Sustainable management in companies and green transition consequences based on the Polish energy sector in 2014-2024

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***Abstract*— Sustainable management in the Polish energy sector in 2014–2024 plays a key role in the transformation process towards the development of green energy. The paper includes a study of the five largest companies in the energy sector in Poland – Enea, Energa, PGE, PGNiG and Tauron – using the Fama-French model to assess the relationship between the excess company rates of return and the excess market rate of return. The results indicate a varied impact of sustainable activities on the financial results and investment risk of companies. The energy transformation in Poland, based on the increase in the share of renewable energy sources is not only an operational challenge, but also an opportunity for long-term development and ESG improvement. The research has shown that the positive consequences of implementing green energy include a reduction in CO_2 emissions and access to new investment funds, while the negative aspects result from the increasing costs of transformation and regulatory pressure. The final conclusions underline the need to implement comprehensive sustainability management strategies to balance the risks and benefits of the green transformation in a dynamically changing market environment.**

Keywords— sustainable management, green transition, energy security, ESG, Fama-French model

I. INTRODUCTION

Sustainable management in energy industry is the pursuit of energy companies to maintain a balance between the needs of an economic, social and environmental nature. Since joining the European Union, the Polish economy has been undergoing a dynamic transformation towards green energy, which involves reducing CO2 emissions, decarbonization and investing in renewable energy sources. This change is not only supported by EU law regulations, but also by social expectations aimed at limiting the negative impact of fossil fuels on the natural environment and public health. The energy sector is a sector covering a wide range of industries, from hard coal, through oil and gas extraction, combined heat and power plants, the fuel industry, to energy generation using renewable sources.

The development of the energy sector is based on investments in renewable energy sources, technological innovations and decarbonization (Mituś, 2024, p. 31). Many companies are actively contributing to this change, implementing various environmental strategies. Despite the challenges, energy transformation is becoming necessary to increase energy security (especially after the beginning of the conflict in Ukraine) and reduce emissions, in line with global trends in the fight against climate change (Partacz, 2022, p. 174).

The paper focuses on the application of the sustainable development strategy of enterprises on the example of selected, largest companies in the energy sector in Poland in the context of the ten-year research period covering the years 2014-2023. In the analysis, the authors focus on presenting the impact of the green transformation strategy on the sustainable development of the Polish energy sector, on a global and national scale. An attempt was also made to answer the following research questions:

Q1: What role does sustainability play in the energy sector?

Q2: What role does operational efficiency play in the sustainability of energy companies?

Q3: How strong is the relationship between the excess return of energy companies and the excess return of the capital market?

Q4: How does the variability of alpha indicators in the Polish

ASEJ - Scientific Journal of Bielsko-Biala School of Finance and Law
Volume 28, No 4 (2024), pages 7
https://doi.org/10.19192/wsfip.sj4.2024.11
Received: September 2024, Accepted: December 2024,
Published: December 2024.

energy sector affect the implementation of sustainable development

goals and thus financial efficiency, taking into account differences in the level of management, RES investments and ESG

regulations?

II. Determinants and goals of sustainable development of the energy sector

The essence of sustainable development is in the issue of cooperation between three spheres – economic, environmental and social (Combe, 2022, p. 84). It integrates human activity with maintaining the balance of nature, has an intergenerational and therefore long-term character, serving to meet the needs of people around the world (Gadomska-Lila, 2016). In the context of enterprise management, it defines a strategy of action that, by meeting current social needs, tries to preserve man and his resources. Examples of the implementation of the sustainable development strategy by enterprises include, among others, electronic invoices, e-receipts, ecological (biodegradable) packaging, or replacing lighting in the company's headquarters with energy-saving ones (Kubala, 2023). Above all, however, it should be noted that this is a sequence of events, considered on many levels of management, which should be related to the specificity of the enterprise and the industry in which it operates. Moreover, the idea does not force the abandonment of the company's profit orientation. This is because it is based on the assumption that making a profit and responsibility within ESG can coexist and support each other (Q1). It is based on four pillars, in which sustainable development is treated as:

a. source of long-term financial benefits manifested by risk reduction and increased operational efficiency while maintaining access to capital;
b. driving force for innovation – by increasing competitiveness and enabling entry into new markets;
c. way to meet the expectations of stakeholders – which is important in a dynamically changing world and society that, through increased awareness, prefers the products and services of socially and environmentally responsible companies;
d. element of a business strategy aimed at creating value for shareholders and as a tool for risk management and improving financial results;
e. driver of trend and regulatory compliance – in particular in connection with the growing role of international climate initiatives or national environmental protection requirements.

At the same time, it indicates the existence of interdependence that occurs within the evolution of the concept of enterprise management and its finances (Mikołajewicz, 2016, p. 191). It assumes a transition from a linear economy to a circular economy, which is based on the secondary use of resources (Sikacz, 2019, p. 60). This activity is optimized, through a renewable ecosystem, stimulating innovation and the development of technologies that increase the efficiency and effectiveness of operations, and thus reduce costs at the operational level (Lachiewicz, 2009, p. 220).

The key objective is therefore long-term value creation, which does not come at the expense of future generations. A manifestation of such action is the reduction of fossil fuel emissions. In 2014, the share of coal in energy production in Poland was 85%. A decade later, this result was 48%. In turn, the share of renewable energy sources in 2014 was 11.45%, while in 2024 it was already around 20%. It is therefore clear that the trend has reversed, which is a manifestation of many small and large investments in green energy (Toborek-Mazur, Partacz, Surówka, 2022). EU funds or changes in prosumer support systems affect the dynamics of investment in photovoltaic installations, which poses challenges for energy producers, e.g. expensive modernization of transmission infrastructure and its adaptation to renewable energy sources, dependence of technology and component imports on the construction of wind farms or photovoltaics.

III. The role of operational efficiency in sustainable management

The economic approach to sustainable development indicates an assessment of efficiency in the context of the long-term functioning of the enterprise, which depends on its financial and competitive strength. Striving for high efficiency is, in turn, a natural goal of every business organization (Piwowar-Sulej, 2022, p. 66). ESG-oriented operational efficiency plays a significant role in sustainable development of a company, as it affects its ability to minimize costs and maximize resources while achieving environmental, social and governance (ESG) goals. In general, companies with higher operational efficiency perform better in key ESG indicators. These include energy intensity, waste reduction or carbon footprint, and the rate of waste recycled (Q2).

The concept of sustainable development is part of the corporate social responsibility model, in which a company's success is based on long-term development that is equally dependent on social, economic and ecological factors (Rudnicka, 2012, p. 49). Corporate social responsibility includes actions that are consistent with environmental and social concerns. Such conduct should contribute to sustainable development, but also combine stakeholder expectations and compliance with law and international standards of proceeding in management (Kopera, 2023, p. 29).

Key areas of the green transformation include:

a. decarbonisation and gradual withdrawal from coal – in line with EU policy and national plans, Poland plans to gradually phase out coal-fired power plants. It is estimated that by 2040, the share of coal in the energy mix, depending on the final scenario, will be between 11-28%;
b. development of renewable energy sources – this applies in particular to wind and photovoltaic energy. In the first case, the green transformation is based on the development of wind farms, especially in the Baltic Sea, including the PGE Baltica project, while in the second, thanks to government

programmes that support PV installations in households;
c. modernisation of the power grid in order to adapt to the changing working conditions associated with RES, which are characterised by unstable energy production resulting from atmospheric conditions;
d. hydrogen investments – Poland is investing intensively in hydrogen technologies and projects enabling its use in industry and transport;
e. heating transformation – heating systems in Poland are switching to less emission fuels.

The largest energy companies in Poland implementing the green transformation are: PGE Polska Grupa Energetyczna, Tauron Polska Energia, Grupa Orlen, Energa (as part of Grupa Orlen) and ZE PAK (Toborek-Mazur, Wójcik-Jurkiewicz, 2022).

According to the SRS ACQuiom ESG Barometer Report, which asked the question: to what extent do ESG factors affect the dynamics of M&A transactions 51,9% of respondents answered that: additional steps in due diligence process, new representations or warranties (44,3%), a filter for analyzing potential transaction (29,1%), post-closing integration (26,6%), purchase price (5,1%), closing conditions (5,1%) and other reasons (11,4%) (Zero, 2021). The results evaluation indicate an extension of the transformation process, which testifies the need to conduct additional analyses to select areas responsible for implementing ESG policy and to identify barriers that could hinder or extend this process (Toborek-Mazur, 2022, p. 199).

Table 1 presents the consequences of green energy development in Poland, along with a comprehensive summary of the impacts of this process on the economic, social, environmental and political areas. The table includes both the benefits and challenges related to the green transformation. On the positive side, there are, among others, the creation of new jobs in the renewable energy sector, improvement of the quality of life by reducing emissions, reduction of dependence on fossil fuels, and strengthening of Poland's position in the international arena in connection with the implementation of climate commitments. Negatives include, among others, high costs of investment in renewable energy infrastructure, the risk of job losses in coal-related sectors, potential political conflicts and environmental challenges, such as the impact of wind farms on the landscape and ecosystems.

The table indicates the multidimensional nature of the changes brought about by the development of green energy, emphasizing the need to balance economic, environmental, social and political interests in order to effectively transform Poland's energy. In this way, it helps to comprehensively understand the implications of the transformation towards sustainable development in the energy sector.

TABLE 1. CONSEQUENCES OF GREEN ENERGY DEVELOPMENT FROM THE POLISH PERSPECTIVE

The nature of the consequences of green energy development	Positive	Negative
Economic	Investments and development of new sectors – renewable energy, photovoltaics, wind energy, hydrogen, energy storage; Savings – reduction of greenhouse gas emissions and modernization of energy, decrease of emission fees, import of fossil fuels; Energy independence – reduction of dependence on import of energy resources, mainly gas and oil.	High costs of transformation – construction of photovoltaic and wind installations or modernization of power grids involves large financial outlays, the cost of which is often transferred to the target recipients; A threat to traditional sectors and jobs – especially in areas dependent on coal, e.g. Silesia; Necessity of financial support for post-coal areas.
Social	Improving the quality of life – reducing pollution, improving public health; New jobs for specialists in innovative technologies.	Social resistance – fear of changes and losses in the coal sector; Need to provide additional training for employees in the use of modern technologies.
Environmental	Reduction of greenhouse gas emissions by switching to renewable energy sources; Protection of biodiversity by reducing environmental degradation and the negative consequences of mining; Increased energy efficiency by investing in new technologies.	Pressure on the local environment through the construction of wind farms; Transformation of the landscape and in some cases negative impact on the surrounding flora and fauna; Problem with recycling components – limited lifespan of photovoltaic panels, energy storage or wind turbines.
Political	Regulatory pressure – the need to adapt energy strategies to EU requirements. Independence of energy and limiting the impact of raw material supplies (limiting the risk of energy “blackmail”) and less susceptibility to fluctuations in international markets.	Legislative delays resulting from the need to adapt the law (risk of sanctions); Conflicts with stakeholders – slow pace of legislative changes, restrictions in access to EU funds; Pressure from the coal lobby or problems with maintaining liquidity of financing of energy transformation (increases in energy prices, new taxes).

Source: author's own studies.

Source literature on energy transformation focuses on sustainable development brings positive (creation of new jobs, diversification of energy sources or stimulation of innovation and reduction of the use of fossil fuels) as well as negative effects (infrastructural challenges, costs of transformation or difficulties in social acceptance) (Miszczuk, Sekuła, Miszczuk, 2024, p. 23). Although in the short term changes of economic, social and environmental nature are noticeable, their full impact will become visible only in the perspective of the next few decades (Partacz, 2022, p. 170).

IV. Measuring the effectiveness of socially responsible investments

ESG factors are gradually being implemented into investment analysis. The aim of this approach is to measure and estimate the impact of various risk areas focused on social, environmental and corporate governance aspects on investments in such a way as to be able to minimize them appropriately (Żaba-Nieroda, 2023, p. 75). This process can be compared methodically to the assessment of efficiency. The efficiency of socially responsible investments is of broad importance because it results from the interest of various groups of recipients, both direct beneficiaries (investors), local society and the entire economy. The model of socially responsible investment assumes the existence of a responsible (rational) investor and a long-term perspective influenced by the natural environment and the social environment. This means that in the context of investment efficiency, which is at the same time a substrate of positive investment value and a correlate of the measure of efficiency, socially responsible investing is important for a wide range of recipients. Among the commonly accepted methods of measuring efficiency - indicator, parametric and non-parametric, it is important to understand the relationships that occur between the layer of financial and non-financial factors. They are catalysed in the issue of socially responsible investing and have the character of a mathematical-econometric model. Some of them are simple, taking into account the rate of return and risk, others are more complicated, having a multi-factor character (Szadziszewska, Majchrzak, Remlein, Szychta, 2021, p. 230). One of the models representing the second group includes the CAPM model (Capital Asset Pricing Model) and the Fama-French model.

The first model describes the relationship between the expected rate of return and the risk of investing in securities. In this model, the expected rate of return is equal to the risk-free rate increased by the premium for this risk. The premium itself depends on the beta coefficient for a given security. In practice, a way to obtain a higher rate of return is to select companies for the investment portfolio that are characterized by higher volatility, which in turn can contribute to obtaining a higher beta coefficient value and rate of return. However, although this model is a simple and useful solution, at the interface of assumptions and reality it encounters several fundamental challenges related to changing investor expectations, and consequently different approaches to accepting (higher) risk. In response to the low effectiveness of the model, in 1992 two professors from the University of Chicago developed a new model based on three indicators, taking into account market risk and the size and valuation of a listed company. The basic advantage indicating the usefulness of the model is the fact that the investor can decide on the construction of the investment portfolio each time, appropriately increasing or decreasing the susceptibility to any risk factor, thus adjusting it to the expected rate of return (Galloppo, 2021, p. 254). The model uses both SMB (Small Minus Big), i.e. the difference between the rates of return of companies with low capitalization and companies with high capitalization. In accordance with the assumption that small companies more often bring higher rates of return than large ones, despite the risk (size effect). On the other hand, HML (High Minus Low) is the difference between the rates of return of companies with a high book value to market ratio and companies with a low ratio (Bacon, 2023, p. 193). In accordance with the assumption that value companies usually have higher rates of return than growth companies with a low book value to market ratio (value effect). The Fama-French model can be supplemented with other factors, e.g. those related to profitability (RMW) or investment (CMA), but also by taking into account factors, e.g. those related to ESG. ESG values recorded in the form of a rating such as “BB” or “AAA” require conversion into numerical values. Companies with a higher ESG rating, e.g. “AAA”, show less variability in excess returns, which in turn suggests greater stability and lower external risks, e.g. resulting from legal changes or social crises.

In the research on Polish companies from the energy sector, the following formula based on the Fama-French model and the four-factor Jensen alpha from the Carhart model was used (Miziołek, Trzebiński, 2017, p. 100):

$$R_{it} - R_{ft} = \alpha_i + \beta_{iMKT} \cdot (R_{MKT} - R_{ft}) + SMB_t + \beta_{iSMB} \cdot SMB_t + \beta_{iHML} \cdot HML_t + B_{iESG} \cdot ESG_t + \epsilon_{it} \quad (1)$$

Where:

R_{it} – tota. return of rate of a stock "i" at time "t"

R_{ft} – risk free rate of return at time "t"

R_{MKT} – total market return at time "t" (market rate premium)

SMB_t, HML_t – Fama – French indicators

ESG_t – ESG indicator for energy company vs time variable "t"

α_i – intercept term

$\beta_{iMKT}, \beta_{iSMB}, \beta_{iHML,} B_{iESG}$ – factor coefficients

ϵ_{it} – residual term

The model is a factor model with an additional component based on ESG. Adding this factor allows us to take into account the impact of sustainable development, social responsibility or corporate governance on the rate of return on investment (Naffa, Fain, 2022). Since companies approach the presentation of the necessary data in this area to a different extent in their reports, it is possible to use the individual components together, as well as to select them individually. ESG is becoming an increasingly important factor in global investing, and therefore

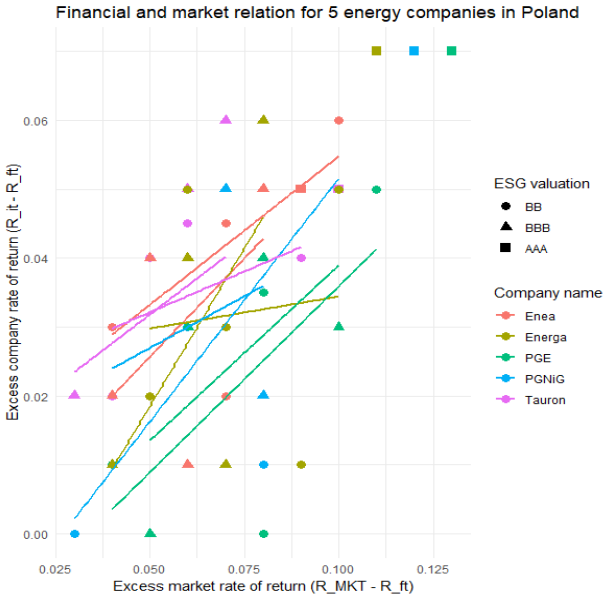
each parameter that allows its assessment improves the degree of the rate of return forecast, especially in sectors sensitive to social and environmental factors, including energy. ESG factors can be measured in several ways, including ESG ratings - i.e. ratings provided by rating agencies, ESG indices or assessments of the impact of individual components on the environment, e.g. reducing greenhouse gas emissions, creating environmentally friendly workplaces or promoting diversity.

The proposed model also includes a residual term – component representing unexplained changes – not resulting from the market premium or ESG results, random events – independent factors specific to a given company or one-time effects or the assumption of normality, where $(E(\epsilon_{it}) = 0)$ and is a normal distribution. Other values of the factor indicate a higher or lower return of the company than that predicted by the model (Connor, Goldberg, Korajczyk, 2010, p. 132). The model uses α_i, which measures the efficiency of the investment independent of market risk factors. At the same time, it indicates whether a given factor brings an additional rate of return (Bessler, Drobetz, Adcock, 2013, p. 615). Therefore, if the value of $\alpha_i > 0$, then the company achieves better results than market expectations, while when the value of $\alpha_i < 0$, then the company achieves worse results than market expectations.

In turn, companies with lower ESG ratings, e.g. "BB" are characterized by greater volatility, and greater susceptibility of financial results to negative external conditions.

The study on the comparison of the level of sustainable development in 5 Polish energy sector companies was based on the analysis of three main areas, i.e. environmental, social and corporate governance. From the perspective of the energy sector, the environmental criterion was the most important because the activities of this sector directly affect the natural environment. Then the social criterion was taken into account, and finally the corporate governance criterion. Individual companies were given ratings based on guidelines (share of renewable energy, activities for decarbonization, impact on the local environment, transparency and quality of corporate governance) and available data sources. These data include sustainability reports, ESG reports and ratings based on external financial and non-financial parameters, as well as the value of risk analyses. Their combined consideration allowed for the ESG assessment, taking into account both strengths and areas requiring improvement in the context of sustainable development. The study also took into account the specificity of a given company. The results were converted to a standard format on a scafe of AAA-CCC based on the adopted quality grading thresholds. The detailed results of the study are presented in Chart 1. The interpretation of Chart 1 indicates that among the five most important companies surveyed from the Polish energy sector, the excess rate of return fluctuated between a value in the range of 2.5% and 12.5% above the risk-free rate. This value is quite typical of the energy sector of developed economies, often dependent on variable macroeconomic factors. In the case of the assessment of the company's rate of return, it can be seen that it assumes a range from 0.00 to 0.06, which means that the excess rates of return of the surveyed companies fluctuated between 0% and 6%.

CHART 1. THE RELATIONSHIP BETWEEN THE COMPANY'S EXCESS RATE OF RETURN AND THE MARKET'S EXCESS RATE BASED ON THE ANALYSIS OF 5 ENERGY COMPANIES IN POLAND (2014-2023)



Source: author's own studies in R based on https://www.sustainalytics.com/ (access date: 17.12.2024) and https://finance.yahoo.com/ (access date: 17.12.2024) and Integrated reports of some companies.

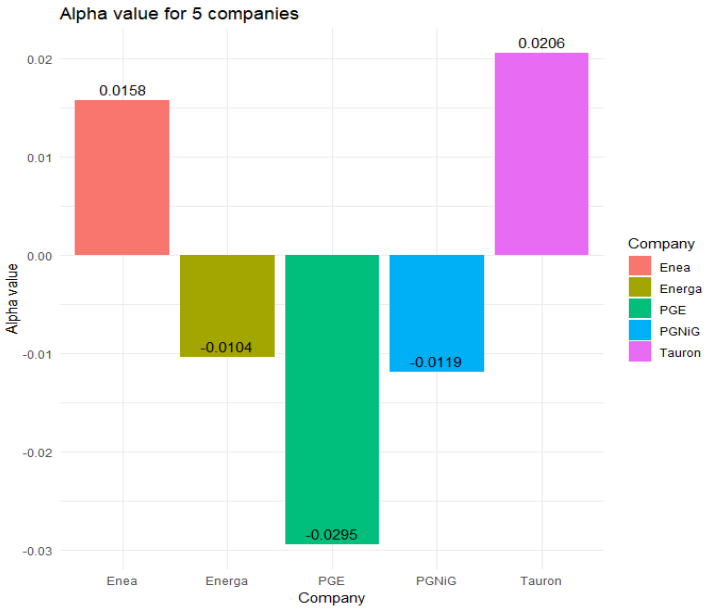
This is a relatively small variability, which may indicate relatively stable results of these companies compared to the market. In conclusion, the surveyed companies are characterized by relatively lower rates of return compared to more volatile markets, e.g. the technology sector, which in the case of the energy sector, which is less susceptible to rapid changes, these values may be fully adequate. This is particularly important when taking into account the Polish perspective, in which the high share of fossil fuels in the energy mix and the more or less conservative policy of successive governments in the area of rapid processing of changes in the green transformation play a significant role.

Chart 1 indicates a significant relation between the excess market rate of return (R_MKT - R_ft) and the excess company rate of return (R_it - R_ft). The market excess rate of return (R_MKT - R_ft) is a premium for market risk, i.e. the difference between the market rate of return and the risk-free rate of return. It reflects the extent to which and how much investors expect additional value for taking on market risk (Q3). The relation helps explain the variability of returns on individual stocks in the context of the current market conditions for the model. In turn, the excess rate of return of the i-th company in time t (R_it - R_ft) measures the excess return of the i-th company over the value of investment in risk-free assets. In other words, it allows you to analyze whether the rate of return on a given company results from the market's actions and expectations, or is a deviation from these expectations. In Chart 1, each company is represented by the occurrence of values in individual years, while the points indicate the change over the 10-year period of the excess rates of return. Trends (regression lines) indicate the existence of a positive correlation between the excess rate of return of the market and individual companies. This means a situation in which the market achieves higher returns (using the

risk-free rate) when companies generate higher excess rates of return. Each line represents a different company.

The slope of the line indicates the degree of sensitivity of the company's returns to market changes. The higher the slope, the greater the sensitivity to the market. At the same time, a higher ESG rating means greater return stability or lower risk. However, the ESG rating in the above example is not a direct predictor of the excess rate of return, as it is one of its elements. It can therefore be an indication of certain changes, but it is not the only determinant. Other determinants include, among others, financial results (financial analysis), but also an assessment of energy policy or the current situation on the raw materials market. This leads to the conclusion that despite a common sector (only the energy sector is analyzed), companies present differences in the level of achieved excess rates of return, which may be the result of different management strategies, levels of operational efficiency, but also approaches to investing in renewable energy sources, which in turn is related to ESG policy. In the context of green energy transformation, companies with a higher ESG rating may achieve a competitive advantage in the future, which may translate directly into financial results. It can be seen that companies with a higher ESG rating are more attractive to investors focused on sustainable investments, but only a detailed financial analysis can indicate differences in the levels of results between individual companies (Zabawa, 2019, p. 77). The regression lines for companies such as Enea, PGE and Tauron suggest a relationship between the excess rate of return of companies and the excess rate of return of the market (Toborek-Mazur, 2022, p. 202). Some companies achieve better alpha results thanks to higher ESG ratings. Based on the study, it can be seen that there were differences at the level of alpha. Companies that recorded a positive alpha value achieved better results than the model would predict. The reasons for the occurrence of a negative alpha value may indicate internal problems or temporary difficulties in management, which suggest that the full market potential has not been used. At the same time, it should be noted that due to different management models and different operational strategies, the value of the indicator may change. This results from the fact that the energy sector is classified as a high-risk sector, and the differences at the level of the alpha indicator may be significant, due to fluctuations in financial results related to the changing market environment and innovations (Szopa, 2021, p. 112). The detailed results of the study are presented in Chart 2. It is not possible to indicate a single alpha value that would be characteristic for the entire sector. However, it can be noted that the difference between the highest and lowest recorded alpha value in Chart 2 is approximately 0.05 and is not extraordinary in the context of the dynamics of the energy sector and the comparative analysis of company results. This results from the fact that the energy sector is a dynamically developing sector, and value fluctuations are the result of the volatility of raw material prices, ESG regulations or diversity in the approach to management. Since most alpha indicators are close to zero (or negative), the results of the energy sector in Poland were largely determined by market factors, and not by independent decisions of companies.

CHART 2. UNIFIED ALPHA INDICATOR VALUES FOR THE ANALYZED ENERGY SECTOR COMPANIES FOR THE YEARS 2014-2024



Source: author's own studies in R based on https://www.sustainalytics.com/ (access date: 17.12.2024) and https://finance.yahoo.com/ (access date: 17.12.2024) and Integrated reports of some companies.

Additionally, differences may occur at the level of specificity and characteristics (size, business profile, or level of technological advancement or investment in RES) of a given energy company (Q4). Therefore, even a negative result is not decisive in the sense that it would suggest a worse financial situation. This is a reference to the achievement of goals within the framework of sustainable development, which does not always have to be associated with failure to achieve financial results (differences between financial and operational efficiency within the framework of sustainable development).

V. CONCLUSIONS

Sustainable development of enterprises is not only a necessity resulting from regulations or adaptation to social expectations, but above all a chance to build competitiveness in a dynamically changing world. This is an expectation noticeable on many levels, which is exemplified by the use by enterprises of various strategies focused on socio-environmental aspects of management. Companies that effectively integrate ESG strategies can count on long-term growth, while limiting the negative impact on the environment and society.

Sustainable development in the Polish energy sector in 2014-2024 was a key challenge and at the same time an opportunity for transformation in line with the requirements of the EU climate policy and national energy strategies. Despite significant progress, including in the renewable energy sources (RES) segment and infrastructure modernization, the sector still struggles with numerous problems, such as dependence on fossil fuels, regulatory pressure and limited availability of capital for green investments. The source literature indicates

that sustainable development requires a holistic approach, taking into account economic, environmental and social aspects.

In financial analysis based on environmental factors and sustainable development, it is important to understand the challenges faced by individual companies and the sectors in which they operate. A thorough analysis can help identify whether a high ESG rating is the result of marketing (greenwashing) or actual activities that translate into financial results. It is worth pointing out the relationship that indicates that the lower the degree of ESG volatility, and thus the higher the degree of predictability, the greater the interest of potential investors, who often look for stable returns. Analyses of the alpha indicator values for energy sector companies in Poland in 2014-2024 indicate a variety of results. Positive values of the indicator for Enea (0.0158) and Tauron (0.0206) indicate a moderate exceedance of the expected market return in these companies, which may suggest more effective use of synergies and better integration of ESG strategies in their operations. In turn, negative values for Energa (-0.0104), PGE (-0.0295) and PGNiG (-0.0119) may indicate difficulties in fully using the synergy potential and limitations related to the energy transformation.

The future of the energy sector in Poland depends on cooperation between the government, businesses and society. The transition to more sustainable energy sources not only fits into global trends, but also offers a number of benefits for the local economy and environment. The energy transformation, although difficult and expensive, is an investment in the future that can bring long-term economic benefits and improved quality of life.

The paper presents the results of scientific research conducted within WAP project financed by a subsidy granted to the Cracow University of Economics.

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