

A Comparative Assessment of Sustainability Performance in the Romanian Energy Sector

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Abstract. *This study compares the sustainability performance of major companies in the Romanian energy sector. To do this, it uses the Analytical Criteria Method within a framework that evaluates environmental, social, and economic aspects, following international sustainability standards.*

The research is based on secondary data from sustainability reports, public regulatory documents, and industry databases for the period 2018–2024. The Analytical Criteria Method was applied to assign weights and rank indicators, allowing a structured and comparable assessment of how companies implement sustainability practices.

The results show notable differences between companies in terms of environmental efficiency and social involvement. These variations indicate that sustainability progress in the sector is uneven and that certain areas require strategic improvements and policy support.

The main contribution of the study is demonstrating that the Analytical Criteria Method can serve as a useful decision-support tool for sustainability evaluation in a transition economy. By providing a structured comparative framework, the research offers both methodological value—through the use of a multi-criteria evaluation model—and practical insights for researchers, specialists, and industry stakeholders regarding performance gaps and strategic priorities in the Romanian energy sector.

Keywords: sustainability assessment; analytical criteria method; energy industry; Romania; performance indicators; environmental performance.

Introduction

The global energy sector is under increasing pressure to become more sustainable due to climate concerns, regulations, and stakeholder demands. In Romania, energy companies are essential for achieving national decarbonization goals while maintaining energy security. Given the context of recent years—characterized by a more dynamic energy market, new EU energy legislation, and regional geopolitical developments—it is relevant to examine whether and how these factors have influenced the country's environmental situation and energy performance. Even though sustainability is very important in the energy sector for Romania, there are not many comprehensive and well-organized studies that analyze it (Lindfors, A. (2021)).

This study aims to address this research gap by applying the Analytical Criteria Method (ACM) to assess the sustainability performance of selected Romanian energy companies. Although the Analytical Criteria Method allows for the consideration of environmental, social, and economic dimensions of sustainability, this research focuses exclusively on environmental factors, which are recognized for supporting efforts to combat climate change by increasing awareness of companies' environmental impacts (Eccles, R. G., Ioannou, I., & Serafeim, G. (2014)). This focused approach enables a more in-depth and comprehensive analysis of environmental performance, providing

valuable insights for community of practices and managers in making informed sustainability-related decisions.

In addition, while a substantial amount of financial information related to sustainability is available for these companies—such as investments in new technologies—the data extracted from sustainability reports provides a broad set of non-financial indicators. These include aspects such as waste management, energy efficiency, social responsibility, and human rights, all of which are reported in accordance with the Global Reporting Initiative (GRI) standards. Previous research indicates that these non-financial indicators are significantly correlated with companies' financial performance, as they promote greater transparency and more responsible resource management (Stanescu, G., Horaicu, A., Ionescu, C., Coman, M., Cucui, I., & Munteanu, V. (2024).

Literature review

Romania's energy sector is undergoing a strategic shift toward sustainability, marked by significant growth in renewable generation capacity and planned investments in grid modernization and energy storage. National and EU policies target an increasing share of renewables within the gross final energy mix, while support mechanisms and private investment are stimulating wind and solar deployment alongside long-term decarbonization goals (European Commission, 2023; Romanian Ministry of Energy, 2024). However, fossil fuels still represent the majority of total energy consumption, and the relative lack of storage and flexibility infrastructure poses challenges for integrating intermittent clean energy sources and achieving Romania's climate commitments, including the EU's 2030 and 2050 targets for emissions reduction and carbon neutrality (World Bank, 2023). The monthly electricity generation in Romania by producer type in 2025 is illustrated in Figure 1, showing the seasonal variability and the interplay between hydro, wind, solar, and conventional sources. These patterns are consistent with earlier findings in the literature, which also emphasize the complementarity of renewable and conventional generation in meeting demand and the resulting need for enhanced grid flexibility and storage capacity (Frățița et al., 2023).

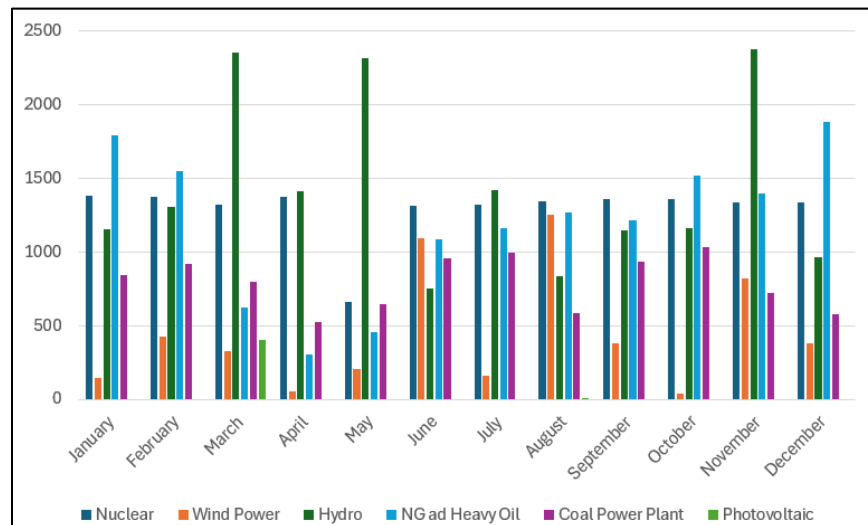


Figure 1. Monthly average electricity generation by energy source in Romania in 2025
(Sistemul Energetic Național, 2026)

Research in sustainability assessment highlights the importance of structured evaluation frameworks that integrate multiple indicators to capture environmental performance

comprehensively. The Global Reporting Initiative (GRI) provides an internationally accepted set of standardized environmental, social, and economic performance metrics that improve transparency and comparability in corporate reporting (our legislation includes GRI as a reporting basis, defining key performance indicators for sustainability disclosures). Literature also emphasizes that sustainability performance measurement increasingly adopts multi-criteria decision analysis methods (MCDA) to systematically weigh and rank alternatives against multiple objectives, facilitating evidence-based decision making across conflicting criteria (Petrichenko, 2025; Vassoney et al., 2021). These methods, including analytical criteria models, pairwise comparisons, and weighted scoring techniques, provide a structured means for combining quantitative GRI-aligned indicators—such as energy use, emissions, and waste—into comprehensive performance assessments, underscoring their relevance for evaluating environmental strategies in sectors like energy.

While prior studies examine Romania's renewable energy expansion and the technical challenges associated with integrating intermittent generation (Frățița et al., 2023; World Bank, 2023), broader research on European energy transitions highlights the systemic adjustments required to reconcile decarbonization, infrastructure flexibility, and socio-economic outcomes (European Commission, 2023). At the same time, sustainability reporting frameworks such as the Global Reporting Initiative provide standardized environmental and governance indicators intended to improve transparency and comparability in environmental performance assessment. Multi-criteria decision analysis methods have also been shown to support complex decision problems with conflicting objectives and heterogeneous data (Wulf et al., 2025), suggesting their potential usefulness in operationalizing sustainability assessments across energy systems.

Despite these parallel developments, existing literature tends to evolve along relatively separate tracks: energy transition studies primarily address macro-level system dynamics, decarbonization pathways, or technology integration challenges, while sustainability assessment research often focuses on corporate disclosure practices or indicator development without systematically linking indicator performance to strategic energy decisions. Recent reviews indicate that although composite sustainability indices and multi-criteria decision analysis-based evaluations are increasingly applied in the electricity sector, critical dimensions such as resilience, equity, and technological integration remain underrepresented (Gammanpila et al., 2026), and methodological practices in multi-criteria decision analysis sustainability assessment frequently lack stakeholder integration and comprehensive indicator weighting (Wulf et al., 2025). Furthermore, research on national energy-level sustainability assessments that combine standardized environmental reporting metrics with multi-criteria decision analysis approaches remains limited, especially within Eastern European energy systems.

This gap is particularly salient in the Romanian context, where increasing renewable penetration coexists with persistent fossil fuel dependence and inadequate flexibility infrastructure, generating complex trade-offs between environmental performance, system reliability, and economic feasibility. An integrated evaluation framework that combines standardized sustainability indicators (e.g., GRI-aligned environmental and social metrics) with structured decision-support tools (e.g., MCDA techniques) tailored to Romania's specific energy transition context is still underdeveloped. By integrating standardized sustainability metrics within a structured MCDA framework applied to Romania's energy sector, the research contributes to bridging the gap between sustainability reporting and strategic energy system evaluation, offering a more operational and context-sensitive assessment model.

Methodology

Given that this study focuses on the Romanian energy sector, five companies were initially selected for comparative analysis: *Societatea de Producere a Energiei Electrice în Hidrocentrale „Hidroelectrica” S.A.*, *Societatea Națională „Nuclearelectrica” S.A.*, *OMV Petrom S.A.*, *Public Power Corporation Romania S.A. (PPC Romania)*, and *E.ON Energie România S.A.*, considering their strategic relevance, market significance, and representativeness within the Romanian energy sector.

Societatea de Producere a Energiei Electrice în Hidrocentrale „Hidroelectrica” S.A. is the largest producer of hydroelectric power in Romania, playing a key role in renewable energy generation. *Societatea Națională „Nuclearelectrica” S.A.* operates Romania's nuclear power plant at Cernavodă city and contributes significantly to the country's low-carbon electricity production. *OMV Petrom S.A.* is an integrated energy company involved in oil and gas exploration, production, refining, and electricity generation. *Public Power Corporation Romania S.A. (PPC Romania)* is active mainly in electricity distribution and supply, while *E.ON Energie România S.A.* operates in the distribution and supply of electricity and natural gas to residential and industrial consumers. Together, these companies cover the main energy value chains (generation, transmission, distribution, and supply), ownership structures (state-owned and private), and energy sources (renewable, nuclear, and fossil-based), enabling a comparative assessment of sustainable performance in the Romanian energy sector.

Accordingly, the case study focuses on these five major actors in Romania's energy market, selected due to their substantial impact at the national level and their involvement in renewable energy generation, natural gas and electricity supply, and energy distribution. Although these companies also conduct operations internationally, the analysis is strictly limited to their environmental and sustainability performance within Romania and with a specific focus on environmental impact indicators only for this study. For this, the selection of environmental performance indicators was based on the Global Reporting Initiative (GRI) Standards, which are internationally recognized for promoting transparent and comparable sustainability reporting (Global Reporting Initiative, 2021). The GRI framework provides topic-specific disclosures covering key environmental aspects such as materials, energy, water, biodiversity, emissions, effluents and waste, environmental compliance, and supplier environmental assessment. These indicators were chosen because they offer a standardized approach to evaluating environmental impacts and allow for consistent comparison across companies. By relying on GRI indicators, the study ensures that the assessment is aligned with global best practices in sustainability reporting and provides a credible basis for analyzing the environmental performance of the selected Romanian energy companies (KPMG, 2022; Eccles, Ioannou, & Serafeim, 2014).

The comparative analysis was conducted using secondary research, primarily through a review of the companies' publicly available Sustainability Reports. Quantitative environmental performance indicators were extracted from these reports, along with other open-access sources, to ensure a reliable dataset for the analytical evaluation (Table 1). This preliminary assessment provided a foundation for the subsequent application of the Analytical Criteria Method, which will allowed for a structured and comprehensive evaluation of the companies' environmental sustainability performance.

Following the preliminary analysis of publicly available sustainability data, *"Hidroelectrica" S.A.* and *Societatea Națională „Nuclearelectrica” S.A.* did not provide sufficient information to support a full comparative evaluation. Specifically, *"Hidroelectrica" S.A.* reported

only a few disclosures—covering energy (302-1, 302-4), effluents and waste (306-2), and supplier environmental assessment (308-1)—while several key environmental indicators, such as materials (301), water (303), biodiversity (304), emissions (305), and environmental compliance (307), were not disclosed. Similarly, "Nuclearelectrica" S.A. disclosed some energy data (302-1) and selected GRI indicators for materials (301-1, 301-2), water (303-1, 303-3), biodiversity (304-1), and emissions (305-7), but lacked data for effluents and waste (306), environmental compliance (307), and supplier assessment (308). This limited reporting reflects the early stage of sustainability disclosure at these organizations. Consequently, the study focused on the remaining three companies—OMV Petrom S.A., Public Power Corporation Romania S.A. (PPC Romania), and E.ON Energie România S.A.—which provided sufficiently detailed and consistent data to allow a robust comparative analysis.

Table 1. Indicators of environmental impact relative to the companies

Company vs. Topic-specific disclosures	Hidroelectrica 2023	Nuclearelectrica 2023	OMV Petrom 2024 O1	PPC 2024 O2	E -ON 2024 O3
301 (Materials)	N/A	301-1, 301-2	N/A	N/A	N/A
302 (Energy)	302-1, 302-4	302-1	302-1 , 302-2, 302-3	302-1 , 302-3	302-1 , 302-4
303 (Water)	N/A	303-1, 303-3	303-1, 303-2, 303-3, 303-4, 303-5	303-1, 303-2, 303-5	N/A
304 (Biodiversity)	N/A	304-1	304-1, 304-2, 304-3, 304-4	N/A	304-3, 3-3-3,
305 (Emissions)	N/A	305-7	305-1, 305-2, 305-3 , 305-4, 305-5, 305-7	305-1, 305-2, 305-3 , 305-4, , 305-6, 305-7	305-1, 305-2, 305-3 ,
306 (Effluents and waste)	306-2	N/A	306-1, 306-2 , 306-3, 306-4, 306-5	306-1, 306-2 , 306-3, 306-4, 306-5	N/A
307 (Environmental compliance)	N/A	N/A	N/A	N/A	N/A
308 (Supplier Environmental Assessment)	308-1	N/A	308-1	308-1	308-1

Source: Authors' own research.

To rank the companies' environmental performance, the analytical criteria method (ACM) was employed in the second stage. This method is particularly effective in business analyses involving multiple options and multidisciplinary teams, as it balances performance and other relevant factors. In this study, the method involved identifying the evaluation criteria, weighting their relative importance, and scoring each company against each criterion, ultimately producing a prioritized ranking of environmental performance. Before applying the analytical criteria method (ACM), the alternatives were clearly identified. The three companies selected for comparison—OMV Petrom (O1), PPC (O2), and E-ON (O3)—were assigned distinct codes to ensure clarity and consistency throughout the analysis.

To prioritize the three companies based on their environmental performance, as it was said, the Analytical Criteria Model was applied. The following steps summarize the process.

- Construct an L-shaped matrix with evaluation criteria as rows and columns, blocking the diagonal cells
- Perform pairwise comparisons: each row criterion is compared to each column criterion, with inverse values recorded for diagonal cells.
- Sum the values in each row to get row totals, then aggregate to calculate the grand total.
- Calculate the relative weight of each criterion by dividing the row total by the grand total. Apply the comparison scale: 1 = equal importance; 5 = significantly more important; 10 = extremely important; 1/5 or 1/10 = less important.
- Base pairwise comparisons on literature insights to ensure objective and informed ratings.
- Use the weighted matrix to rank the companies and guide the comparative analysis of environmental indicators.
- Integrate both the relative importance of criteria and the actual performance of OMV Petrom (O1), PPC (O2), and E-ON (O3) into the final evaluation (Tague, N. R. (2005)).

Therefore, a set of relevant evaluation criteria was established to reflect key aspects of environmental performance for energy companies in Romania. These criteria were weighted relative to each other to determine their importance, providing a structured basis for comparison (Table 2). Each company was then assessed against some of these criteria, using their topic-specific disclosures:

- OMV Petrom (O1) reported extensively on energy (302-1, 302-2, 302-3), water (303-1 to 303-5), biodiversity (304-1 to 304-4), emissions (305-1 to 305-5, 305-7), effluents and waste (306-1 to 306-5), and supplier environmental assessment (308-1);
- PPC (O2) disclosed on energy (302-1, 302-3), water (303-1, 303-2, 303-5), emissions (305-1 to 305-4, 305-6, 305-7), effluents and waste (306-1 to 306-5), and supplier assessment (308-1);
- E-ON (O3) reported on energy (302-1, 302-4), biodiversity (304-3, 3-3-3), emissions (305-1 to 305-3), and supplier assessment (308-1).

Table 2. Indicators of environmental impact relative to the companies

Company vs. Topic-specific disclosures	OMV Petrom 2024 O1	PPC 2024 O2	E -ON 2024 O3
301 (Materials)	N/A	N/A	N/A
302 (Energy)	302-1 , 302-2, 302-3	302-1 , 302-3	302-1 , 302-4
303 (Water)	303-1, 303-2, 303-3, 303-4, 303-5	303-1, 303-2, 303-5	N/A
304 (Biodiversity)	304-1, 304-2, 304-3, 304-4	N/A	304-3, 3-3-3,
305 (Emissions)	305-1 , 305-2 , 305-3 , 305-4, 305-5, 305-7	305-1 , 305-2 , 305-3 , 305-4, , 305-6, 305-7	305-1 , 305-2 , 305-3 ,
306 (Effluents and waste)	306-1, 306-2 , 306-3, 306-4, 306-5	306-1, 306-2 , 306-3, 306-4, 306-5	N/A
307 (Environmental compliance)	N/A	N/A	N/A
308 (Supplier Environmental Assessment)	308-1	308-1	308-1

Source: Authors' own research.

The common topic-specific disclosures identified for comparison included: 302-1 (Energy consumption within the organization), 305-1 (Direct GHG emissions), 305-2 (Energy indirect GHG emissions), 305-3 (Other indirect GHG emissions), 306-2 (Waste by type and disposal method), and 308-1 (New suppliers screened using environmental criteria). After cataloging which disclosures each company reported and identifying those shared by all, the comparative analysis proceeded using the analytical criteria method. It should be noted that disclosures related to 304 (Biodiversity) varied significantly in scope and reporting practices among the companies, preventing a meaningful comparison; consequently, this indicator was excluded from the analysis.

Next, quantitative values were assigned to each common indicator based on the data reported in the companies' Sustainability Reports, providing a foundation for a structured comparison of environmental performance. Table 3 presents these values, enabling a clear, side-by-side evaluation of the companies' sustainability actions. For the Effluents and Waste indicator (306-2), reported values were further categorized into H (hazardous), NH (non-hazardous), E (eliminated), and R (recycled), allowing for a more nuanced analysis of waste management practices and providing a deeper understanding of how each company addresses environmental impacts.

Table 3. Quantitative values of every environmental indicator

Company vs. Topic-specific disclosures	OMV Petrom Romania 2024		PPC Romania 2024		E -ON Romania 2024	
302-1	140.379.793,2 GJ		157.921.572,78 GJ		3,542,400 GJ	
305-1	9,778,526 t CO ₂		10,528,802.99 t CO ₂		730 000 t CO ₂	
305-2	991,275 t CO ₂		1,670,019.92 t CO ₂		120,000 t CO ₂	
305-3	1,036,020 t CO ₂		8,501,695.64 t CO ₂		3,600,000 t CO ₂	
306-2	372,034 t	H	13,232.78 t	H	249 t	H
	628,992 t	NH	547,887.4 t	NH	1,003 t	NH
	736,136 t	R	561,120.2 t	R	123,8 t	R
308-1	100%		88%		39%	

Source: Authors' own research.

The next phase of the analysis aimed to prioritize the three companies based on their environmental performance by constructing an L-shaped matrix, where the evaluation criteria were represented both as row labels and column headings, with the diagonal cells blocked out (Tague, 2005), as illustrated in Table 4. Once the matrix was established, the relative importance of each criterion was assessed by comparing it to every other criterion, with the row criterion rated against the column criterion. For the corresponding diagonal cells, the inverse value was recorded to maintain balance.

After completing the pairwise comparisons, the values in each row were summed to calculate a total for that criterion, and these row totals were then aggregated to determine a grand total. Subsequently, the relative weight of each criterion was derived by dividing the row total by the grand total, providing a normalized measure of importance. The comparison scale was applied to guide the ratings as mentioned before: 1 indicated equal importance, 5 indicated that the row criterion was significantly more important than the column, 10 indicated extreme importance, while 1/5 and 1/10 represented significantly and extremely less important, respectively (Tague, 2005).

The pairwise comparison process was informed by insights from specialized literature on environmental performance evaluation. This ensured that the assessment of each criterion was grounded in established knowledge and best practices. The resulting weighted matrix provided a systematic foundation for ranking the three companies, enabling an objective prioritization of their environmental actions.

Finally, these weighted scores presented in equation (1) were used to guide the comparative analysis of the environmental indicators, applying the established algorithm to quantify and rank the companies' performance across all selected criteria. This approach ensured that both the relative importance of the indicators and the actual performance of OMV Petrom (O1), PPC (O2), and E-ON (O3) were systematically integrated into the final evaluation.

$$\text{Relative weight} = \text{sum} / \text{grand total} \quad (1)$$

Table 4. Criteria Matrix

Criteria	302-1	305-1	305-2	305-3	306-2	308-1	Sum	Relative weights
302-1		1/5	1/5	5	10	5	20.4	0.21
305-1	5		1	5	10	10	31	0.32
305-2	5	1		1	10	5	22	0.22
305-3	1/5	1/5	1		10	5	16.4	0.17
306-2	1/10	1/10	1/0	1/10		1/5	0.6	0.01
308-1	1/5	1/10	1/5	1/5	5		5.7	0.1
							96.1	

Source: Authors' own research.

The comparison of environmental indicators was structured according to their relative importance in the energy sector. The prioritization followed these rules.

Indicator 302-1 (Energy consumption within the organization) was judged significantly more important than 305-3 (Other emissions) and 308-1 (Supplier environmental assessment) and extremely more important than 306-2 (Effluents and waste) because energy use is a central indicator of resource efficiency and environmental performance, widely recognized in sustainability frameworks as a core metric for tracking organizational impact and progress toward energy efficiency goals (ISO 14031:2013 provides guidance on selecting core environmental performance indicators)

Greenhouse gas emissions indicators (305-1, 305-2, 305-3) were assigned the highest importance. 305-1 (Direct GHG emissions) was rated significantly more important than 302-1 and 305-3, and extremely more important than 306-2 and 308-1. 305-2 (Energy indirect GHG emissions) was significantly more important than 302-1 and 308-1, and extremely more important than 306-2. Indicator 305-3 (Other indirect GHG emissions) was significantly more important than 308-1 and extremely more important than 306-2. Managing emissions effectively is crucial for strong environmental performance and provides a competitive advantage in the sector (OECD highlights GHG emissions as a core metric for environmental scoring).

Indicator 06-2 (Effluents and waste) was considered extremely less important relative to the other criteria because in the energy sector, waste streams tend to have a more limited environmental footprint compared to energy consumption and greenhouse gas emissions; consequential research shows that energy and emissions metrics often dominate corporate sustainability reporting due to their higher materiality for stakeholders and regulatory frameworks

environmental performance in the energy sector compared to energy use or emissions (Giannakis, M., Dubey, R., Vlachos, I., & Ju, Y. (2020)).

Indicator 308-1 (New suppliers screened using environmental criteria) was rated significantly more important than 306-2. Sustainable supply chain management is essential, as suppliers with negative environmental impacts can reduce the effectiveness of a company's overall sustainability efforts (Giannakis et al., 2020).

Therefore, the calculated weights indicated that "Waste by Type and Disposal Method" (306-2, relative weight 0.01) and "New suppliers screened using environmental criteria" (308-1, relative weight 0.1) are considerably less significant than the other criteria. Consequently, these indicators were excluded from the subsequent stages of the analysis. After assigning weights to the criteria, four additional matrices were created, corresponding to the remaining evaluation criteria. Each matrix compared the three companies against one specific criterion, allowing a detailed assessment of how each option performed relative to the others. These matrices are presented in Tables 5 to 8.

Table 5. Options versus criteria 302-1 matrix

302-1	O1	O2	O3	Sum	Relative weights
O1		1/5	10	10.2	0.49
O2	5		5	10	0.48
O3	1/10	1/5		0.3	0.01
				20.5	

Source: Authors' own research.

Table 6. Options versus criteria 305-1 matrix

305-1	O1	O2	O3	Sum	Relative weights
O1		5	10	15	0.73
O2	1/5		5	5.2	0.25
O3	1/10	1/5		0.3	0.01
				20.5	

Source: Authors' own research.

Table 7. Options versus criteria 305-2 matrix

305-2	O1	O2	O3	Sum	Relative weights
O1		10	5	15	0.73
O2	1/10		1/5	0.3	0.01
O3	1/5	5		5.2	0.25
				20.5	

Source: Authors' own research.

Table 8. Options versus criteria 305-3 matrix

305-3	O1	O2	O3	Sum	Relative weights
O1		1/10	1/5	0.3	0.01
O2	10		5	15	0.96
O3	5	1/5		0.3	0.01
				15.6	

Source: Authors' own research.

The calculation of relative weights for the options followed the same algorithm as previously applied for the criteria. This process generated a set of relative weights for each company with

respect to every remaining criterion, forming the basis for the final prioritization of environmental performance.

In the final step, the relative weights of all criteria were combined with the relative weights of each option in the last matrix (Table 9). For each option, the criterion weight was multiplied by the corresponding option weight, and the resulting values were summed across all criteria to produce an overall score for each company. These scores provided a clear basis for prioritizing the options. Once the summary matrix was completed, the interpretation of the results was straightforward. The companies could be ranked according to their overall environmental performance, with the final scores reflecting both the relative importance of the criteria and the performance of each company.

Table 9. Summary matrix of options versus criteria

Options vs. All Criteria	302-1 0.21	305-1 0.32	305-2 0.22	305-3 0.17	Sum
O1	$0.49 \times 0.21 = 0.10$	$0.73 \times 0.32 = 0.23$	$0.73 \times 0.22 = 0.16$	$0.01 \times 0.17 = 0.002$	0.49
O2	$0.48 \times 0.21 = 0.10$	$0.25 \times 0.32 = 0.08$	$0.01 \times 0.22 = 0.002$	$0.96 \times 0.17 = 0.16$	0.34
O3	$0.01 \times 0.21 = 0.002$	$0.01 \times 0.32 = 0.003$	$0.25 \times 0.22 = 0.05$	$0.01 \times 0.17 = 0.002$	0.06

Source: Authors' own research.

Based on this analysis, *OMV Petrom S.A* achieved the highest overall score, followed by *Public Power Corporation Romania S.A. (PPC Romania)* in second place, and *E.ON Energie România S.A.* in third, demonstrating their respective levels of engagement in environmental sustainability initiatives within Romania (Table 9).

Results and discussions

The analysis using the Analytical Criteria Model revealed significant differences in environmental performance among the three energy companies included in the study (Table 8). OMV Petrom (O1) achieved the highest overall score of 0.49, reflecting consistently strong performance in energy consumption (302-1) and greenhouse gas emissions (305-1 and 305-2). PPC (O2) scored 0.34, showing notable performance in 305-3, while E-ON (O3) had the lowest score of 0.06, indicating limited engagement across the evaluated environmental criteria. These results support the research hypothesis that companies with more structured energy management and emissions reduction strategies achieve higher sustainability scores.

It is important to note that two additional companies were excluded from the study due to insufficient publicly available data, limiting the overall scope. Future research incorporating these companies, should relevant data become accessible, could provide a more comprehensive assessment of environmental performance across the Romanian energy sector.

Critical analysis of the results highlights that energy consumption and greenhouse gas emissions are the most influential criteria driving overall environmental scores. OMV Petrom's leading position demonstrates effective integration of these core indicators into corporate sustainability strategies. PPC's performance in 305-3 suggests a targeted focus on specific emissions, while E-ON's low score points to gaps in a broader, systematic approach. These findings are consistent with the literature emphasizing the importance of energy efficiency and emissions management for corporate sustainability (Marrucci, Daddi, & Iraldo, 2023; Giannakis et al., 2020).

Comparing the results with similar studies, the observed prioritization of energy and emissions aligns with global trends in the energy sector, where these indicators are considered central to

environmental performance evaluation. The application of the Analytical Criteria Model in this study also demonstrates its usefulness as a practical tool for systematically ranking companies, supporting a structured, evidence-based approach to sustainability assessment. Overall, the findings confirm the relevance of the model and suggest that companies integrating energy management and emissions reduction into their strategic priorities are better positioned to achieve measurable environmental outcomes and competitive advantage.

Future research could expand this study in several important directions. First, incorporating a broader sample of companies from the Romanian and regional energy markets would improve the generalizability of the findings and allow comparative cross-country analysis. Second, future studies could integrate additional ESG indicators—such as water consumption, waste management, biodiversity impact, and social governance variables—to develop a more holistic sustainability assessment framework. Third, applying longitudinal analysis over multiple reporting years would enable the examination of performance trends and the long-term effectiveness of corporate decarbonization strategies. Methodologically, future research could compare the Analytical Criteria Model with alternative multi-criteria decision-making approaches, such as AHP or TOPSIS, to test robustness and sensitivity of rankings. Finally, qualitative investigations, including interviews with sustainability managers, could complement quantitative findings by providing deeper insight into strategic decision-making processes behind environmental performance outcomes.

Conclusion

This study provides a structured assessment of environmental performance in the Romanian energy sector using the Analytical Criteria Model. The results indicate that OMV Petrom (O1) leads in sustainability performance, followed by PPC (O2) and E-ON (O3), with energy consumption and greenhouse gas emissions being the most influential criteria. The analysis demonstrates that companies integrating these core indicators into their strategic priorities achieve higher measurable environmental outcomes. By applying a weighted, criterion-specific model, this research contributes a systematic and replicable approach for ranking and comparing corporate environmental performance, which can support decision-making and sustainability benchmarking in the sector.

However, the study has limitations. Two additional companies had to be excluded due to insufficient publicly available data, restricting the comprehensiveness of the analysis. Future research could extend this work by including all relevant companies and incorporating additional environmental indicators, enabling a more exhaustive evaluation of sector-wide sustainability practices. Despite these limitations, the findings highlight the importance of energy efficiency and emissions reduction as central drivers of corporate environmental performance and provide practical insights for managers and policymakers seeking to enhance sustainability outcomes in the energy industry.

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