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Mapping Strategies of Net Working Capital in the Energy Sector in Poland – Transformation Perspective

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Abstract: The aim of the article is to identify net working capital management strategies used in the energy sector. The analysis covered all companies listed on the Warsaw Stock Exchange under the WIG-Energy industry index. The study was conducted on the basis of financial reports for 2022-2023, with data from the latest reported quarters, i.e. Q1 and Q2 of year 2023, used in strategy mapping. The ratio analysis method was used with reference to industry indicators, and the dynamics of changes in the examined indicators was taken into account. The research results indicate that currently energy entities mainly use agressive strategies (64%). The sector's net working capital forecast indicates that the strong growth trend that has been seen since 2020 will gradually begin to slow down from 2023. As a result of using the indicator mapping technique, significant concentration of indictors can be noted in the sector, with only two entities differing from the rest of the sector in this regard.

Keywords: net working capital, net working capital management strategies, energy, cash conversion cycle, energy sector transformation

1. Introduction

Effective working capital management is a key element of both the financial condition and the sustainable development of every firm. Especially in a time of energy transformation, energy entity managers should not only be aware of how to optimise this area, but also take action that aims to optimise working capital by planning long-term undertakings and investments. Appropriate working capital management ensures firms the necessary financial liquidity and effectiveness of action. Such

an approach is vital in times of crisis and a changing business environment (Heryan, 2020). The Polish energy sector finds itself at a point of energy transformation related to the move away from fossil fuels. Changes in energy prices, fuel prices and exchange rates, the war in Ukraine and the need to invest in 'green' assets, as well as changes to legal regulations, all have a significant impact on the changes taking place on the market. Since 2021, the Polish Energy Policy 2040 has been in force in Poland (*Polityka Energetyczna Polski do 2040 r.,* 2021), the aim of which above all is energy security. The assumptions of this policy initiated the taking of strategic investment decisions that aimed to make use of the country's potential in terms of the economy, resources, technology and personnel, as in 2040 over half of installed energy production is to constitute zero emission sources. Energy sector transformation at the level of company activity requires high levels of capital. Increasing and diversifying the scope of activity of energy companies by entering into new sources of energy production translates into increased receivables from contractors and greater liabilities with regard to suppliers (Zimon and Tarighi, 2021). At the same time, the sale of a greater number of units of generated energy requires an increase in stock, usually in the form of fuel and material resources. The concept of working capital in scientific studies is most frequently considered in relation to profitability and firms' financial results (Sanchez et al., 2018), but also operational costs (Pham et al., 2020). In this article, net working capital (NWC) is defined as current assets less current liabilities (Fernando, 2022). The indicator analysis and the process of mapping NWC strategies take into account the fact that the amount of working capital depends on the composition of assets and liabilities, in accordance with suggestions indicating the significant role of receivables (Masri and Abdulla, 2018), liabilities (Abuhommous, 2017), and inventory and cash (Michalski et al., 2018).

Research indicates that in the analysis of working capital and its impact on a firm's liquidity and profitability, a significant role is played by the domain in which it functions, that is industry, trade or construction, and the specifics of the sector (Czapiewski and Kubiak, 2008, pp. 21-22). In the times of its transformation, the energy sector is a particularly interesting subject of research. In Poland, the energy producers market is concentrated around large capital groups. For this reason, the research was conducted on entities listed on the Warsaw Stock Exchange from the WIG-energy sector index. This portfolio includes companies covered by the WIG and belonging to the energy sector: PGE Polska Grupa Energetyczna S.A. (PGE), Tauron Polska Energia S.A. (TPE), Enea S.A. (ENA), ČEZ a.s. (CEZ), Zespół Elektrowni Pątnów-Adamów-Konin S.A. (ZEP), Zespół Elektrociepłowni Wrocławskich Kogeneracja S.A. (KGN), Polish Energy Partners S.A. (PEP), Onde S.A. (OND), Columbus Energy S.A. (CLC), Photon Energy N.V. (PEN), ML System S.A. (MLS), Elektrociepłownia Będzin S.A. (BDZ), RAEN S.A. (RAE), NOVAVIS Group S.A. (NVG).

The data was obtained from financial reports available in the Biznes Radar paid online database (data supplier Quant Research Sp. z o.o.). The aim of the article was to identify strategies for managing net working capital used in the energy sector, the main implementer of the European Union's policy aiming to ensure the *zero emission* system required by the European Union.

The research method was indicator analysis using the cash conversion cycle indicator (CCC), and the indicator of coverage of operating costs with working capital. The analysis takes into consideration the context of the sector and the dynamics of change in the period 2021-2022 and in the first half of 2023. The NWC mapping method was developed using two methods. The first uses three types of indicators (Tokarski and Tokarski, 2006), while the second classical method was based on the level of current assets and short-term liabilities proposed by Czapiewski and Kubiak (2008, pp. 34-36). The research concluded with an NWC forecast for the sector drawn up on the basis of historical data from the years 2019-2022.

2. Literature Review

Bibliometric analysis shows that in the last few decades there has been a growth in interest within the scientific community with regard to topics related to working capital (Kayani et al., 2019). Prior research mainly indicated the usefulness of applying the working capital indicator in sectoral analyses

(Migliaccio and Tucci, 2019; Monastyrenko, 2017). In this context, the working capital indicator has been applied in analyses of the wood industry (Cardoso et al., 2019), the electrical industry (Monastyrenko, 2017), and in research into the food industry (Martinho and Dominques, 2021; Migliaccio and Tucci, 2019; Linh, Mohaningam, 2018). It should be noted that sectoral research most often related to financial limitations for SMEs and the importance of policies for managing working capital in such entities (Hoang et al., 2019; Kieschnick and Rotenberg, 2016). A popular topic among researchers was evaluation of the interconnections between managing working capital and profitability in SMEs (Pais and Gama, 2015; Frimpong, 2018). The connection between working capital and profitability was pointed out by Vukovic et al. (2017), who added that the practice of managing working capital differs around the world depending on the sector and firm size. Adam and Quansah (2019) confirm that working capital management policies impact firms' financial results, although this varies depending on the sector in which the firm functions, as shown in research by Kabuye et al. (2019). It is assumed that working capital management policies are influenced by liquidity (Chen and Kieschnick, 2018), achieved financial results (Adam et al., 2017), the value of the firm (Frimpong, 2018), and the return for shareholders (Masri and Abdulla, 2018), while the level of working capital in a company is influenced by inventory strategy and property resources management (Maity et al., 2019). Entities with a higher level of working capital pay their liabilities in a shorter period (Falavigna and Ippoliti, 2020). A lack of working capital is a limitation for firms as it complicates the management of current debts and liabilities (Monastyrenko, 2017) and can increase the costs of financing (Zabolotnyy and Sipilainen, 2020).

Significant interest is shown among researchers in the cash conversion cycle (CCC) indicator, which is often considered to be an element of working capital management among firms in the SME sector (Banos-Caballero et al., 2010). Barac and Muminovic (2018) indicated the connection between CCC and profitability, while Moussa (2018) showed the relation between firm results and the value of the indicator. In researching the relationship between CCC and profitability, Chang (2018) indicated that CCC depends on the firm's strategy (aggressive or conservative) with regard to working capital management. Such strategies focus on achieving such aims as improving the firm's efficiency and ensuring financial liquidity while at the same time aiming to optimise current assets and their sources of financing (Barac and Muminovic, 2018; Kreczmańska-Gigol, 2010, p. 89). Experience from economic experience, related to the often-differing decisions of companies in terms of issues of the level and structure of current assets and the type and structure of their financing, became the basis in this article for identifying three typical strategies for managing net working capital: a conservative strategy (cautious), an aggressive strategy (dynamic) and a moderate strategy (balanced) (Pluta, 1999, p. 46).

It is worth noting that in terms of the type of strategy for managing working capital, it is often indicated that an aggressive policy is related to a higher level of profitability (Prempeh and Peprah-Amankona, 2020), which can be important from the perspective of assessing the financial condition of energy companies in the process of acquiring funds (Poluyanov and Palamarchuk, 2017). In this article, we apply the assumption that the strategic approach to managing net working capital should be flexible and adapted to the surroundings (Chauhan, 2019).

3. Research Results

The research was conducted in four steps using measurements of activity, with the assumption that net working capital constitutes the value of current assets minus current liabilities. In step 1, analysis was conducted of the cash conversion cycle indicator. Step 2 analysed the indicator of the share of net working capital in overall assets, current assets and sales revenue. Step 3 analysed the indicator of the level of current assets and short-term liabilities. Steps 2 and 3 concluded with summaries of the strategies used by the entities studied. Step 4 consisted of a synthesis of steps 1-3, and the resulting strategy was assigned to the entities. The data was obtained on the 5th September 2023. Figures 1 and 2 present the values of the calculated indicators for the analysed companies, while Table 1 and Figure 3 depict the size and the indicators characterising the net working capital management strategy of the companies, together with a graphical depiction. The research concludes with a summary of the research (Table 2) using an NWC forecast.

3.1. Cash Conversion Cycle and Coverage of Operational Costs with Working Capital

The first investigated indicator identifying the working capital strategy was the cash conversion cycle. Selection of the strategies was conducted in accordance with the assumptions proposed by A. Tokarski and M. Tokarski (2006, p. 10). Firms considered to be using conservative strategies were those whose indicator significantly diverged from the average sectoral indicator value (below). The average value of the CCC sectoral indicator in the analysed period was -36,9. It is worth noting that 8 entities had a negative CCC indicator. Figure 1 presents the CCC indicator levels for the studied entities.

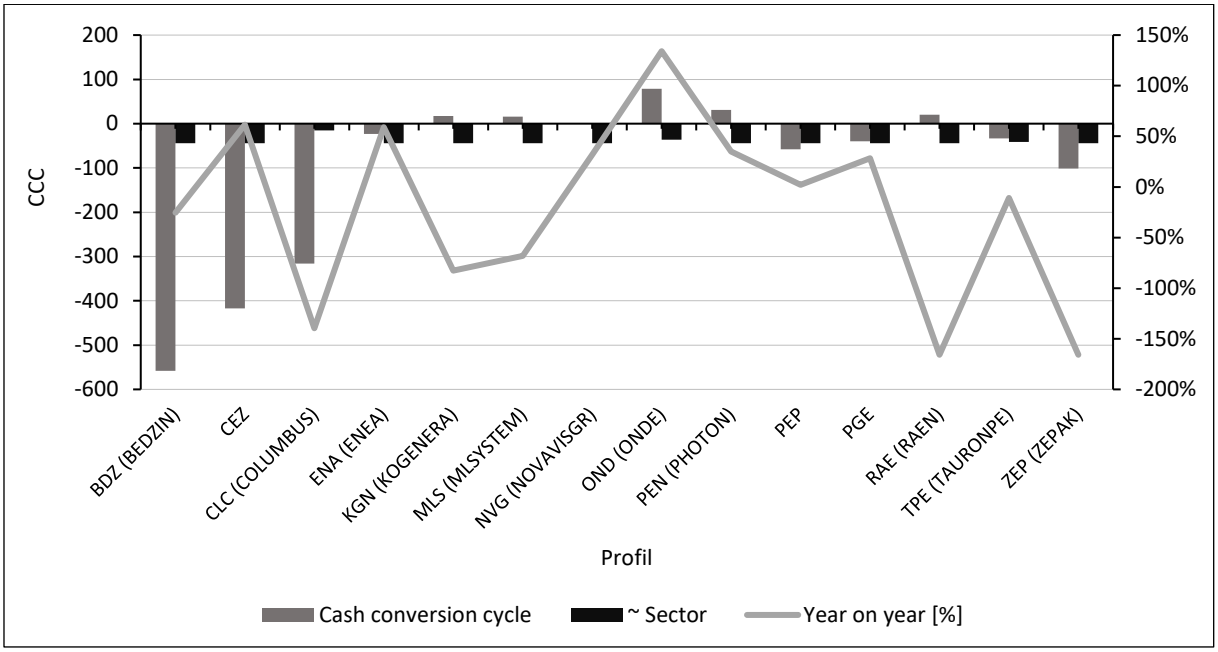

Figure 1. Cash conversion cycle in days (left axis) for Q1 and Q2 2023, together with the dynamics of change (%) in the years 2022-2023 (right axis) 2022-2023 [N = 14]

Source: own elaboration based on data from financial reports for capital groups from the WIG-Energia index.

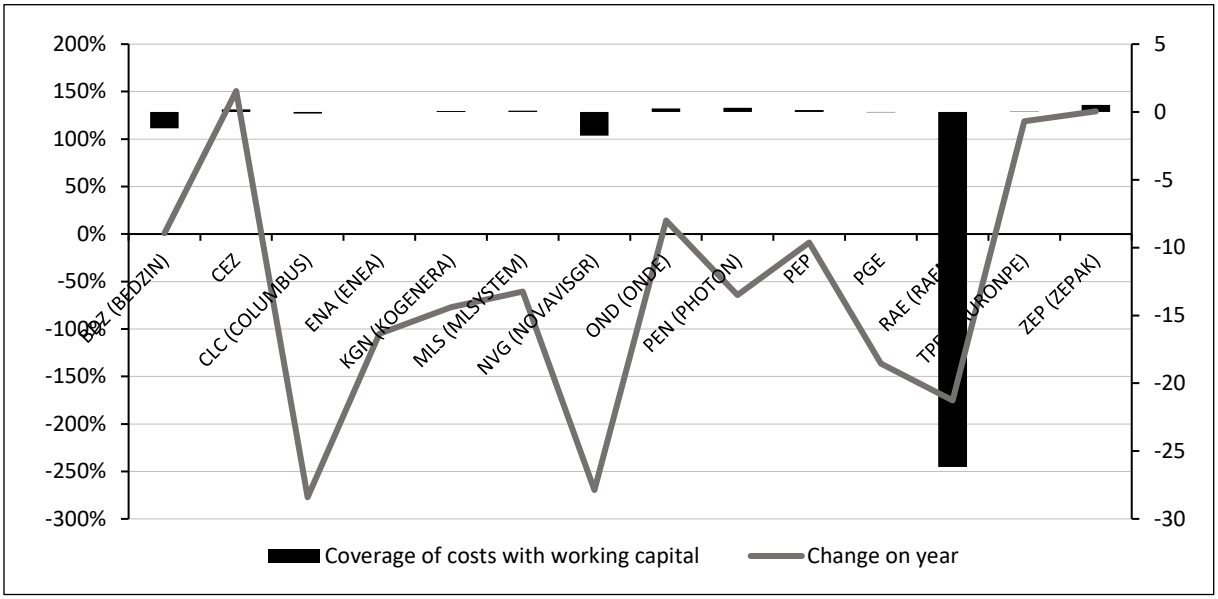

Figure 2. Coverage of operating costs with working capital (right axis) in Q1 and Q2 2023 and the dynamics of these changes (left axis) in the years 2022-2023 [N = 14]

Source: own elaboration based on data from financial reports for capital groups from the WIG-Energia index.

In principle, the lower the CCC indicator, the more beneficial the situation of a given enterprise. An excessively long period may mean problems with maintaining liquidity. The longest but negative CCC indicator took place in BDZ, CEZ and CLC. This means that these entities receive payment for their sold products or goods before they pay their trade liabilities. The dynamics of change in relation to the previous reporting period is indicated by the grey line. The average dynamics of change was -21.92%. Significant deviations from this average in the dynamics indicators were found for CLC, RAE and ZEP. The highest positive dynamics indicators was for OND.

Next, the level of the indicator for coverage of operating costs with working capital was examined (Figure 2). The aim was to verify to what degree current assets cover the current costs of the enterprise's activities after payment of current liabilities (short-term). The research results show that the average indicator for the sector was -1.98, and the year-on-year dynamics of change was -0.54%. A positive indicator level was noted for 8 of the studied entities, with the highest indicator level of 0.52 occurring for ZEP and the lowest -26.18 for RAE. It should be noted that this indicator was characterised by powerful, negative dynamics of change year on year, in the region of 200% for CLC and NVG. Only BDZ, PEP and OND had relatively stable indicator levels.

3.2. Net Working Capital – Mapping and Sectoral Forecast

The next stage of the research (step 2) was assessing the level of NWC, with the assumption that companies can implement three different strategies for managing net working capital. This aim of this stage was to obtain information on the amount of available funds a company has to cover its short--term liabilities. The higher the level of working capital it possesses, the lower the risk of the loss of financial liquidity. The study used the model proposed by Czapiewski and Kubiak (2008, pp. 34-36), using the context of the sectoral indicator as a point of reference. Table 1 presents the size of selected net working capital indicators in the studied capital groups together with the appropriate working capital strategies. Selection of the strategies was motivated by the assumptions proposed by A. Tokarski and M. Tokarski (2006, p. 10). The key indicator in this research was the share of net working capital in current assets. Firms using conservative strategies were considered to be those whose indicator significantly deviated from the average sectoral indicator value. Firms with an indicator considerably below the sectoral indicator were assigned aggressive strategies. The sector NWC indicator in total assets was 7%. Analysis of the indicator of the share of NWC in total assets showed that 8 companies in the energy sector implement an aggressive strategy. The net working capital in these firms is most often negative, which means they are accompanied by considerable financial risk. This is particularly visible in the case of the firm BDZ (Będzin). A conservative strategy was implemented by a group of 4 firms, i.e. OND, RAE, ZEP and PEP. The remaining 2 energy sector companies implement a moderate strategy. In this group of companies, working capital participates to a minimal degree in financing assets.

The next indicator analysed in this part of the research is the indicator measuring the share of NWC in current assets. The average value of this indicator in the energy sector was 0.13. Values below this average were obtained by 7 entities, with 2 implementing a moderate strategy and 5 a conservative strategy.

The indicator of the share of NWC in revenue from sales averaged 23%. Here, it can be noted that 7 entities out of 14 used aggressive strategies, and 7 used conservative strategies.

In summing up this stage of the research, it should be noted that taking into account the predominant types of strategy in the studied entities in the scope of the indicators analysed above, 57% of participants in the energy sector use an aggressive strategy for managing net working capital, 7% use a moderate strategy and only 36% use a conservative strategy.

Table 1. Share of net working capital in total assets, current assets and sales revenue together with the assigned strategy after Q2 IIQ 2023 [N = 14]

Entity	NWC/Total assets [%]	NWC/Current assets [%]	NWC/Sales revenue [%]
BDZ (BEDZIN)	-2.88	-6.63	-9.26
CEZ	0.04	0.09	0.44
CLC (COLUMBUS)	-0.10	-0.16	-0.58
ENA (ENEA)	0.00	-0.01	-0.01
KGN (KOGENERA)	0.04	0.13	0.25
MLS (MLSYSTEM)	0.07	0.17	0.80
NVG (NOVAVISGR)	-0.29	-0.78	-3.29
OND (ONDE)	0.41	0.48	0.83
PEN (PHOTON)	0.07	0.31	1.03
PEP	0.13	0.46	0.56
PGE	-0.02	-0.09	-0.11
RAE (RAEN)	5.96	0.84	0.78
TPE (TAURONPE)	0.01	0.05	0.05
ZEP (ZEPAK)	0.55	0.60	8.19
Average sector indicator value	*0.07*	*0.13*	*0.23*

Source: own elaboration based on data from the database biznesradar.pl, access 5th September 2023.

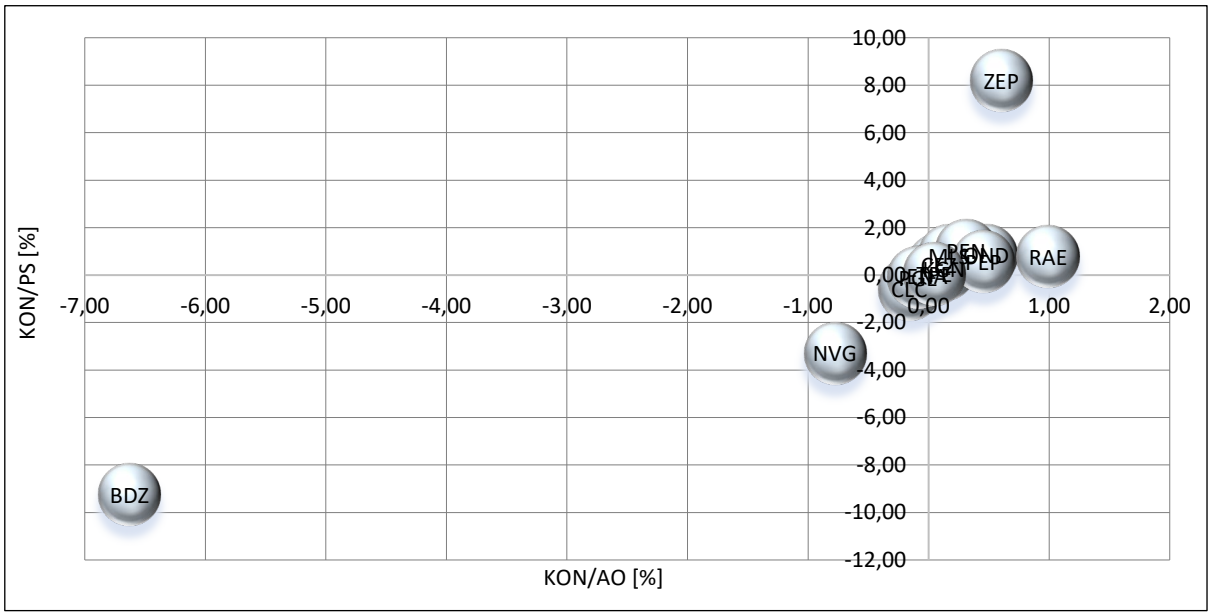

Figure 3. Mapping strategies based on the indicators of the share of NWC in sales revenue and the share of NWC in current assets in Q1 and Q2 2023 [N = 14]

Source: own elaboration.

Figure 3 presents in graphical form the strategies applied in the energy sector, together with the use of two measurements i.e. the share of NWC in current assets and in sales revenue. The indicator of the share of NWC in current assets has been omitted in the graphical presentation (the numerical data can be found in Table 1). Two entities, BDZ and ZEP, considerably deviate from the rest of the sector. The remaining 12 companies use varied strategies, but they have similar indicator values. In this group, the leader of the conservative strategy is ZEP, while BDZ is at the forefront of the aggressive strategy. It is worth noting that these are private entities that do not have large shares of the energy market.

Figure 4 presents the next approach to mapping strategies employing the methodology for calculating the indicators proposed by Czapiewski and Kubiak (2008, pp. 34-36). Mapping of the sector was conducted according to NWC management strategies, using the indicators: level of current assets and short-term liabilities. Adopting consistently the criterion of the division into conservative, moderate and aggressive strategies for the average values for the sector, the average indicator level for current assets in the energy sector is 0.83, while for short-term liabilities it is 0.55. In the case of the former indicator, only ENEA uses a moderate strategy, and only 3 entities use a conservative strategy. The decided majority, as many as 10 entities, implement an aggressive strategy. In the case of BDZ, the indicator of the level of short-term liabilities is at an abnormal level and is difficult to interpret, similarly to the level of the current assets indicator in the case of PGE. The remaining group of entities should predominantly (11 entities) be considered to apply aggressive strategies in terms of short-term liabilities (below the average), while 3 entities use a conservative strategy.

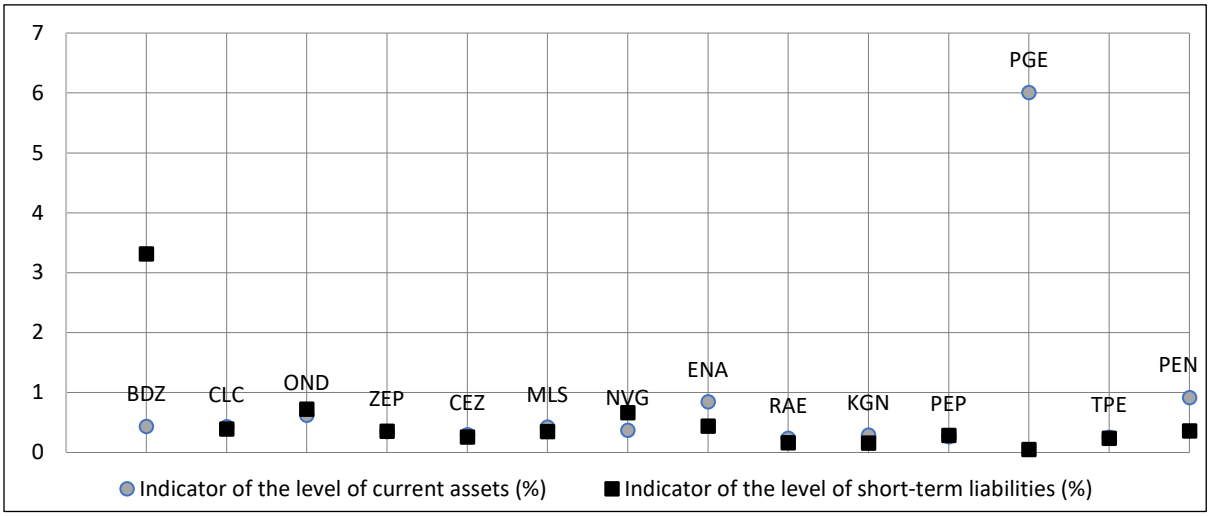

Figure 4. Mapping strategies based on the indicators of the level of current assets and short-term liabilities [N = 14]

Source: own elaboration.

Table 2. Presentation of research results [N = 14]*

Entity	STEP I	STEP II				STEP III			STEP IV
	CCC [days]	NWC/Total assets [%]	NWC/Total assets [%]	NWC/Sales revenue [%]	Step II** Summary	Total assets/Total assets [%]	Current liabilities/Total assets [%]	Step III** Summary	Summary
BDZ	-558	a	a	a	a	a	c	a/c	a
CEZ	-417	a	a	c	a	a	a	a	a
CLC	-316	a	a	a	a	a	c	a/c	a
ENA	-23	a	a	a	a	a	a	a	a
KGN	17	a	m	a	a	a	a	a	a
MLS	16	m	m	c	m	a	a	a	a
NVG	0	a	a	a	a	a	c	a/c	a
OND	79	c	c	c	c	m	a	m/a	c/m/a
PEN	31	m	c	c	c	a	a	a	c/a
PEP	-58	c	c	c	c	a	a	a	c/a
PGE	-40	a	a	a	a	a	a	a	a
RAE	20	c	c	c	c	c	a	c/a	c
TPE	-33	a	a	a	a	a	a	a	a
ZEP	-101	c	c	c	c	c	a	c/a	c

*Strategy types: a – aggressive, m – moderate, c – conservative.

**Step summaries contain information on the dominating strategy indicating the predominance of the strategy within a given step. The last step is the result of steps II-III.

Source: own elaboration.

Table 2 presents a synthetic view of the research results. In step I, 8 entities were identified with a negative CCC indicator level in days. In step II it was confirmed that a considerable number of the entities use an aggressive strategy (only 2 entities using a conservative strategy have a negative CCC). This is also confirmed in the next stage of the research (step III). In summarising the research, step IV attempted to classify the entities by individual types of strategy. As a result, 9 entities using an aggressive strategy were identified (64%), 2 entities using a conservative strategy (14%) and 3 entities a mixed strategy (OND, PEN and PEP).

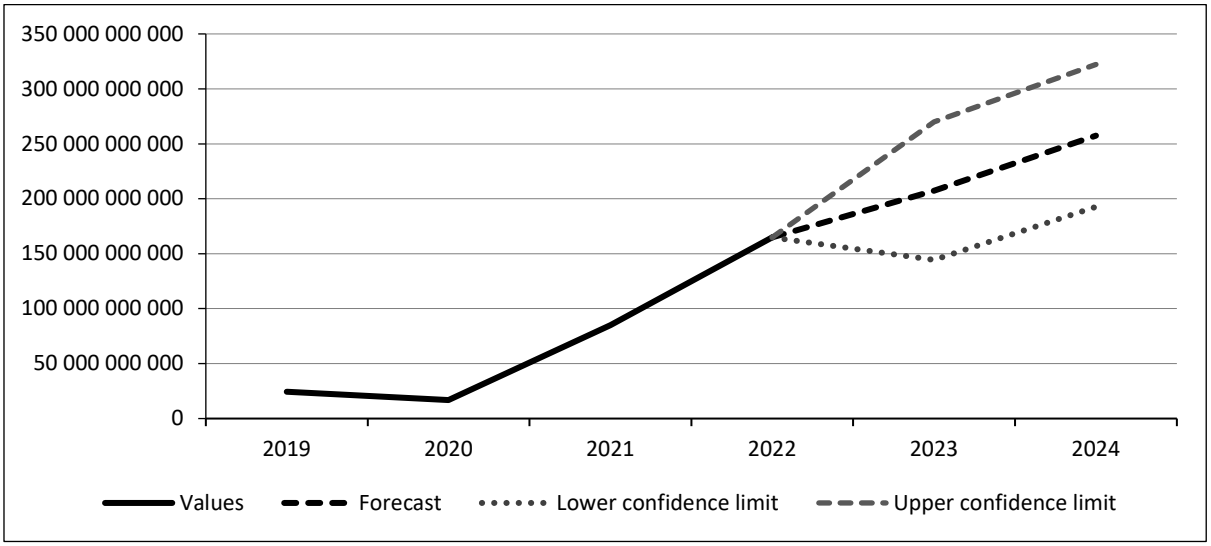

Figure 5. Forecast for the level of working capital in WIG-ENERG companies in the years 2023-2024 [N = 14]

Source: own elaboration.

The final stage of the research was an attempt to diagnose what the NWC would be in the energy sector in the future. Taking into account the challenges the sector faces, research was conducted using forecasts (linear regression method with a 95% confidence interval). In the years 2020-2022 there is a visible strong growth trend in the level of NWC. In the forecast, from 2023 this rapid growth gradually begins to slow down (Figure 5).

4. Summary and Research Conclusions

The research shows that positive working capital dominates among energy sector entities in Poland listed on the WSE. This proves that part of the short-term assets are financed by long-term capital, which in effect limits the risk of a loss of financial liquidity. Among the 14 companies studied, only 5 showed negative net working capital. Energy sector companies implement various net working capital management strategies. Of the 14 companies studied, 14% employed a conservative strategy and 64% used an aggressive strategy (at least in two criteria in Table 1 a conservative strategy). The considerable predominance of entities using an aggressive strategy shows that energy entities take care to maintain liquidity, but are interested in reducing the costs of financing. The research shows that companies implementing an aggressive strategy for managing net working capital have cash conversion cycle and NWC operating cost coverage indicators below the recommended levels, indicating a significant risk of a loss of financial liquidity. Meanwhile, entities implementing a conservative strategy finance a considerable part of current assets using fixed capital, thus the risk of a loss of financial liquidity is minimal, which in only one case is reflected in the level of the CCC indicator and that of coverage of costs using net working capital. Companies that use an aggressive strategy showed a lower level of these indicators. What is more, analysis of the average values of the

current financial liquidity indicator shows that in 2022, the average indicator value fluctuated within the range 1.06-1.09. This means that in order to ensure financial liquidity, energy sector companies were forced to maintain current assets at the level of 1.06-1.09 times greater than current liabilities.

At this point, it is worth underlining that the research used classical economic tools and measurements that do not fully reflect the specifics of the Polish energy sector. This is because the sector is characterised by high capital intensity, and at the same time companies' activities are not based only on the impact of market mechanisms as the regulatory and political environment play a significant role. Due to state regulations and a strategic national energy policy, the economic results presented are indicative in nature.

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Mapowanie strategii kapitału obrotowego netto w sektorze energetycznym w Polsce – perspektywa transformacji

Streszczenie: Celem artykułu jest identyfikacja strategii zarządzania kapitałem obrotowym netto stosowanych w sektorze energetycznym. Analizą objęto wszystkie spółki notowane na Giełdzie Papierów Wartościowych w Warszawie w ramach indeksu branżowego WIG-Energia. Badanie zostało przeprowadzone na podstawie raportów finansowych za lata 2022-2023, przy czym w mapowaniu strategii wykorzystano dane z ostatnich raportowanych kwartałów, tj. Q1 i Q2 roku 2023. Zastosowano metodę analizy wskaźnikowej w odniesieniu do wskaźników branżowych oraz uwzględniono dynamikę zmian badanych wskaźników. Wyniki badań wskazują, że obecnie podmioty energetyczne stosują głównie strategie agresywne (64%). Prognoza kapitału obrotowego netto sektora wskazuje, że silny trend wzrostowy, który obserwujemy od 2020 r., od 2023 r. zacznie stopniowo zwalniać. W wyniku zastosowania techniki mapowania wskaźnikowego można zauważyć znaczną koncentrację wskaźników w sektorze, przy czym tylko dwa podmioty różnią się pod tym względem od reszty sektora.

Słowa kluczowe: kapitał obrotowy netto, strategie zarządzania kapitałem obrotowym netto, energia, cykl konwersji środków pieniężnych, transformacja sektora energetycznego