2025 Volume 3, Issue 1
Educational Innovation Research
ISSN: 3029-1844(Print)
ISSN: 3029-1852(Online)

A Discourse Study of New Energy Academic Paper Abstracts Based on LancsBox

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Abstract:

The abstract is a critical component of a thesis and a key method for disseminating research findings. This study uses the term "new energy" as a search criterion to construct a corpus of abstracts from academic papers related to the topic of new energy. Abstracts of recent publications in this field were collected from the Science Citation Index (SCI) and the Chinese Science Citation Database (CSCD). Using the corpus tool LancsBox, this research analyzes word frequency and collocation to identify patterns of vocabulary usage in new energy research texts and their role in advancing the field. The study provides insights into how vocabulary usage in academic papers contributes to the promotion of new energy development.

Keywords:

Corpus
LancsBox
New energy
Dissertation abstracts
Discourse research

Online publication: February 22, 2025

1. Introduction

With the progression of globalization and the increasing prevalence of academic exchanges in recent years, interactions within scholarly communities have significantly intensified. Both domestic researchers and international experts actively contribute to their respective disciplines, disseminating their latest findings in many esteemed academic journals recognized both nationally and globally. In this era of knowledge proliferation, the importance of academic papers has grown substantially. The abstract, representing the core of a paper's content, naturally draws the attention of academic scholars.

As a vital component of academic papers, the abstract enables readers to quickly grasp the fundamental concepts and research significance of the work. A concise and well-crafted abstract serves as a critical tool for information retrieval, providing readers with an efficient pathway to access the full text. Additionally, in terms of citation, the abstract facilitates the widespread dissemination of academic findings, fostering knowledge exchange and collaboration. An exemplary academic abstract typically showcases the author's novel ideas, rigorous research methodologies, and distinctive insights, thereby attracting greater interest and engagement

from peers. As such, the abstract plays an essential role in academic publishing and communication, serving as the foundation of a paper while also acting as a significant driver of academic progress and disciplinary development.

Energy, often regarded as the lifeblood of human civilization, is not only a fundamental resource for daily life and industrial production but also a complex and strategically important asset. It intersects with numerous disciplines, including economics, political science, natural science, culture, and ethics. Energy reflects humanity's concerns over issues such as national security, economic growth, and environmental preservation. Globally, energy has evolved from a basic necessity to a symbol of national strength and a critical bargaining tool in international politics.

As the global population and economic activity expand, energy demand continues to rise, posing significant challenges due to the depletion of traditional fossil fuel resources. Fossil fuels, including coal, oil, and natural gas, generate energy but cause irreversible damage to the environment. Their combustion releases substantial greenhouse gases, exacerbating the risk of global climate change and inflicting lasting harm on ecosystems. Furthermore, the limited availability of these resources, often influenced by geopolitical factors, increases vulnerabilities in energy security.

Under these circumstances, the pursuit of alternative energy sources to achieve sustainable development and reduce dependence on fossil fuels has become an urgent global priority. The energy transition not only impacts the well-being of future generations but also serves as a key mechanism for driving societal progress and enhancing individual quality of life. Consequently, efforts at all levels—ranging from policy formulation and technological innovation to raising public awareness—are focused on developing cleaner, more efficient, and diversified energy solutions. The advancement of new energy technologies and the optimization of energy structures represent significant strides toward greener, low-carbon, and sustainable development.

This paper centers on new energy as its primary theme. It constructs a corpus of abstracts from new energy research papers, employs the LancsBox corpus tool to extract high-frequency vocabulary, generates visual maps, and analyzes vocabulary collocations. The study aims to explore the linguistic characteristics of energy research texts and their contributions to advancing new energy development.

2. Research status

Dissertation research in the energy sector primarily focuses on analyzing energy discourse within individual nations. Jones provided data and critiques the academic community's fixation on energy humanities, arguing that an excessive focus on oil impedes the transition toward renewable energy [1]. Yu explored the dynamics of energy discourse and the evolution of international institutions, emphasizing that energy security encompasses not only global trends but also the vital interests of major energy-consuming and energy-producing nations. As China and other emerging economies undergo economic transformation and adjustment, they need to prioritize improving the energy security environment while addressing the robustness of institutions within global governance frameworks [2]. Cui examined the global transition to clean energy and the development of China's technical standard discourse, asserting that active participation in international standardized governance is critical for enhancing China's influence and authority in clean energy governance [3].

Sun and Zhang applied the denotative space theory of cognitive linguistics to analyze the discourse surrounding "zero nuclear power" in the context of Japan's nuclear power restart. Their study focuses on discourse producers related to the "central government" and "nuclear power." They investigate the differences in discourse strategies employed by producers in editorials addressing "restarting nuclear power" versus "zero nuclear power" and the cognitive mechanisms behind these strategies, considering three categories of social practice actors: "the central government," "nuclear power companies," and "the local populace" [4].

Corpus technology is predominantly used for qualitative and quantitative analysis in linguistic research. Baker analyzed the term "troops" as a focal word to examine its usage in The Sun and the societal sentiments it reflects [5]. Lillqvist and Harju studied discourse patterns on the Facebook community platform, using the

collocation network of LancsBox to identify associations among the terms voice, give, you, and our, us, we [6]. Germond and Ha curated texts on climate change and maritime safety from the International Maritime Organisation (IMO) website and analyzed collocation networks and common collocations using LancsBox. They recommended that IMO practitioners acknowledge the intrinsic connection between climate change and maritime safety and incorporate this into relevant narratives [7].

Wen *et al.* conducted a comparative analysis of learner corpora and found that advanced written English by Chinese learners, similar to that of other foreign language learners, exhibits a marked colloquial tendency. However, as English proficiency improves, this colloquial inclination gradually diminishes in written expressions [8]. Pu performed a corpus analysis of Chinese English learners, focusing on class connections and collocations—two critical dimensions of vocabulary depth. The study revealed deficiencies in students' vocabulary and highlighted their limited understanding of class connections and collocations of common words [9]. Drawing on Bloom's cognitive development theory, He analyzed a corpus of over 170,000 words of English classroom discourse from high school, junior high school, and elementary school classes in China. He outlined the cognitive thinking-oriented characteristics of teachers' discourse and its educational and pedagogical functions [10].

As demonstrated above, studies on integrating new energy and corpus technologies in China remain limited. Corpus technology, as an innovative research tool, significantly facilitates the analysis of energy sector discourse, particularly in new energy, by uncovering patterns and ideologies through subject word examination and the expansion of collocation networks, among other functionalities. This paper examines the abstracts of domestic and international publications related to new energy, employing a methodology that integrates corpus and discourse analysis. It aims to investigate the characteristics of new energy discourse systems and reveal the underlying social influence factors.

3. Corpus and research tools

3.1. Corpus selection

This study retrieved and downloaded abstracts from the latest publications in the field of new energy from the Science Citation Index (SCI) and the Chinese Science Citation Database (CSCD) available on the Web of Science. A total of 972 abstracts were collected, with 486 from each source, forming a comprehensive corpus of cutting-edge research in the domain of new energy. The combined word count of the corpus reached 179,304 words.

A corpus-assisted critical discourse analysis methodology was employed in this study. Through high-frequency word analysis and collocational word analysis using corpus software, valuable stylized insights hidden beneath the surface of the text were uncovered. This approach facilitated the interpretation of recurring linguistic patterns and enabled the identification of discourse trajectories through qualitative methods [11]. By bridging the gap between quantitative and qualitative research, this method provided discourse researchers with a robust foundation for conducting quantitative analyses [12].

3.2. Research tool: LancsBox 6.0

Advancements in science and technology have led to rapid evolution in research methodologies, with various effective tools now available for corpus retrieval and analysis. This study adopted the corpus analysis methodology and selected LancsBox as its primary analytical tool.

LancsBox, developed by Vaclav Brezina's team at Lancaster University, represents a new generation of visual corpus software. It is a free, cutting-edge tool that combines traditional functionalities with innovative capabilities. The software supports multilingual and multi-format corpora, enables the multi-tiered expansion of collocation networks, and offers advanced retrieval and statistical features. It also incorporates significant improvements in retrieval techniques, statistical algorithms, data processing, and visualization [13]. Key features of LancsBox include: (1) Lexical, syntactic, and semantic retrieval, as well as word class annotation. (2) Advanced, customizable data algorithms. (3) Multi-tiered collocation network expansion. (4) Data visualization capabilities. (5) Comparison across over 20 varieties

of English, Chinese, French, German, and Russian. (6) Compatibility with various file formats, including TXT, XML, DOC, PDF, ODT, XLS, DOCX, XLSX, ZIP, and CSV. (7) Bidirectional import of local and some online corpora. (8) The ability to parse and compare multiple text databases on a single screen. The application of LancsBox in China is still in its early stages, with only a few dozen articles referencing its use in the Knowledge Network.

This paper seeks to further explore the role of LancsBox in analyzing and applying Chinese corpora. The research process involved building a custom corpus, named CSCD & SCI Abstracts, using LancsBox 6.0. High-frequency words and collocation networks were analyzed to generate various visual maps and tables. This analysis aimed to reveal connections between energy policy and ideology within contexts such as politics, economics, culture, and education.

3.2.1. Subject matter index: KWIC

KWIC, an acronym for Key Word in Context, is a program designed to generate search terms through indexing, arrange occurrences in the corpus within a specified span, and display these search terms or node words centrally.

The primary functions of KWIC are: (1) Retrieving the frequency of various word classes in the corpus, including nouns, verbs, and adjectives. (2) Extracting complex linguistic structures through intelligent search capabilities. (3) Organizing and refining index rows for clarity and usability. (4) Examining the usage of retrieved words across two corpora and conducting comparative and statistical analyses.

3.2.2. Matching: GraphColl

Corpus linguistic research highlights that semantics are not derived from isolated words but rather emerge from their co-occurrence. Words typically appear in characteristic collocations that encompass associations, connotations, and implied assumptions [14]. GraphColl, short for graphical collocations, is a tool within LancasBox that visualizes collocations. This function clarifies the co-occurrence patterns of node words and their associated terms, enabling a deeper understanding of their contextual environments. By analyzing the frequency and distribution of collocations, GraphColl provides insights into various linguistic relationships [15]. The GraphColl program identifies collocations, presenting them in both tabular formats and graphical networks. While the KWIC index allows for a fragmented analysis of collocations, GraphColl's statistics feature organizes them into ascending or descending order, offering a more coherent and visual representation through graphs.

GraphColl performs the following tasks: (1) Retrieving collocations of words or phrases. (2) Identifying co-occurrences of grammatical categories. (3) Visualizing collocations and their networks. (4) Highlighting common collocations of words or phrases.

3.2.3. Search term distribution: Whelk

The Whelk tool provides insights into the distribution of search terms within the corpus. It determines both absolute and relative frequencies, filters search results based on various criteria, and organizes documents according to the absolute and relative frequencies of the search terms.

Whelk aids in analyzing the discrete distribution of retrieved items within the corpus by illustrating: (1) The spread of retrieved items across subfiles. (2) Index line information related to the search terms. (3) The absolute and relative frequency of terms within the entire corpus and its subfiles. By integrating frequency data with distribution patterns, researchers can achieve a more intuitive and comprehensive understanding of how retrieved items are utilized across the corpus.

3.2.4. Vocabulary module: Words

The Words vocabulary module consists primarily of word lists and thematic word lists. The word list includes the terms used in the corpus along with their frequencies, enumerating the various inflected forms of each word individually. The thematic word list highlights terms that occur more frequently in the corpus compared to a reference corpus. In addition to enabling corpus comparison through the keyword technique, the module facilitates detailed analysis of the frequency of lexical items, elements, and attributes.

The key features of the vocabulary module are as follows: It can automatically generate word lists without requiring pre-existing lists for reduction. It can produce

word class lists based on assigned word class categories. It supports the generation of thematic word lists categorized by word classes, enhancing classification to identify the subject or content characteristics of the target corpus.

3.2.5. N-element structure: Ngram

Ngrams represent sequences of contiguous lexical items (types), lemmas, or parts of speech (POS). They can be used to identify Ngrams, word strings, and phrase frames by comparing two corpora to derive significant Ngrams. This involves calculating the frequency and distribution of Ngram lexical items, lemmas, and properties, as well as visualizing the frequency and distribution of Ngrams within the corpus, including identifying key Ngrams.

The main characteristics of Ngrams are as follows: They allow for the filtering of specific N-metric structures and the generation of assignment sequences for these structures based on lexical attributes. They facilitate the creation of collections of thematic assignment sequences.

4. Corpus analysis

4.1. Lexical characterization of new energy dissertation abstract texts

This study utilizes the terms function in LancsBox 6.0 to identify high-frequency terms within the corpus. To ensure the validity of the analysis, tense verbs, auxiliary verbs, prepositions, conjunctions, and articles in English are excluded. High-frequency words are defined as those occurring 100 times or more across the text. The top 20 high-frequency words identified are presented in **Table 1**.

Table 1 demonstrates that the concept of "energy" has produced a diverse range of high-frequency terms across various levels, predominantly consisting of nouns. Essays on new energy primarily focus on four central themes: (1) Energy types: gas, fuels, nuclear; (2) Energy infrastructure: infrastructure, pipelines; (3) Energy development trajectories: innovation, technologies; and (4) Energy strategic objectives: system, security. These findings accurately reflect the framework and principles of the contemporary global energy system, encompassing a broad spectrum of energy sectors that exhibit multi-tiered development.

The category of energy types reflects the current global energy configuration, particularly the development of oil and gas resources. Oil and natural gas, as conventional fossil energy sources, are widely regarded as major contributors to climate change and recurrent environmental disasters due to their high carbon emissions and pollution levels. Consequently, there is a global consensus on reducing reliance on fossil fuels, advancing renewable energy alternatives, and pursuing low-carbon development pathways to address climate change and environmental challenges.

Energy infrastructure and energy development trajectories emphasize technological advancements and future-oriented developments within the energy

Table 1. List of high-frequency words (real words) in abstracts of new energy papers

Serial number	High-frequency words	Frequency	Serial number	High-frequency words	Frequency
1	energy	3771	11	proposed	583
2	new	2516	12	nuclear	565
3	gas	1102	13	policy	551
4	innovation	930	14	security	520
5	fuels	820	15	industry	464
6	development	679	16	infrastructure	446
7	technologies	650	17	based	426
8	vehicles	618	18	network	404
9	method	617	19	control	393
10	system	603	20	pipelines	393

sector, as highlighted in contemporary academic discourse. The term "innovation," ranked fourth in frequency, underscores the global focus on scientific and technological progress. The technological transformation of conventional fossil energy sources is perceived as a viable development pathway, offering a balance between maintaining traditional fossil industries and jobs while addressing public demands for environmental protection. This dual approach aims to rejuvenate fossil energy sectors, safeguard employment, and align with environmental conservation priorities. Thus, there is a global focus on strengthening energy infrastructure, revitalizing the manufacturing industry, encouraging the reshoring of manufacturing processes, and achieving the objectives outlined in strategic energy plans.

The energy strategic objectives highlight the global effort to promote the development of new energy sources and foster innovation within the energy sector, particularly to ensure energy security and establish a new strategic energy framework.

The adjective "new" ranks as the second most frequently used term, reflecting the current prioritization of "new energy" in the global energy discourse. As the world population and economy grow, the earth's finite energy reserves face increasing pressure, even as renewable energy technologies advance. Environmental pollution caused by conventional energy sources continues to worsen, with issues such as smog, photochemical smog, and acid rain being compounded by the long-validated prediction by Arrhenius in 1896 that rising atmospheric carbon dioxide levels would lead to global warming. In recent years, terms such as "carbon footprint," "low-carbon economy," "low-carbon technology," "low-carbon development," "low-carbon lifestyle," "low-carbon society," "low-carbon city," and "low-carbon world" have gained prominence. These expressions reflect the emergence of numerous new concepts related to "new energy." The development and utilization of new energy sources have once again captured global attention. Currently, nations worldwide are vigorously promoting energy transitions, prioritizing sustainable development, focusing on renewable energy advancements, and accelerating the adoption and application of new energy technologies.

The Ngrams function was utilized with a parameter of 2 to identify word clusters containing "energy" that frequently appeared in the corpus. High-frequency word clusters were compiled, invalid clusters were discarded, and the top 20 high-frequency word clusters are presented in **Table 2**.

The table highlights high-frequency word clusters, reflecting various critical domains within the energy sector. This sector encompasses a wide range of technologies and goods, making it a highly relevant subject of study. For instance, terms such as energy vehicles, energy industry, vehicle industry, new industry, and electric cars illustrate efforts in energy conservation, pollution reduction, and sustainable

Table 2. High-frequency word clusters in abstracts of new energy papers

Serial number	High-frequency word clusters	Frequency	Serial number	High-frequency word clusters	Frequency
1	new energy	2040	11	energy industry	87
2	energy vehicles	457	12	vehicle industry	77
3	energy vehicle	355	13	energy power	75
4	energy consumption	213	14	control strategy	73
5	energy storage	162	15	new industry	70
6	power grid	145	16	government subsidies	69
7	power system	121	17	electric vehicles	67
8	renewable energy	118	18	energy automobile	66
9	the government	108	19	energy sources	65
10	power generation	92	20	supply chain	64

mobility. Furthermore, energy infrastructure, as the backbone of energy conversion and transportation, has received significant attention. Terms like energy system, power grid, control plan, and supply chain emphasize the importance of security, economic stability, and environmental conservation in energy provision.

In addition, the classification and allocation of energy resources represent key areas of scholarly interest, as seen in terms such as power generation, energy sources, and energy power. These areas are integral to the sustainable provision of energy and the improvement of the global energy framework. Lastly, concepts such as energy consumption and energy storage shed light on strategies for optimizing energy management and utilization, minimizing waste, and enhancing energy efficiency.

Energy has become a critical global concern, underpinning human survival and progress while significantly influencing environmental sustainability and climate change. The depletion and overuse of conventional energy resources have led to ecological crises, while carbon emissions have exacerbated global warming. These issues demand collective action from society. Recent research in the energy sector addresses these challenges, focusing on the role of technological innovation in energy transformation and distribution. Advancements in renewable energy technologies, including wind, solar, and geothermal energy, have opened new pathways for energy transformation. Simultaneously, the integration of information technology, such as smart grids and big data analytics, has modernized energy management and supply chain operations.

Research and development in emerging sectors are crucial for addressing energy challenges. Innovations such as electric bicycles, motorbikes, buses, and drones have revolutionized energy consumption, while advancements in clean energy sources and energy storage technologies are helping to bridge the gap between energy supply and demand. These efforts are vital for reducing dependence on fossil fuels and achieving a green, low-carbon energy system.

The analysis of high-frequency word clusters underscores the need for proactive measures to address the challenges facing the energy sector. It is essential to accelerate research and development in traditional energy alternatives while fostering the growth of new industries and clean energy technologies. This dual approach aims to transform and upgrade the energy structure, protect the ecological environment, and promote sustainable economic and social development. Achieving these goals requires the collaborative efforts of governments, corporations, and the public, alongside international cooperation and knowledge exchange, to explore energy solutions aligned with future development trends.

4.2. Characterization of discourse collocation in abstracts of new energy papers

Collocation provides a clear representation of the associative characteristics and discourse meaning of words in speech analysis. Using the high-frequency word analysis discussed earlier, we utilize the GraphColl function in LancsBox 6.0 to generate a graphical collocation map automatically (**Figure 1**). The MI algorithm is employed as the benchmark, with a span distance of 5 and a collocation frequency threshold exceeding 50 occurrences, to identify the nearest word collocations with the primary high-frequency term "energy." These collocations are then visually presented in the graphical collocation map (**Figure 1**).

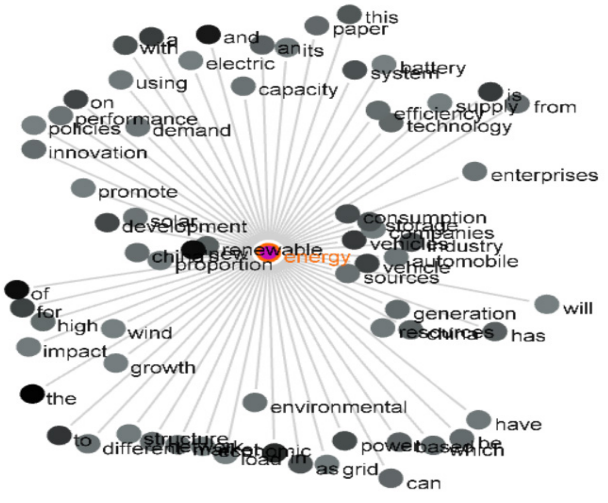

Figure 1. Collocation network mapping for "energy"

Figure 1 reveals that the terms strongly collocated with "energy" in the abstracts of new energy research publications can be categorized as follows: Primary category: Key terms include "China's," "renewable,"

"resources," "wind," "solar," "enterprises," and "development." Based on their semantic fields, these terms can be divided into two subgroups. first subgroup, represented by "China's," reflects China's international perspective on energy. As a national energy entity, China positions itself within the global energy landscape, engaging in self-assessment, strategic positioning, and decision-making. This reflects the Chinese government's approach to managing energy issues within an interconnected international and domestic context. The second subgroup comprises terms such as "resources," "renewable," "wind," "solar," "enterprises," and "development." These terms highlight the current state of global energy practices. Energy is regarded as a critical natural resource, with the global energy composition still heavily reliant on fossil fuels. While the immediate decarbonization of fossil fuels remains a significant challenge, the drawbacks of fossil energy are undeniable. Therefore, nations must prioritize mitigating the adverse effects of fossil fuels and advancing renewable energy development, particularly wind and solar power. The shift toward a low-carbon or decarbonized energy transition necessitates leveraging market-driven regulatory mechanisms.

Secondary category: High-strength collocations include core conceptual vocabulary such as "innovation," "technology," "efficiency," "structure," and "policies." Scholars emphasize that the primary tools for advancing energy development and ensuring energy security are technological innovation, improved energy efficiency, policy collaboration, and restructuring energy systems. Nations worldwide advocate for mutually beneficial collaboration across various domains, including the energy sector. Such collaboration fosters equality and constructive discourse among energy stakeholders, contributing positively to the global energy ecological framework. The overall analysis suggests that the global new energy sector should align with the unique energy contexts of individual nations, draw insights from emerging trends in international energy development, and actively pursue energy transformation. This transformation should adopt an ecological perspective characterized by openness, inclusivity, harmony, and mutually beneficial cooperation.

The secondary collocation expansion graph (**Figure 2**) was derived by analyzing the collocation of "new," which exhibits the highest degree of correlation with the term "energy," serving as a novel node word.

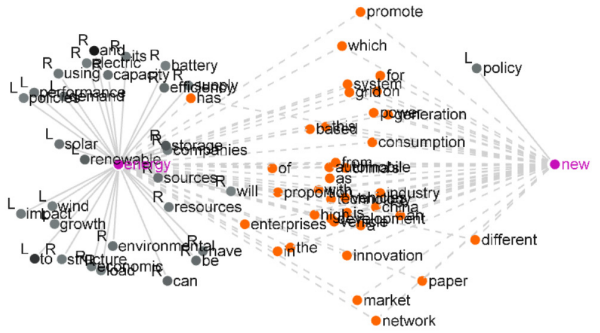

Figure 2. Secondary collocation network with "energy" and "new" as nodes

Figure 2 illustrates the secondary collocations associated with "energy" and "new" as nodes, including terms such as promote, system, grid, generation, consumption, automobile, industry, proportion, technology, development, enterprises, vehicle, innovation, market, and network. An analysis of **Figures 1** and **2** reveals that the terms "energy" and "new energy" within the corpus exhibit multi-level collocations.

The primary development objectives of the modern energy system focus on enhancement and innovation across several critical domains. These objectives encompass the utilization of renewable energy sources (e.g., solar, wind, etc.), which are considered fundamental components of future energy systems. Advances in science, technology, and policy initiatives have positioned renewable energy as a vital solution for mitigating the depletion of conventional fossil fuels and addressing environmental pollution. Enhancing energy efficiency remains a key priority; through technological innovation, businesses can reduce energy consumption, lower operational costs, and contribute to sustainable development.

Moreover, the advancement of energy storage technologies plays a pivotal role in modern energy systems. Improved energy storage solutions enable more efficient management and storage of power, addressing unforeseen demand fluctuations or supply disruptions. This capability is essential for maintaining grid stability during unexpected events and ensuring functionality

during periods without solar or wind energy generation. Consequently, research and development in efficient energy storage technologies are critical to establishing a reliable and cost-effective energy system.

Current research in the energy sector adopts a multifaceted approach, focusing on both the transformation and enhancement of conventional energy sources and the progression of the clean energy revolution. This comprehensive strategy aims to create a sustainable, resilient, and environmentally friendly energy future. By integrating diverse energy types and technologies, the sector is paving the way for a clean, low-carbon energy landscape that will ultimately benefit humanity as a whole.

The second tier of development objectives emphasizes methods of energy production. In contemporary society, energy generation extends beyond traditional production and consumption practices. With technological advancements and growing market demand, energy production methods have expanded to encompass markets, innovation, technology, enterprises, and resources. This multifaceted approach underscores the critical role of infrastructure in driving economic development.

Currently, nations worldwide are focusing on advancing energy development. Infrastructure development is particularly vital for countries with strong economic foundations and significant market potential. Enhancing energy infrastructure not only ensures the efficient operation of the energy sector but also attracts investment, creates jobs, and enhances the overall competitiveness of the economy. A notable example is the advancement of the electric vehicle industry. As a clean energy transportation solution, electric vehicles not only reduce greenhouse gas emissions but also generate millions of jobs in related sectors such as manufacturing, sales, maintenance, and the development of charging infrastructure, battery recycling, and other areas.

Furthermore, research, technology, and innovation play a pivotal role in the energy transition process. Achieving sustainable energy development requires continuous improvements in energy technology standards. China, for instance, is committed to enhancing its autonomous innovation capabilities in energy science and technology. The country is accelerating the establishment of a technological innovation system that integrates enterprises, markets, and academia. This effort not only narrows the gap with globally advanced standards but also provides robust technological support for China's energy strategy.

In summary, all aspects of energy development—including markets, innovation, technology, enterprises, and resources—must be evaluated holistically. A comprehensive and multifaceted approach is essential to address future energy challenges, maintain a leading position in the global energy sector, and ensure a cleaner, more sustainable planet for future generations.

5. Conclusion

This study explores the discursive construction of global clean energy development in contemporary academia, employing a self-constructed corpus of abstracts from academic articles on new energy. By focusing on high-frequency phrases and collocations, the analysis highlights the critical role of technological innovation in addressing traditional energy challenges and driving energy transitions. Technological solutions are promoted as essential for mitigating the climate and environmental issues caused by conventional energy sources and for harnessing natural resources to support sustainable human development.

Throughout history, energy acquisition and utilization have been pivotal drivers of societal progress. The exploitation and consumption of natural resources have undergone continuous evolution, with each shift profoundly influencing human productivity and lifestyles. In the early stages, humans primarily relied on firewood for sustenance and heating. This rudimentary method was not only inefficient and costly but also contributed significantly to environmental pollution. With advancements in science and technology, the discovery and utilization of coal became a crucial enabler of economic growth, providing abundant energy resources and facilitating industrialization. However, coal is finite, and its extraction has increasingly harmed the environment. This reliance was later challenged by the emergence of oil and natural gas, which became foundational to modern industry due to their cleaner and more efficient characteristics. The extensive extraction of

oil and gas brought about a major transformation in the global energy landscape, but it also exacerbated issues related to ecological security and climate change.

In the 21st century, the concept of new energy has gained prominence, leading to significant advancements in renewable energy sources such as solar and wind power. The growing development and consumption of non-traditional energy resources signal a shift in the energy sector toward a new paradigm, one characterized by the coexistence of oil, natural gas, coal, and renewable energy.

Despite the abundance of global mineral resources, they cannot be exploited indefinitely. Technological progress and environmental conservation have necessitated a transition from prioritizing economic gains to achieving sustainable development. An inevitable shift is underway, moving from reliance on conventional fossil fuels to cleaner and more sustainable energy sources. The rapid development of new energy technologies offers the potential to alleviate the challenges associated with fossil fuels while ushering in a new energy era. However, while technological innovation can address some of the issues related to fossil fuels, it cannot entirely resolve broader challenges, such as resource depletion, environmental degradation, and climate change.

To achieve genuine sustainable development, humanity must adopt a more accurate perspective on ecological energy. This requires abandoning an anthropocentric view of natural energy resources and recognizing that the natural world is inherently interconnected with living systems. Embracing the ecological principle of harmonious coexistence between humans and nature is essential. It also necessitates rejecting consumerist behaviors and reshaping lifestyles and societal structures that have led to the excessive exploitation of energy resources.

To build a better future, it is imperative to transform human behaviors, organizational frameworks, and societal values. By establishing appropriate principles, advocating for a societal green revolution, and transitioning comprehensively from fossil fuels to renewable energy sources, humanity can pave the way for a harmonious world. Only by fundamentally altering behaviors that hinder environmental protection and resource conservation can we achieve a sustainable future characterized by blue skies, white clouds, and clear waters.

Disclosure statement

The authors declare no conflict of interest.

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