

International Journal Research Publication Analysis

Page: 01-10

IMPACT OF POWER GENERATION TYPE ON ESG PERFORMANCE—EMPIRICAL EVIDENCE FROM CHINA'S A-SHARE POWER INDUSTRY

*Jian Hao

Farabi International Business School, Al-Farabi Kazakh National University, Almaty,
Kazakhstan.

Article Received: 28 June 2026

*Corresponding Author: Jian Hao

Article Revised: 17 July 2026

Farabi International Business School, Al-Farabi Kazakh National University, Almaty,
Kazakhstan.

Published on: 05 August 2026

DOI: <https://doi-doi.org/101555/ijrpa.1815>

ABSTRACT

493 annual observations from 82 A-share listed power generation companies in China from 2019 to 2025 are applied to empirically examine the impact of power generation type (new energy power generation vs. traditional thermal power companies) on the overall ESG (Environmental, Social, and Governance) performance as well as separate dimension performance of these companies. It is revealed that after controlling company size, debt-to-equity ratio, profitability, and equity nature, new energy power generation companies significantly outperform traditional thermal power companies in both overall ESG performance and the environmental dimension performance, while the significance in social and governance dimensions are relatively weaker. This research provides empirical evidence from China's power industry for further understanding of the relationship between energy structure transformation and ESG performance.

KEYWORDS: ESG performance, power industry, generation type, soe, renewable energy.

1. INTRODUCTION

Recently, driven by the “Dual Carbon” goals, energy structure transformation in China has continued to deepen and the installed capacity of new energy power generation has grown rapidly. As a significant sector of carbon emissions, the power industry's ESG performance has increasingly attracted the attention of regulators, investors as well as the public. At the same time, a differentiation in the energy structure within the power industry has appeared:

some companies primarily focus on new energy such as wind, solar, and hydropower, while others still rely on traditional thermal power, represented by coal-fired power. These two types of companies differ significantly in business models, environmental compliance pressures, and policy support, which theoretically could lead to a systemic divergence in their ESG performance.

Existing literature on the driving factors of ESG performance in the power industry mainly focuses on financial characteristics such as company size, equity structure, and profitability, etc. However, the impact of power generation structure on ESG performance is rarely analyzed and few studies further examine its differentiated impact on the single ESG aspect. Therefore, this paper uses sample of A-share listed power generation companies in China from 2019 to 2025 to empirically examine whether there are significant differences between new energy power companies and traditional thermal power companies in their overall ESG performance as well as single E/S/G dimension. The aim is to provide empirical evidence from the Chinese power industry to understand the relationship between energy structure transformation and corporate ESG performance, and also to provide a reference for evaluating the policy effects of green transformation in power companies.

2. Literature Review and Research Hypotheses

2.1 Power generation type and Corporate environmental performance

Existing research generally agrees that the cleanliness level of a specific industry is closely related to the quality of its environmental disclosure and performance. Due to the inherent low-carbon and clean nature, new energy power companies face less strict environmental compliance pressures and are more likely to obtain policy support and green financing convenience through environmental information disclosure, thus having an incentive to demonstrate superior environmental performance. In contrast, traditional thermal power companies, as high-carbon emitters, have faced stricter environmental regulations for a long time and higher emission reduction costs, thus their environmental performance is relatively constrained. Therefore, this paper proposes:

H1: Compared to traditional thermal power plants, new energy power generation companies have better overall ESG performance.

H2: Compared to traditional thermal power companies, new energy power generation companies perform better in the E(environmental) dimension.

2.2 Power generation types and corporate social and governance performance

Unlike the environmental dimension, a company's fulfillment of social responsibility (such as

employee rights protection, community relations, and supply chain management) and corporate governance level (such as equity structure, board independence, and quality of information disclosure) depend more on the perfection of its internal governance mechanisms than on its power generation energy structure itself. In other words, whether a new energy company or a traditional thermal power company, as long as its governance mechanisms are sound and its internal controls are in place, it is likely to achieve good performance in the social and governance dimensions. The direct explanatory power of energy generation type for these two dimensions may be relatively limited. Therefore, this paper proposes:

H3: The performance differences between new energy power generation enterprises and traditional thermal power enterprises in the social (S) and governance (G) dimensions are not as significant as those in the environmental dimension.

3. Research Design

3.1 Data sources

This paper uses listed companies in China's A-share electricity industry from 2019 to 2025 as the initial sample. Based on whether the companies' main business is renewable energy power generation (wind power, photovoltaic, hydropower, etc.), the samples are divided into renewable energy power generation companies (NewE=1) and traditional thermal power companies (NewE=0). ESG data are from Huazheng Securities, and financial data (debt-to-equity ratio, return on total assets, company size) and corporate governance data (ownership nature) are from the CSMAR database. After removing observations with missing ESG rating data, a final sample of 493 companies from 82 listed companies from 2019 to 2025 was obtained, including 203 observations of renewable energy power generation companies and 290 observations of traditional thermal power companies, forming an unbalanced panel database.

3.2 Variable definitions

The explained variables are the overall ESG score of the enterprise and its three sub-scores: Environment (E), Society (S), and Governance (G). The core explanatory variable is NewE, a dummy variable indicating whether the enterprise is a new energy power generation enterprise (yes = 1, no = 0). This variable is a static attribute at the enterprise level and does not change over time during the sample period. Referring to existing literature, this paper selects the following control variables: enterprise size (log_size, natural logarithm of total assets), debt-to-equity ratio (lev, total liabilities/total assets), return on total assets (roa, net profit/average total assets), and ownership structure (soe, whether the enterprise is

state-owned or controlled, yes = 1, no = 0). To eliminate the influence of extreme values, this paper performs winsorization on the three continuous variables lev, roa, and log_size at the 1% and 99th percentiles.

3.3 Model setting

Since NewE is a static attribute at the firm level that remains unchanged from the beginning to the end of the sample period, if a firm fixed effects model is used, the coefficient of NewE will be completely absorbed by the fixed effects and cannot be identified. Therefore, this paper adopts pooled least squares (OLS) and incorporates year fixed effects to control for the combined impact of macroeconomic fluctuations and changes in industry policies over time. Simultaneously, standard errors are clustered at the firm level to alleviate the problem of serial correlation between observations of the same firm in different years. The specific model settings are as follows:

$$ESG(orE/S/G)_{it} = \alpha + \beta_1 NewE_i + \beta_2 lev_{it} + \beta_3 roa_{it} + \beta_4 log_size_{it} + \beta_5 soc_{it} + \lambda_t + \varepsilon_{it}$$

The subscript i represents the enterprise, t represents the year, λ is the fixed effect of the year, and ε is the random error term. This article focuses on the sign and significance of β_1 . If the significance of β_1 is positive, it indicates that new energy power generation enterprises perform better than traditional thermal power enterprises in the corresponding ESG indicators.

4. Empirical results and analysis

4.1 Descriptive statistics

Table 1 reports the descriptive statistics of the main variables of the entire sample. During the sample period (2019-2025), the average ESG score of A-share listed power generation companies in China was 65.19, with a standard deviation of 9.82. The lowest score was 40.03, and the highest was 91.44, indicating that the overall ESG performance of listed power companies was at a medium-to-high level, but there were significant differences between companies. Looking at the sub-dimensions, the average scores for Environment (E), Society (S), and Governance (G) were 66.55, 75.90, and 78.62, respectively, which indicates that compared to the Environment dimension, the samples score higher on Social and Governance dimensions. This is consistent with the industry characteristics of high carbon emissions and significant environmental compliance pressure in the power (especially thermal power) sector. The mean of the core explanatory variable NewE is 0.412, indicating that approximately 41.2% samples belong to new energy power generation enterprises, while the

rest 58.8% are traditional thermal power enterprises. The distribution of the two types of enterprises in the sample is relatively balanced, providing a statistical basis for inter-group comparisons.

Table 1 Descriptive statistics.

Variables	N	Mean	SD	Min	Max
ESG	493	65.190	9.824	40.030	91.440
E	493	66.547	5.929	54.530	85.720
S	493	75.904	6.126	59.770	94.100
G	493	78.624	4.708	59.240	89.760
NewE	493	0.412	0.493	0.000	1.000
lev	493	0.573	0.174	0.013	1.112
roa	493	0.026	0.035	-0.175	0.166
log_size	493	24.137	1.494	20.815	27.342
soe	493	0.852	0.356	0.000	1.000

Note: N is the number of observations, and Mean/SD/Min/Max are the mean, standard deviation, minimum, and maximum values, respectively.

Table 2 further lists the means and standard deviations of each variable by grouping new energy enterprises (NewE=1) and traditional thermal power enterprises (NewE=0). Preliminary observations show that the new energy enterprise group has higher means in ESG and its three sub-items than the traditional thermal power enterprise group. Meanwhile, the new energy enterprise group has lower means in debt-to-equity ratio (mean lev 0.538 vs. 0.598), enterprise size (mean log_size 23.890 vs. 24.311), and state-owned equity ratio (mean soe 0.813 vs. 0.879) than the traditional thermal power enterprise group. This distribution characteristic suggests that there are systematic differences between new energy enterprises and traditional thermal power enterprises in financial characteristics and equity structure. Without controlling for these differences, directly comparing the ESG performance of the two groups may lead to variable omission bias. This is an important reason why lev, roa, log_size, and soe are introduced as control variables in the main regression.

Table 2 Grouped descriptive statistics. (NewE=1 vs. NewE=0)

Variables	NewE Group	N	Mean	SD
ESG	0	290	64.215	9.602
ESG	1	203	66.583	9.991
E	0	290	66.081	5.603
E	1	203	67.212	6.322
S	0	290	75.657	5.793
S	1	203	76.256	6.571
G	0	290	78.096	4.968
G	1	203	79.377	4.208
lev	0	290	0.598	0.173
lev	1	203	0.538	0.171
roa	0	290	0.024	0.040
roa	1	203	0.029	0.024
log_size	0	290	24.311	1.421
log_size	1	203	23.890	1.564
soe	0	290	0.879	0.326
soe	1	203	0.813	0.391

4.2 Between-group mean difference test

Table 3 reports the mean differences and t test results between new energy companies and traditional thermal power companies on the total ESG as well as E/S/G scores. The results show that the total ESG score of new energy companies is significantly higher than that of traditional thermal power companies (difference 2.368, $p=0.0088$), the environmental dimension (E) is also significantly higher (difference 1.131, $p=0.0413$), and the difference in governance dimension (G) is also significant at the 1% level (difference 1.280, $p=0.0022$). In contrast, although the mean value of the social dimension (S) of new energy companies is slightly higher (difference 0.600), it fails the significance test at the 10% level ($p=0.2961$).

This preliminary result shows that the type of energy generation has a significant impact on corporate ESG performance, and this impact is more obvious in the environmental and governance dimensions. However, no robust conclusion can be drawn in the social dimension, which provides directional clues for the following regression analysis and discussion.

Table 3 Grouped mean difference test.

Variables	NewE=1 mean	NewE=0 mean	Difference	t	p
ESG	66.583	64.215	2.368	2.632	0.0088***
E	67.212	66.081	1.131	2.047	0.0413**
S	76.256	75.657	0.600	1.046	0.2961
G	79.377	78.096	1.280	3.084	0.0022***

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; the t-test uses Welch's t-test (without assuming homogeneity of variance).

4.3 Principal regression results

To further examine the net effect of NewE on ESG performance after controlling for firm characteristics, this paper employs a Pooled OLS model, controlling for firm debt-to-equity ratio (lev), return on total assets (roa), firm size (log_size), and ownership type (soe), and incorporating a fixed year effect. Standard error clustering is performed at the firm level, with ESG, E, S, and G as the dependent variables. The results are shown in Table 4.

The regression results show that, after controlling for firm characteristics and year effects, the coefficient of NewE is 2.617 ($p=0.0452$) in the model with ESG as the dependent variable and 1.477 ($p=0.0459$) in the model with E as the dependent variable, both significantly positive at the 5% level. This indicates that new energy power generation companies are significantly better than traditional thermal power companies in both overall ESG performance and environmental dimension performance, thus supporting hypotheses H1 and H2. In the models with S and G as explained variables, the NewE coefficients were 1.093 ($p=0.0918$) and 1.056 ($p=0.0810$), respectively, only marginally significant at the 10% level. This indicates that the impact of energy structure type on corporate social responsibility performance and corporate governance level is relatively limited, weaker than its impact on the environmental dimension.

Comparing the inter-group mean difference test in Table 3 with the regression results in Table 4, it can be found that, before and after controlling for corporate characteristics, the impact of NewE on ESG and E remains significant, indicating that this finding has a certain degree of robustness. However, the significance of the G dimension decreased from 1% to the 10% marginal level after controlling for variables, while the S dimension changed from insignificant to marginally significant. This suggests that financial characteristics such as corporate size and profitability, to some extent, explain the differences in performance

between new energy companies and traditional thermal power companies in the social and governance dimensions, and the independent explanatory power of energy structure itself for these two dimensions is relatively weak.

Table 4 Principal regression results.

Interpreted Variable	N	R ²	NewE coefficient	Std. Err	p
ESG	493	0.412	2.617	1.306	0.0452**
E	493	0.415	1.477	0.740	0.0459**
S	493	0.523	1.093	0.648	0.0918*
G	493	0.267	1.056	0.605	0.0810*

*Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; the values in parentheses report the significance test corresponding to the cluster robust standard error; due to space limitations, the specific coefficients of the control variables and year fixed effects are not listed in the table.*

4.4 SUMMARY

Based on the results in Tables 1 to 4, this paper finds that among A-share listed power generation companies in China, new energy power generation companies demonstrate significantly better overall ESG performance than traditional thermal power companies. This advantage primarily stems from their leading position in environmental dimensions. However, in terms of social responsibility and corporate governance, the differences between the two types of companies are relatively small, and some are less robust. This result aligns with intuition—new energy companies inherently possess environmentally friendly attributes in their business operations, naturally giving them an advantage in environmental information disclosure and environmental performance; while the fulfillment of social responsibility and the level of corporate governance depend more on the sophistication of the company's internal management mechanisms, and their correlation with the power generation energy structure is relatively indirect.

5. CONCLUSIONS AND LIMITATIONS

This paper uses 82 A-share listed power companies and 493 enterprises as a sample for annual observation from 2019 to 2025 in China to empirically examine the differentiated

impact of power generation energy structure on corporate ESG performance and its E/S/G components. The study finds that after controlling for company size, profitability, debt-to-equity ratio, and ownership structure, new energy power generation companies significantly outperform traditional thermal power companies in both overall ESG performance and environmental (E) dimension, while their advantages in social (S) and governance (G) dimensions are relatively weak and only marginally significant. This indicates that the improvement in corporate ESG performance due to energy structure transformation is mainly reflected in the environmental dimension, while improvements in social responsibility fulfillment and corporate governance depend more on the construction of internal governance mechanisms and cannot be automatically achieved solely through clean energy transformation at the business level.

Based on the above findings, this paper argues that: on the one hand, regulators and investors should pay attention to the differentiated impacts of energy structure transformation on different ESG dimensions when evaluating the ESG performance of power companies, avoiding simply equating leading in environmental dimensions with a comprehensive improvement in overall ESG performance; on the other hand, traditional thermal power companies should simultaneously strengthen corporate governance and social responsibility while promoting low-carbon transformation, while new energy companies should not neglect the continuous improvement of governance mechanisms due to the environmental attributes of their businesses.

This paper has the following limitations: First, the classification of NewE may involve a self-selection problem among companies, meaning that larger, more policy-supported companies may be more inclined to transform to new energy. This paper did not use methods such as propensity score matching to address this potential endogeneity issue, which can be further explored in future research; second, due to space limitations, this paper does not delve into the specific mechanisms by which energy structure affects ESG performance, nor does it examine the moderating effect of external shocks such as dual-carbon policies. These are all research directions worthy of future expansion.

REFERENCES

1. Hmouda A M O, Orzes G, Sauer P C, et al. Determinants of environmental, social and governance scores: Evidence from the electric power supply chains[J]. *Journal of Cleaner Production*, 2024, 471: 143372.
2. WANG B, YANG M J. Research on the influence mechanism of ESG performance on

- enterprise value: empirical evidence from A-share listed companies in China[J]. *Soft Science*, 2022, 36(6): 78-84.
3. LI J L, YANG Z, CHEN J, et al. Mechanism research on how ESG boosts corporate performance: from the perspective of corporate innovation[J]. *Science of Science and Management of S. & T.*, 2021, 42(9): 58-66.
 4. QIU M Y, YIN H. Corporate ESG performance and financing cost under the background of ecological civilization construction[J]. *The Journal of Quantitative & Technical Economics*, 2019, 36(3): 108-123.
 5. LIAN Y H, HE X Y, ZHANG L. Corporate ESG performance and debt financing cost[J]. *Collected Essays on Finance and Economics*, 2023(1): 48-58.
 6. MA W J, YU B J. Corporate ownership and divergence between Chinese and foreign ESG ratings[J]. *Journal of Finance and Economics*, 2023, 49(6): 124-136.
 7. WANG L M. An empirical study on the relationship between financing structure and corporate performance of listed companies in energy industry[J]. *Finance*, 2023, 13(3): 658-668.
 8. YU Y, WU H C, YI R H. Corporate ESG performance and value creation[J]. *Chinese Journal of Management Science*, 2025, 33(3): 107-117.
 9. Friede, G., Busch, T., & Bassen, A. (2015). ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies. *Journal of Sustainable Finance & Investment*, 5(4), 210-233.
 10. Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The Impact of Corporate Sustainability on Organizational Processes and Performance. *Management Science*, 60(11), 2835-2857.
 11. SUN D, YANG S, ZHAO Y X, et al. Research on the correlation among ESG performance, financial status and systemic risk: evidence from A-share listed power companies in Shanghai and Shenzhen stock exchanges[J]. *Chinese Journal of Environmental Management*, 2019, 11(2): 37-43.