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The use of accounting system to assess the pursuit of sustainable development in environmental protection by the Polish listed companies from the energy sector

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Abstract: The purpose of this study is to verify the extent, to which an accounting system enables acquisition of environmental protection data, and assess the presence of correlation between the pursuit of environmental protection and financial condition. The research hypotheses are: Does accounting system make possible obtaining information about environmental protection? Is there connection between environmental protection and companies condition? To attain this goals, heuristic methods and indicator methods were used. The entities publish increasingly more information on environmental protection. Formalizing and structuring the presentation of environmental protection data in the companies' reports would be recommended. There is no correlation between environmental protection and condition of a company.

Keywords: sustainable development, environmental protection, accounting, financial reporting

1. Introduction

The issue of sustainable development (SD) gains on importance for the operation of many undertakings, including in particular those from the energy sector. Conducting business in accordance with the SD principles may however negatively affect the financial performance of the company. Thus, auditing the extent to which the entity manages to pursue the principles of sustainable development and associating these principles with financial performance of the company is reasonable.

The main source of knowledge on the company's or capital group operations is the individual or consolidated financial statements as well as report on the operations and the remaining components of the companies' reports.

The essential source of data used in the reports is the company's accounting. The form of statements is also governed by the accounting legislation (the Accounting Act, optionally IFRS and IAS).

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The purpose of this study is to verify to what extent the existing accounting principles, including in particular these referring to the scope and method of presentation of environmental protection data, enable the analyst to draw conclusions regarding a company's implementation of sustainable development principles in environmental protection.

Secondly, the study aims at verifying to what extent the pursuit of sustainable development is correlated with the financial condition of a company.

2. Literature review

The sustainable nature of development has been increasingly emphasized in recent years.

Łozowicka described the increase in effectiveness of the implementation of sustainable development policy (Łozowicka, 2020). She used quantitative methods to assess sustainable development policy management. The author emphasizes that her studies were focused on countries of low level of sustainable development implementation. However, when comparing to 2005, in 2015 these countries pursue sustainable development to a much greater extent.

Fazlagić and Szczepankiewicz focused on the conceptual model describing the role of territorial self-government in supporting creative industries (Fazlagić and Szczepankiewicz, 2020). They designed a model that may be helpful for territorial self-governments.

Garcia-Fejioo, Eizaguirre and Rica-Aspiunza (2020) dedicated their research to the issue of preparation of the economic universities' graduates to deliver the sustainable development goals. In their opinion, there is not enough research and studies concerning the practical implementation of the sustainable development goals.

The issue of reflecting the company's operations in the scope of corporate social responsibility (CSR) in its accounting books was described in many scientific studies.

It was also the leitmotiv of the study by W. Skoczylas (2019), in which the author analyzed the implementation of corporate social responsibility in the macro-sector companies: industrial production as well as construction and assembly production. The outcome included the statement that the companies from this sector generally implement the CSR principles and confirmed the validity of non-financial reports.

Wójcik-Jurkiewicz (2017) described the role of CSR reporting. She analyzed the reports presented by WIG 30 companies. The studies performed by the author confirmed the existing reporting chaos and the need for standardization of reports.

Also K. Kobiela-Pionnier (2019; 2020) dedicated her studies to this issue, focusing on analysis of assumptions of integrated reports. The result of the analysis contained in the 1999 study is a rather negative assessment of conceptual assumptions of integrated reports, emphasizing the use of imprecise and abstract terms in definitions. The conclusion of the 2020 publication is that there is an increasing interest among capital donors in non-financial report and the pursuit of sustainable development.

Majchrzak and Nadolna (2020) carried out the research on the scope and place of disclosure of valuable environmental information in the annual consolidated financial statements of the largest listed companies from the energy sector in Poland. The outcome of this research was the statement that these companies disclose similar groups of environmental information however the place of disclosure and content of such information are both highly differenti-

ated. This significantly impedes comparing environmental information in space. In addition, the authors examined primarily the items included in the financial parts of the statement (balance sheet and profit and loss account).

Kotyla and Hyży (2020) verified to what extent the financial statements of companies involved in public transport disclose the environmental protection information, in particular the emitted carbon footprint. In effect of verification they stated that information in these statements is far from sufficient.

Comparison of sustainable business with the financial results of British companies was a subject matter of a paper by A. Herdan, L. Neri and A. Ruso (2020). The resulting conclusion was that the measures in the area of sustainable development are not correlated with the financial results of the company.

Kaczmarek performed a comparative study of value creation versus financial security of companies (Kaczmarek, 2019). He concluded that there is a directly proportional correlation between the delivery of sustainable development goals and financial security.

M. Mazurowska (2020) evaluated the existing legal regulations as well as practice on presentation of guarantees of origin and CO_2 emission allowances. The author demonstrated the insufficiency of the existing regulations and even certain errors, recommending further works on the issue.

The paper by Krasodomska and Zarzycka (2020) was dedicated to non-financial key performance indicators. The authors emphasized that implementation of non-financial indicator effectiveness requires reducing their number to the crucial ones. The point is that the higher disclosure standardization rate is achievable and would improve data comparability.

Application of the Global Reporting Initiative (GRI 2016) standards was the subject matter of the study by Karwowski, Raulinajtys-Grzybek and Chróstny (2020). In the opinion of the authors, the most comprehensive (CSR)-related standards are (GRI 2016). According to those authors, the most frequently disclosed data include these pertaining to trainings and education, followed by no discrimination, while health, safety and environment data were among those the least frequently disclosed.

The history of evolution in the area of sustainable development reporting was examined by S. Gokten, Y. Ozehan and P. O. Gokten (2020), who presented the development of reporting changes in time.

S. Gokten and P. O. Gokten discussed also who is the recipient of information related to value creation reporting (2017). They believe that short-term value is of interest for the managements of companies, fair value of capitals is of interest for the investors, while long-term value applies to the society.

Węgrzyńska, Pereira-Lopez, Veiga-Carballido (2020) conducted studies on presentation of non-financial information of an agricultural holding statement. In the conclusion they stated that there is an information gap in this area. The statements should include a description of management method, soil conditions, sowing structure and yielding.

Ferens (2017) performed a process-based analysis of energy production in her research. In the author's opinion, such approach may enable designing of a pro-ecological value system.

Disclosure of value creation in the corporate social responsibility reports was the leitmotiv of the paper by Fijałkowska and Macuda (2017). The conclusion highlighted that the CSR reports presented by Polish companies are generally of low usefulness.

Also Silva and Cerqueira (2021) provided their opinion on the CSR reports. In effect they concluded that the quality of financial statements is assessed differently by the investors.

The research by Cho et al. (2020) was also dedicated to advanced sustainable development reporting. The outcome of their research was the conclusion on the observable progress among the Canadian listed companies in preparing the sustainable development reports. Despite the progress made, Canada features certain delays comparing to the USA and other countries. Qualitative progress is far behind the quantitative one.

The subject matter of the study by J. Błażyńska (2018) was preparation of integrated reports. The author presented the evolutionary approach from the onset of CSR reporting to integrated report.

Opportunities of use of accounting instruments for the purposes of environmental protection management were described by I. Majchrzak (2018). The author points out that well-developed costing may be useful in environmental protection management.

Energy enterprises from Poland are of interest of some papers. Jędrych, Limek and Rzepka (2022) sacrificed their work to social capital in these companies. They summed up that energy companies generally have higher levels of social capital than companies in other industries.

Non-financial company's report concerning CSR was subject of investigations (Szczepankiewicz, Loopesko and Ullah, 2022). Authors proposed model of risk information disclosure.

The economic literature suggests many indicators to assess the condition of an undertaking, dominated by financial indicators (Sierpińska and Jachna, 2020; Nowak, 2017; Gołębiowski et al. 2020; Jerzemowska (ed.). 2018; Gabrusewicz 2019).

Certain studies emphasize also the useful role of non-financial indicators (Sierpińska and Jachna, 2020) as the reason conditioning the company's operations.

3. Research methodology

The methodology applies primarily the heuristic method consisting in analysis of annual statements of listed companies from the energy sector. The statements were analyzed in terms of measurable information on environmental protection contained therein, that can be used for indicator designing.

Also the indicator method was applied as a useful tool in assessing to what extent a company pursues sustainable development in environmental protection.

The research uses consolidated data, since such data cover more entities comparing to individual data.

3.1. Financial statements of listed companies from the energy sector

Pursuant to Article 45 of the Accounting Act—the financial statement of issuers of securities admitted to—intending to apply or applying for admitting to trading on one of the regulated markets of the European Economic Areas countries may be prepared in accordance with the Accounting Act or IAS. In addition, the financial statements and reports on the operations

of these entities are prepared on the basis of the provisions of the Act, with consideration to the provisions on trading in securities. In practice, however, the provisions on public trading do not limit the scope of information required in the statement but, on the contrary, significantly extend such scope. The companies with share capital and other companies listed in Article 49 of the Accounting Act enclose the report on the operations to their financial statement. The same article specifies the scope of such statement. It requires among others information on the significant achievements in research and development as well as key non-financial performance indicators related to the operations of the entity and information on labour issues and natural environment.

Therefore it is clear that if an entity actually follows the Accounting Act, it should provide information on the implementation of some of sustainable development goals in its report on the operations.

While such components of financial statement as: the balance sheet, profit and loss account, changes in equity and cash flow statement are strictly formalized and standardized, there are no guidelines pertaining to labour issues or natural environment. Thus, the scope of presented information is decided only and exclusively by the management of the company.

Delivery of this goal is one of the issues of interest of this paper. The main market of the Warsaw Stock Exchange lists the following companies in the energy sector: Elektrociepłownia Będzin SA, Enea SA, Energa SA, ML System SA, PGE Polska Grupa Energetyczna SA, Polenergia SA, Tauron Polska Energia SA, Zespół Elektrociepłowni Wrocławskich Kogeneracja SA, Zespół Elektrowni Pątnów – Adamów – Konin SA. Information on environmental protection contained in their statements are discussed below.

Elektrociepłownia Będzin SA publishes no information related to natural environment, excluding the balance sheet values of the CO_2 emission allowances and their redemption.

Enea SA published the additional, complete reports on corporate social responsibility from 2011 to 2018. Starting from 2019, it releases only brief online information. The company publishes however detailed data on natural environment in its report on the operations. It includes data on emission of CO_2, SO_2, PM, NO_x, quantitative data on coal mining, produced energy and energy sales. In addition, it reports on the environmental protection investments.

Energa SA—similarly as Enea SA prepares the CSR reports, in which it presents among others detailed data on natural environment. In addition, Energa SA publishes the environmental statement containing detailed environmental protection data on annual basis.

ML System SA is involved in photovoltaics, thus it has a positive impact on the environment. However, since the company itself emits no gases and produces no energy, no such data are available.

PGE Polska Grupa Energetyczna SA publishes only the CO_2 emission data in its report on the operations, since the emission affects its financial results.

Polenergia SA publishes the CSR reports in which data on CO_2 emission are provided.

Tauron SA in its reports on the operation of capital group publishes data on produced energy and CO_2, SO_2,NO_x and PM emission. Kogeneracja SA reports in the same way as Tauron SA.

The Pątnów, Adamów, Konin power plant complex provides data on the CO_2 emission and certain emission indicators, i.e. emission of harmful substances per TWh of energy in its report on the operations.

Table 1 below presents the summary of key environmental protection values that can be acquired from the reports of listed energy sector companies in Poland.

Table 1. Data on sustainable development in environmental protection from the consolidated stock exchange reports of the energy sector companies

Enea					
Mg	2015	2016	2017	2018	2019
CO_2	11,720,380	20,106,393	18,747,623	22,680,305	21,981,281
SO_2	32,236	17,349	18,110	16,468	15,156
NO_x/NO_2	17,027	29,945	24,059	15,791	17,537
Total PM	1017	1002	901	900	899
Energy in TWh	16.0	20.1	21.0	26.5	25.9
Energa					
Mg	2015	2016	2017	2018	2019
CO_2	2,959,167	2,701,452	2,723,155	2,661,669	2,723,154
SO_2	6958	5042	3864	3677	3864
NO_x/NO_2	4780	3 007	2753	2169	2753
Total PM	257	257	282	287	282
Energy in TWh	4.1	3.9	4.3	5.1	5.4
PGE					
Mg	2015	2016	2017	2018	2019
CO_2	58,288,268	55,936,776	59,452,692	70,186,130	60,663,255
SO_2	99,409	51,504	55,631	63,130	36,831
NO_x/NO_2	57,008	47,466	47,014	47,966	37,179
Total PM	2921	2072	2145	2492	1324
Energy in TWh	53.8	53.7	56.8	65.9	58.3
Polenerga					
Mg	2015	2016	2017	2018	2019
CO_2	373,166	365,719	368,848	372,447	363,319
TWh	1.3	1.5	1.6	1.4	1.5
Tauron*					
Mg	2015	2016	2017	2018	2019
CO_2		14,933,394	16,574,584	14,615,129	12,195,217
SO_2		15,702	16,910	12,875	10,329
NO_x/NO_2		13,875	15,317	12,532	10,401
Total PM	0	968	964	729	586
Energy in TWh	18.6	16.8	18.4	16.2	13.9

ZE PAK**					
	2015	2016	2017	2018	2019
CO_2	12,260,000	11,460,000	10,860,000	7,230,000	6610000
SO_2	21,040	20,710	23,873	6,631	0.64
NO_x/NO_2	17,220	16,320	17,993	11,208	1.12
Total PM	2560	3030	3175	1027	0.11
Energy in TWh	9.8	9.3	8	6	6

S o u r c e: Authors' own elaboration on the basis of consolidated reports of the above-mentioned companies.

* For Tauron SA, environmental data are available since 2016.
** For ZE PAK, no global emission data for SO_2, NO_x/NO_2 in 2019 were provided, only emission per TWh.

As it may be concluded form the above Table, since 2016, the listed companies operating in the energy sector have been publishing the essential information on environmental protection. This is however presented in a chaotic manner, frequently "drowned" in the sea of other data, often difficult to identify, with major risk of making a mistake by the reader. A specific freedom in data presentation should also be noticed. In the case of ZE PAK, in the last financial year, the only presented emission data included, apart from CO_2, emission per 1 TWh. No global emission data were provided. Nonetheless, it is important to publish global data and, by doing so, enable the analyst independent calculation of the indicators of interest.

Energa has the lowest emission because it has least share of coal source of energy. It is impossible to use renewable source of energy in great scale out of the cost and performance reasons.

It is quite different with data concerning strictly the components of financial statement: statement of financial position, statement of comprehensive income, cash flow statement, statement of changes in equity. In the case of these statements, the method of financial data presentation is formalized, which is why data resources are easily available. The selected financial data of examined companies are presented in Table 2.

Table 2. Selected economic values from the consolidated financial statements of the analyzed companies in million PLN

Enea					
	2015	2016	2017	2018	2019
X1 Current assets	4786	5050	6233	6928	9052
X2 Inventory	650	449	846	1265	1376
X3 Receivables	1733	1824	1904	1875	2123
X4 Total assets	22,989	24,537	28,313	29,966	9052
X5 Equity	12,123	13,012	13,400	15,049	15,480
X6 Current liabilities	2409	2918	4250	4807	6509
X7 Total liabilities	10,866	11,525	14,313	14,916	17,364
X8 Sales revenue	9848	11,256	11,406	12,673	16,401

including energy	5972	6861	7281	9419	12,218
X9 Costs	8337	9890	9813	11,754	14,664
X10 Result	–399	849	1165	719	423
Energa					
	2015	2016	2017	2018	2019
X1 Current assets	4583	4216	6126	5417	4692
X2 Inventory	513	472	352	687	756
X3 Receivables	1762	1947	1843	1429	1489
X4 Total assets	18,456	18,731	21,056	21,599	20,967
X5 Equity	8814	8817	9465	10,356	9264
X6 Current liabilities	2240	2497	2623	2805	4791
X7 Total liabilities	9642	9914	11,591	11,243	11,703
X8 Sales revenue	10,804	10,181	10,534	10,337	11,479
including energy	10,804	10,181	10,534	10,337	6616
X9 Costs	8786	8864	8615	8284	11,674
X10 Result	840	147	789	744	–1001
PGE					
	2015	2016	2017	2018	2019
X1 Current assets	11,710	13,399	9519	9131	12,593
X2 Inventory	1959	1596	1890	2699	4509
X3 Receivables	3748	6325	3522	4102	4815
X4 Total assets	61,296	67,474	72,183	75,905	77,650
X5 Equity	40,417	42,475	46,378	47,801	43,137
X6 Current liabilities	7584	7697	8995	12,640	11,826
X7 Total liabilities	20,879	24,699	25,805	28,104	34,513
X8 Sales revenue	28,542	28,092	23,100	25,946	37,627
including energy	19,970	19,904	13,420	17,483	25,992
X9 Costs	32,299	25,580	17,683	21,087	42,594
X10 Result	–3037	2566	2605	1511	–3928
Polenergia					
	2015	2016	2017	2018	2019
X1 Current assets	751	704	615	1177	599
X2 Inventory	47	41	26	35	38
X3 Receivables	159	149	123	116	86

X4 Total assets	2975	3198	2664	3054	2480
X5 Equity	1397	1267	1182	1186	1295
X6 Current liabilities	498	691	587	914	245
X7 Total liabilities	1801	1707	1482	1869	1184
X8 Sales revenue	2772	2997	2762	3449	2491
including energy	478	423	415	2849	2290
X9 Costs	2599	2858	2647	3320	2423
X10 Result	67	–112	–88	3	109
Tauron					
	2015	2016	2017	2018	2019
X1 Current assets	3,947,248	4,308,641	4,786,474	4,555,612	6,865,478
X2 Inventory	433,279	486,120	652,260	201,663	684,152
X3 Receivables	1,830,033	1,894,065	2,032,813	2,229,363	2,290,746
X4 Total assets	32,071,433	33,456,894	35,835,016	37,097,477	41,917,765
X5 Equity	16,048,157	16,679,318	18,067,813	18,428,481	19,092,660
X6 Current liabilities	7,439,326	4,808,857	5,027,351	7,286,742	7,861,831
X7 Total liabilities	16,023,276	16,777,576	17,767,203	18,668,996	22,825,105
X8 Sales revenue	18,264,440	17,646,489	17,424,551	18,121,748	19,558,292
including energy	10,712,993	10,172,573	9,456,294	10,767,118	11,329,312
X9 Costs	19,028,962	15,717,462	14,512,207	16,437,147	20,422,371
X10 Result	–1,804,215	370,137	1,382,946	207,045	–11,683
ZE PAK					
	2015	2016	2017	2018	2019
X1 Current assets	1260	1099	1007	902	936
X2 Inventory	158	105	98	109	104
X3 Receivables	268	246	253	354	261
X4 Total assets	4974	4801	4459	3871	3118
X5 Equity	1885	2144	2211	1687	1176
X6 Current liabilities	1260	1268	999	1210	953
X7 Total liabilities	3090	2658	2248	2184	1942
X8 Sales revenue	2948	2705	2443	2305	2878
including energy	2544	2351	2151	2015	2572
X9 Costs	4651	2241	2035	2628	3307
X10 Result	–1880	250	184	–464	–446

S o u r c e: Authors' own elaboration on the basis of consolidated reports of the analyzed companies.

Published data—listed in Table 2—enable calculation of significant environmental protection indicators. In certain reports these are already calculated and presented. The basic indicator is emission of individual substances per energy unit:

$$Q_{it} = \frac{E_{it}}{Pe_t}. \quad (1)$$

where:
Q_{it}—means value of emission *i*-substance in time *t* per energy production unit,
E_{it}—emission *i*-substance in time *t*,
Pe_t—production of electric energy in time *t*.

Emission of harmful substance may be also associated with financial results. Such attempt may be emission of substance per sales revenue unit.

$$\Phi_{it} = \frac{E_{it}}{Se_t}. \quad (2)$$

where:
Φ_{it}—means value of emission *i*-substance in time *t* per energy sales unit,
E_{it}—as (1),
Se_t—sales of electric energy in time *t*.

Converting the emission value to energy production unit or sales unit is reasonable, since comparing the emission values in time without converting it into production unit may lead to incorrect conclusions. Reducing the emission alone does not need to be positive information if it results from decreased energy production. Comparing the emission per production unit or, optionally, per sales unit, is the most reasonable.

The indicators of emission of harmful substances per energy production unit are presented in Table 3:

Table 3. Indicators of emission of harmful substances per 1 TWh of produced energy

Enea					
Thousand of tonnes/TWh	2015	2016	2017	2018	2019
CO_2	732.5	1000.3	892.7	855.9	848.7
SO_2	2.015	0.863	0.862	0.621	0.585
NO_x	1.064	1.490	1.146	0.596	0.677
PM	0.064	0.050	0.043	0.034	0.035
Energa					
CO_2	721.7	692.7	633.3	521.9	504.3
SO_2	1.697	1.293	0.899	0.721	0.716
NO_x	1.166	0.771	0.640	0.425	0.510
PM	0.063	0.066	0.066	0.056	0.052

PGE					
	2015	2016	2017	2018	2019
CO_2	1083.4	1041.7	1046.7	1065.0	1040.5
SO_2	1.848	0.959	0.979	0.958	0.632
NO_x	1.060	0.884	0.828	0.728	0.638
PM	0.054	0.039	0.038	0.038	0.023
Polenergia					
	2015	2016	2017	2018	2019
CO_2	287	244	231	266	242
Tauron					
	2015	2016	2017	2018	2019
CO_2		888.9	900.8	902.2	877.4
SO_2		0.935	0.919	0.795	0.743
NO_x		0.826	0.832	0.774	0.748
PM		0.058	0.052	0.045	0.042
ZE PAK					
	2015	2016	2017	2018	2019
CO_2	1251.0	1232.3	1292.9	1185.2	1101.7
SO_2	2.147	2.227	2.842	1.087	0.64
NO_x	1.757	1.755	2.142	1.837	1.12
PM	0.261	0.326	0.378	0.168	0.11

S o u r c e: Authors' own elaboration based on Table 1.

The values listed in Table 3 enable comparing the emission of undesired substances both in time and space as well as assessing data reliability. According to Table 3, the CO_2 emission per 1 TWh in Polenerga should be extremely low. Thus, it should be suspected that these data are not accurate. From among the remaining companies, the greatest emission per 1 TWh is recorded for ZE PAK, PGE, while the average emission values are listed for Enea, Tauron. The lowest emission per production unit is recorded for Energa.

Change of emission of individual substances in time for the analyzed companies can be presented in graphs:

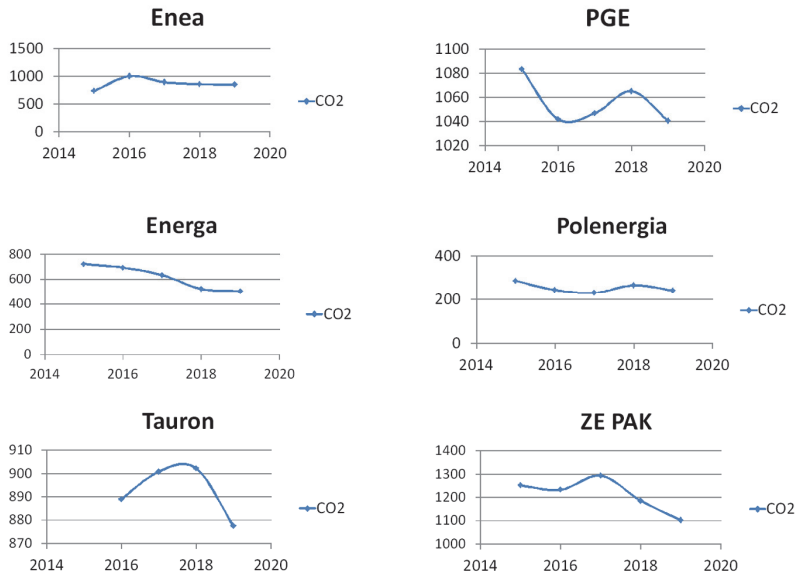

Figure 1. Graph of CO_2 emission per TWh in years for individual capital groups

S o u r c e: Authors' own elaboration based on Table 3.

The presented graphs enable observing a generally downward trend in the long time perspective, however in the individual cases an increase in CO_2 emission in time is noticeable.

The SO_2 and NO_x emissions are presented in the subsequent graphs:

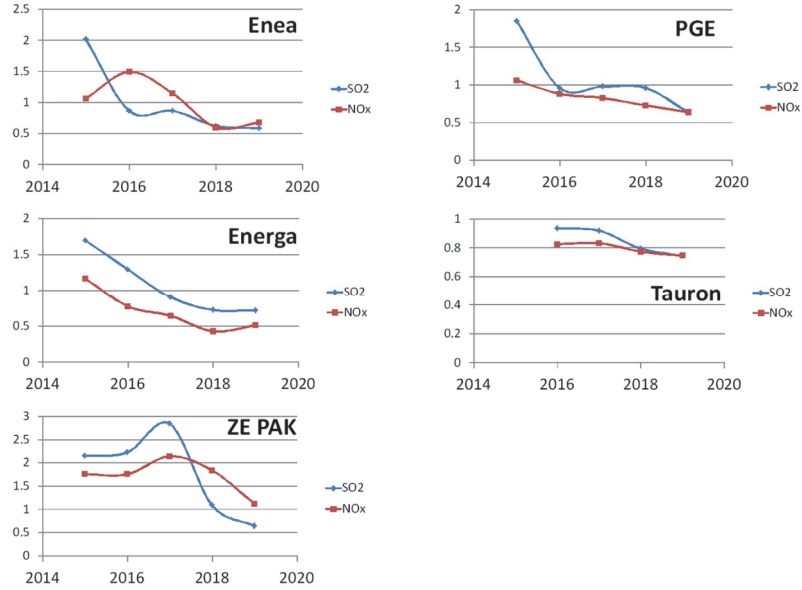

Figure 2. Emission of SO_2 and NO_x per 1 TWh of electric energy in years

S o u r c e: Authors' own elaboration based on Table 3.

Similarly as in the case of CO_2, a downward trend of emission per 1 TWh is noticeable in the long time perspective, with occasional increases. Co-linearity of SO_2 and NO_x emissions per unit of produced energy is clearly delineated.

PM emission is presented in Figure 3:

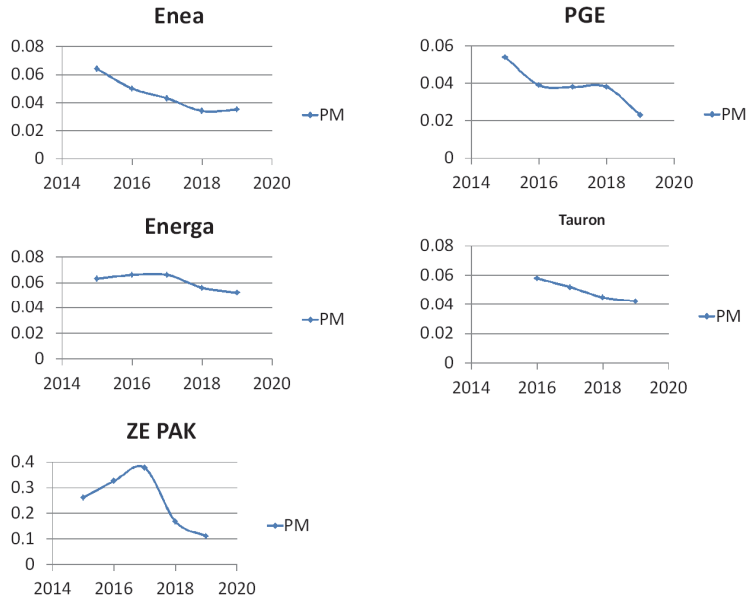

Figure 3. PM emission per 1 TWh of electric energy in years

S o u r c e: Authors' own elaboration based on Table 3.

Graph 3 confirms the conclusions from graphs 1 and 2. In general, in the case of vast majority of companies, formation of the *a*/*m*-substances per unit of produced energy during emission is strongly intercorrelated (linear correlation coefficients exceed 0.87). However, in the case of Enea and Tauron capital groups correlation coefficients were lower. It may be yet concluded that emission of individual substances is strongly correlated.

Environmental protection is the major issue, however the undertakings need to finance their operations, that is why correlating the environmental protection with finances of the company or capital group seems to be reasonable.

To assess the financial condition, the conventional financial condition indicators (ROA, ROE, current ratio (CR), quick ratio (QR) and debt rate (DR)) were used (Nowak, 2017; Sierpińska and Jachna, 2020). These indicators for the analyzed capital groups are as follows:

Table 4. Key financial indicators of the analyzed capital groups

Enea					
	2015	2016	2017	2018	2019
ROA	–0.017	0.035	0.041	0.024	0.047
ROE	–0.033	0.065	0.087	0.048	0.027

CR	1.987	1.731	1.467	1.441	1.391
QR	1.717	1.577	1.268	1.178	1.179
DR	0.105	0.119	0.150	0.160	0.719
Energa					
ROA	0.046	0.008	0.037	0.034	–0.048
ROE	0.095	0.017	0.083	0.072	–0.108
CR	2.046	1.688	2.335	1.931	0.979
QR	1.817	1.499	2.201	1.686	0.822
DR	0.121	0.133	0.125	0.130	0.229
PGE					
	2015	2016	2017	2018	2019
ROA	–0.050	0.038	0.036	0.020	–0.051
ROE	–0.075	0.060	0.056	0.032	–0.091
CR	1.544	1.741	1.058	0.722	1.065
QR	1.286	1.533	0.848	0.509	0.684
DR	0.124	0.114	0.125	0.167	0.152
Polenergia					
	2015	2016	2017	2018	2019
ROA	0.023	–0.035	–0.033	0.001	0.044
ROE	0.048	–0.088	–0.074	0.003	0.084
CR	1.506	1.018	1.047	1.287	2.445
QR	1.412	0.958	1.002	1.249	2.290
DR	0.168	0.216	0.220	0.299	0.099
Tauron					
	2015	2016	2017	2018	2019
ROA	–0.056	0.011	0.039	0.006	0.000
ROE	–0.112	0.022	0.077	0.011	–0.001
CR	0.531	0.896	0.952	0.625	0.873
QR	0.472	0.795	0.822	0.598	0.786
DR	0.232	0.144	0.140	0.196	0.188
ZE PAK					
	2015	2016	2017	2018	2019
ROA	–0.378	0.052	0.041	–0.120	–0.143
ROE	–0.997	0.117	0.083	–0.275	–0.379
CR	1.000	0.867	1.008	0.745	0.982
QR	0.875	0.784	0.910	0.655	0.873
DR	0.253	0.264	0.224	0.313	0.306

S o u r c e: Authors' own elaboration based on Table 2.

The indicators listed in Table 4 were used to design a synthetic measure of financial condition of the individual capital groups: this measure is expressed by the following formula:

$$MS_a = \frac{ROA_a^{uz} + ROE_a^{uz} + CR_a^{uz} + QR_a^{uz} + DR_a^{uz}}{5}. \qquad (3)$$

where:
MS_a—synthetic measure of financial condition of capital group of company *a*,
ROA_a^{uz}—ROA for the company *a* standardized with the zero unitarization method (Kukuła, 2000),
ROE_a^{uz}—ROE for the company *a* standardized with the zero unitarization method,
CR_a^{uz}—CR for the company *a* standardized with the zero unitarization method,
QR_a^{uz}—QR for the company *a* standardized with the zero unitarization method,
DR_a^{uz}—ROE for the company *a* standardized with the zero unitarization method,
provided that ROA, ROE, CR and QR are treated as stimuli, while DR as inhibitor.

Table 5 presents the synthetic measures of financial condition of the analyzed capital groups.

Table 5. Synthetic measures of financial condition of the analyzed companies

Enea					
	2015	2016	2017	2018	2019
MS	0.828	0.823	0.758	0.728	0.549
Energa					
MS	0.892	0.784	0.957	0.853	0.556
PGE					
	2015	2016	2017	2018	2019
MS	0.705	0.822	0.670	0.572	0.577
Polenergia					
	2015	2016	2017	2018	2019
MS	0.757	0.589	0.599	0.656	0.990
Tauron					
	2015	2016	2017	2018	2019
MS	0.466	0.623	0.656	0.552	0.596
ZE PAK					
	2015	2016	2017	2018	2019
MS	0.244	0.616	0.646	0.423	0.445

S o u r c e: Authors' own elaboration based on Table 4.

Linear correlation coefficient between the chain index of increase in CO_2 emission per TWh and synthetic measure of the condition of capital groups is 0.014, for SO_2 it amounts to –0.09, for NO_x –0.11, for PM 0.25, respectively, which means that there are no correlations between the pro-environmental activities and financial condition.

4. Conclusions

On the basis of the performed research it can be stated that the listed energy sector companies are committed to environmental protection.

Each subsequent year, the companies present an increasing amount of data on natural environment. However, due to specific freedom in the scope of their publishing, not all undertakings publish them. In addition, these are frequently difficult to identify by an analyst, which creates the possibility of mistake.

Therefore, formalization of the method of presenting the environmental data seems to be reasonable.

There is no correlation between the pursuit of sustainable development in environmental protection and financial condition.

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Wykorzystanie systemu rachunkowości w ocenie realizacji postulatu zrównoważonego rozwoju w zakresie ochrony środowiska przez polskie firmy giełdowe sektora energetycznego

Abstrakt: Celem pracy jest weryfikacja, w jakim stopniu system rachunkowości umożliwia uzyskanie danych dotyczących ochrony środowiska, oraz ocena występowania związku pomiędzy realizacją postulatu ochrony środowiska a kondycją finansową. Hipoteza badawcza pracy zawarta jest w pytaniach: Czy system rachunkowości umożliwia uzyskanie danych dotyczących ochrony środowiska? Czy istnieje związek pomiędzy ochroną środowiska a kondycją firmy? Dla osiągnięcia celu wykorzystano metody heurystyczne i metody wskaźnikowe. Jednostki publikują coraz więcej informacji dotyczących ochrony środowiska. Wskazane byłoby sformalizowanie i uporządkowanie sposobu prezentowania danych dotyczących ochrony środowiska w raportach spółek. Występuje brak związku między ochroną środowiska a kondycją firmy.

Słowa kluczowe: rozwój zrównoważony, ochrona środowiska, rachunkowość, sprawozdawczość finansowa