarily from the fact that respondents are worried about losing their jobs if the mining industry ceases to operate. Interestingly, only 40% of households in which at least one household member is employed in the mining or mining-related industry reported coal as a heating source, and coal subsidies were marked by 76% of them. Such a situation may be due to the fact that the subsidy may assume the form of 'coal allowance' received by employees of mining companies, which can be used, e.g., to pay bills, and not necessarily to purchase coal. It is also worth noting that all households that receive coal subsidies are opposed to the departure.

The last hypothesis, assuming that at least 50% of households using coal as a heating source are against Poland's departure from coal, was also accepted, as the percentage was up to 91%. Analyzing the surveys, it was observed that more than 68% of households using coal as a heating source received a coal subsidy.

The survey characterizes a specific study group, which has both its advantages and disadvantages. The advantage of the analysis is a clear indication that the vast majority of Upper Silesian residents are opposed to Poland's departure from coal. Such a high ratio is mainly due to the character and traditions of the region, shaped largely by mining and mining-related industries, but it may also be a consequence of lack of awareness and a clear vision and state policy in this matter, as well as overlooking the opinions of residents, which causes fear and social unrest. According to the authors, it would be important to increase the scale of the study and expand the analysis to the entire country and EU countries in order to be able to make a comparative analysis differentiating the perceptions of the energy transition process by a geographical criterion. Such research would certainly give a more approximate picture of public opinion and also make it possible to tailor and target awareness-building activities to the specific characteristics of the respective regions and to prepare individual groups for the planned changes.

Some of the most difficult challenges in the transformation of the Silesian region are changes that will need to take place in the labor market. This is confirmed by the results obtained in the survey, showing that the concerns of Silesian residents mainly revolve around the loss of jobs and the destabilization of the local economy. In this regard, it would be advisable to consider introducing appropriate financial and non-financial strategies at the national and EU level to realistically support coal companies, mining-related enterprises and their employees in the process of reorganization and retraining.

Additionally, attention should be paid to the necessity of extending the aforementioned support to peri-mining companies, which have been overlooked in government programs directed at the mining industry to date. Such assistance can be of great importance, particularly for companies for which the mining industry is the main, and often the only, partner and primary market. Dedicated measures can support such enterprises in developing their production potential and redirecting it to other sectors of the economy, such as energy, construction (underground, road, specialized), chemical, machinery and automotive industries, thus offsetting the negative impact on the labor market.

At the same time, building public awareness of the changes underway plays a significant role in the transformation process, making it equally important to have an appropriate information policy to raise awareness of the benefits of moving away from coal and promote sustainable practices. Such an approach will certainly help change the attitudes of the population and play a key role in the transition process.

In conclusion, the energy transition is currently a challenge for many international economies seeking to minimize the share of non-renewable energy sources in favor of more sustainable and renewable ones. Climate goals are the primary motivator for such efforts, but ensuring energy security around the world in the face of an unstable geopolitical situation is also crucial. Nonetheless, leading a just transition cannot be limited to unreflective implementation of strategies that reduce the dependence on coal but must also minimize the negative impact on local communities through supportive measures that reduce fear, create jobs and revitalize the local economy. Examples from Europe and America show that a well-planned energy transition can bring both economic and social benefits, and a properly executed process with appropriate state involvement can be an opportunity for positive change [104–107].

5. Conclusions

Sustainable development is a set of activities aimed at achieving a balance between the economy, society and the environment. According to this concept, therefore, a balance should be maintained between meeting the current needs of all people and improving the quality of the environment. Achieving the environmental goals adopted by the European Union should therefore not adversely affect the energy security of a country, as well as the quality of life of the current society. Therefore, it is extremely important that when implementing sustainable development strategies, the social aspect should not be overlooked. In Poland, the adoption of such radical changes in such a short period of time may result in greater social stratification due to an increase in the cost of electricity and a loss of national energy security. In addition, the EU's energy system transformation strategy may be felt most acutely by the public in coal regions with a concentration of mining and mining-related activities. In making the energy transition, it is therefore expedient to take into account the opinions of the residents of these regions on this subject.

The results of the survey and analyses show that the vast majority of Upper Silesian residents are against the departure from coal, which is being planned in Poland's energy transition.

The characteristics of the group of respondents who oppose the departure from coal show that they are mostly 31–50 years old, living mainly in single-family houses or multi-family houses (blocks of flats). The majority of respondents opposed to the departure from coal heat their homes with natural gas, the municipal grid and coal, and among the most significant factors determining their attitude toward coal is the belief that Poland's departure from coal will entail a loss of energy self-sufficiency and negatively affect energy security. Also evident among the responses are concerns about job losses or the lack of funds needed to carry out the energy transition. Issues regarding Poland's image or meeting EU regulations are the least important to them. On the other hand, the group of respondents favoring Poland's departure from coal are mostly young people under 30, with no professional ties to the mining industry, for whom the most important issues are ecology, improved air quality and the need to launch nuclear power plants that can satisfy the energy demand. Poland's image and meeting EU regulations are also important to this group.

The constructed model indicated that for the decision to depart from coal, there were five most statistically significant and predictive factors, which were related to the age of respondents, the heating source used, air quality issues and loss of energy independence, as well as working in the mining/mining-related industry. Of course, it should be taken into consideration that this approach is only a certain approximation of the studied phenomenon and an attempt to put it in the form of a mathematical model. The survey found that a majority of Silesian residents oppose Poland's coal transition. These results underscore important local concerns about energy policy changes and can be used by policymakers to develop more effective communication and support strategies for coal communities, which could accelerate the energy transition in Poland.

However, caution should be exercised when extrapolating these results to other areas in Poland and coal regions in other countries due to the unique socio-economic circumstances of Silesia. The study's shortcomings include the limited sample size and the specific regional context created by the concentration of mining in the study area. Therefore, we plan to conduct further research involving a broader sample and other coal regions to verify whether the observed trends are universal.

Certainly, further research on a larger scale will make it possible to take into account other aspects of this extremely important problem and to generate more precise estimates. Nevertheless, at this stage, the research indicates that the planned energy transition in Poland cannot take place without the social consent of the inhabitants of the region for whom the changes will be most significant, and the energy policy of the state should consider the identified problems and respond to the expectations, needs and interests of both groups.

In addition, we recommend further research into the impact of coal transition on various aspects of social and economic life. Such research can provide a more comprehensive understanding of the long-term effects of these changes.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to Polish law regarding research requiring a positive opinion from the relevant bioethics committee differs from European regulations, which govern only a narrow area of medical experiments conducted on humans by medical professionals (Act of 5 December 1996 on the Professions of Doctor and Dentist). Thus, under the current state of the law in Poland, a positive opinion from the bioethics committee is not required for non-medical scientific research involving humans. Additionally, Polish legislation does not regulate the necessity of establishing a research ethics committee within Polish scientific entities.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are available on request from the authors.

Conflicts of Interest: The authors declare no conflicts of interest.

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