



# Mapping Global Trends in Renewable Energy Research: A Bibliometric Analysis and Systematic Literature Review

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## Abstract:

This study aims to analyze global research trends in renewable energy to support sustainable energy transition using a combined approach of Systematic Literature Review (SLR) based on PRISMA and bibliometric analysis. Data were collected from the Scopus database for the period 2022–2026, with a total of 2500 selected documents using a threshold-based selection method. The analysis was conducted using VOSviewer and Bibliometrix (RStudio) to map keyword networks, author collaborations, and publication distributions. The results indicate a significant increase in renewable energy research, with dominant themes including renewable energy, sustainable development, and alternative energy. The findings also reveal several major research clusters related to clean energy technologies and energy management systems. Research collaboration is dominated by countries such as China, the United States, and India. This study contributes by providing a comprehensive mapping of research trends and identifying future research opportunities to support the global sustainable energy transition

Keywords: Bibliometric analysis; Energy transition; Renewable energy; Systematic literature review; Sustainability

## 1. Introduction

The global energy crisis and climate change have become major challenges driving the transformation of energy systems toward more sustainable pathways. Dependence on fossil fuels has significantly increased greenhouse gas emissions, accelerating global warming and causing various environmental impacts (Desai et al., 2026; Peter et al., 2026; Siregar et al., 2024). In this context, renewable energy sources such as solar, wind, biomass, and hydropower have emerged as strategic solutions to reduce carbon emissions and support the achievement of net-zero emission targets (Nasirov et al., 2026; Siregar Mawardi; Alhadi, Rafli; Sembiring, Anita Christine, 2023; Siregar et al., 2021). Along with the increasing global energy demand, the utilization of renewable energy has continued to grow across various sectors, which has also contributed to a significant rise in scientific publications in this field, particularly after 2020 (Manirambona et al., 2026). The complexity and rapid development of this research area require a systematic analytical approach to comprehensively understand its direction and scientific structure.

In recent years, the combination of PRISMA-based Systematic Literature Review (SLR) and bibliometric analysis has been increasingly used to evaluate the development of a research field. SLR enables the identification, screening, and evaluation of literature to be conducted transparently and systematically, resulting in a collection of relevant studies (Callychurn & Hurreeram, 2026; Demir et al., 2026). Meanwhile, bibliometric analysis plays an important role in mapping research trends, collaboration patterns, and intellectual structures through quantitative network-based approaches using software such as VOSviewer and Bibliometrix (RStudio) (Al-Obaidi, 2026). Based on the PRISMA process, this study initially identified a large number of publications from the Scopus database and conducted several filtering stages based on document type, publication period, language, and subject area to obtain a relevant body of literature. However, considering the large volume of data generated, an additional selection stage was carried out to obtain a representative dataset that could be analyzed in greater depth.

Although several previous studies have examined renewable energy trends using either bibliometric analysis or SLR approaches, most studies have applied these methods separately and have not comprehensively integrated both approaches. Furthermore, many studies focus only on specific subtopics without considering multidisciplinary approaches that encompass energy, engineering, and environmental sciences (Singh & Gupta, 2026). Another limitation is the lack of studies utilizing recent datasets and the limited discussion connecting research trends with the context of sustainable energy transition. Therefore, this study offers novelty by integrating a PRISMA-based SLR approach with bibliometric analysis using a selected dataset of 2,500 documents from the Scopus database during the 2022–2026 period. The selection of this dataset was intended to ensure the quality, relevance, and efficiency of the analysis, enabling a deeper exploration of publication patterns, scientific collaborations, and research clusters. Thus, this study aims to analyze global research trends in renewable energy, identify the intellectual structure of the field, and uncover future research opportunities in supporting the sustainable energy transition.

## 2. Method

This study employed a combined approach of a PRISMA-based Systematic Literature Review (SLR) and bibliometric analysis to examine global research trends in renewable energy. This approach was selected because it integrates a systematic literature selection process with quantitative data-based analysis, thereby providing a comprehensive overview of research developments in the field (Callychurn & Hurreeram, 2026; Guzmán et al., 2026). The SLR method was used to identify, screen, and evaluate literature in a structured manner, while bibliometric analysis was applied to map publication patterns, scientific collaborations, and the intellectual structure of renewable energy research through a network-based approach (Salari et al., 2026).

The research data were obtained from the Scopus database using keywords related to renewable energy. The inclusion criteria applied in this study were: (1) document type limited to articles, (2) publication period from 2022 to 2026, (3) English language publications, and (4) subject areas including energy, engineering, and environmental science. The selection process followed the PRISMA stages consisting of identification, screening, eligibility, and inclusion, resulting in a total of 8,883 documents that met the criteria for further analysis.

**Table 1.** Selection criteria and characteristics of research datasets based on search results in the Scopus database for the 2022–2026 period

| Criteria                    | Description                                                                                                                       |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Database                    | Elsevier Scopus — an internationally reputable multidisciplinary scientific database with broad coverage                          |
| Publication Period          | 2022–2026                                                                                                                         |
| Search Keywords             | "renewable energy" OR "solar energy" OR "wind energy" OR "biomass energy" OR "green hydrogen" AND "sustainable energy transition" |
| Subject Areas               | Energy; Engineering; Environmental Science                                                                                        |
| Document Type               | Article                                                                                                                           |
| Language                    | English                                                                                                                           |
| Access Status               | All documents (open access and non-open access)                                                                                   |
| Initial Number of Documents | 88,302 documents                                                                                                                  |
| After PRISMA Screening      | 8,883 documents                                                                                                                   |
| Final Analysis Dataset      | 2,500 documents (based on threshold-based selection: citations, relevance, and keyword linkage)                                   |

To improve the quality and effectiveness of the analysis, an additional selection process was conducted using a threshold-based selection approach, resulting in 2,500 core documents considered the most representative based on citation counts, topic relevance, and keyword relationships (Lu et al., 2026). Bibliometric analysis was performed using VOSviewer for network visualizations such as co-authorship and co-occurrence, while Bibliometrix (RStudio) was utilized for descriptive statistical analysis and publication

trend analysis(Szamosi & Rosas-Casals, 2026). The analysis stages included data extraction, data cleaning and normalization, network mapping, and interpretation of results to identify patterns and trends in renewable energy research.

To ensure transparency and reproducibility, a detailed explanation of the selection criteria and dataset characteristics was necessary. Therefore, the following table presents information regarding the data sources, inclusion criteria, and the number of documents at each stage of the selection process.

Based on Table 1, data was obtained from Scopus for the 2022–2026 period and selected using the PRISMA method, reducing the number of documents from 88,302 to 8,883. Furthermore, 2,500 primary documents were selected through threshold-based selection to ensure the relevance and efficiency of the analysis.

### 3. Results and Discussion

#### Literature selection process using the PRISMA method

The PRISMA image shows the systematic literature selection process carried out in this study. In the identification stage, 88,302 documents were obtained from the Scopus database with keywords related to renewable energy.

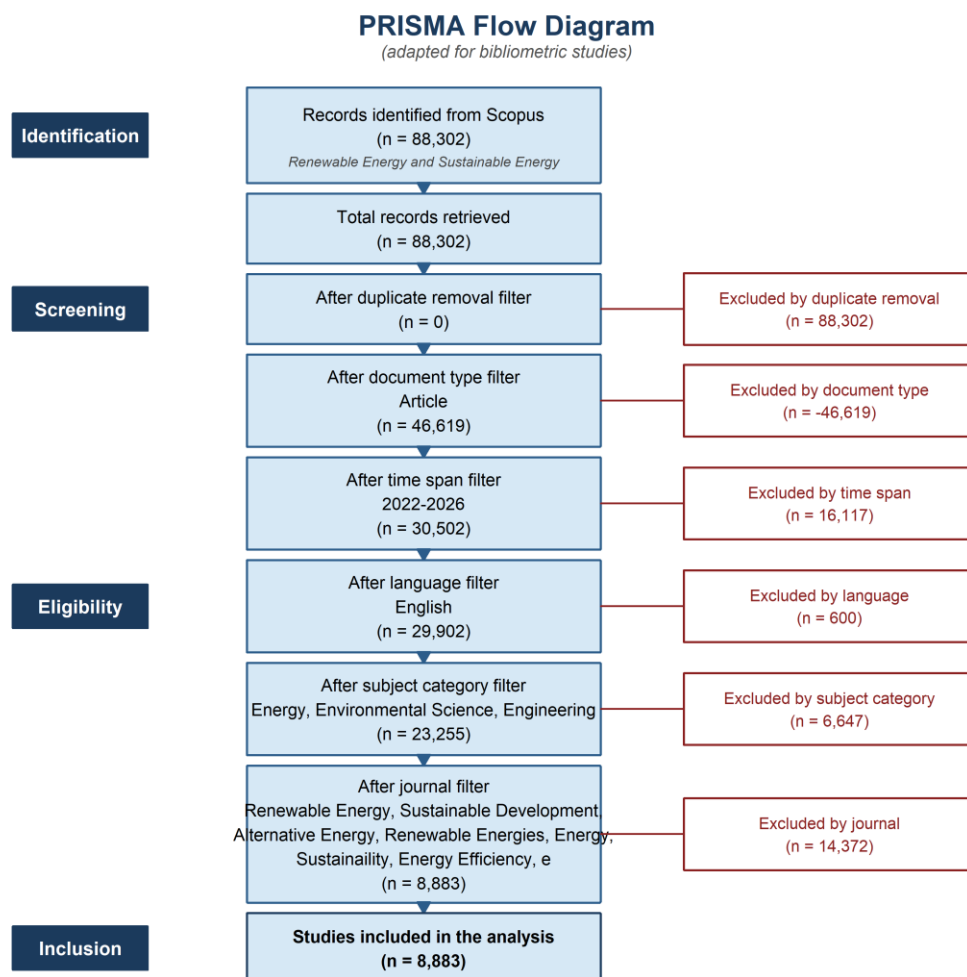


**Figure 1.** PRISMA flowchart in the research literature selection process

Next, in the screening stage, filtering was carried out based on document type (article), publication period (2022–2026), and removal of duplicates and irrelevant documents. After that, in the eligibility stage,

further filtering was carried out based on language (English) and field of study (energy, environmental science, engineering), reducing the number of documents to 23,255. The selection process continued with filtering based on relevant journals, resulting in 8,883 documents meeting the inclusion criteria.

Although the final PRISMA-based dataset reached 8,883 documents, this study used only 2,500 documents as the primary dataset for the bibliometric analysis. This was achieved through a threshold-based selection approach to ensure high data quality and facilitate interpretation of the network visualization. (Juwana et al., 2026). Thus, the PRISMA diagram not only demonstrates the transparency of the data selection process but also confirms that the dataset used is a relevant representation of the entire research population.

### Keyword network analysis (co-occurrence) in renewable energy research

The co-occurrence network visualization shows the relationships between keywords that frequently appear together in publications related to renewable energy. Based on the analysis using VOSviewer, several key clusters representing global research focuses are visible. The largest cluster centers on the keywords renewable energy, sustainable development, and alternative energy, indicating that sustainability issues are a dominant theme in renewable energy research (Guzmán et al., 2026).

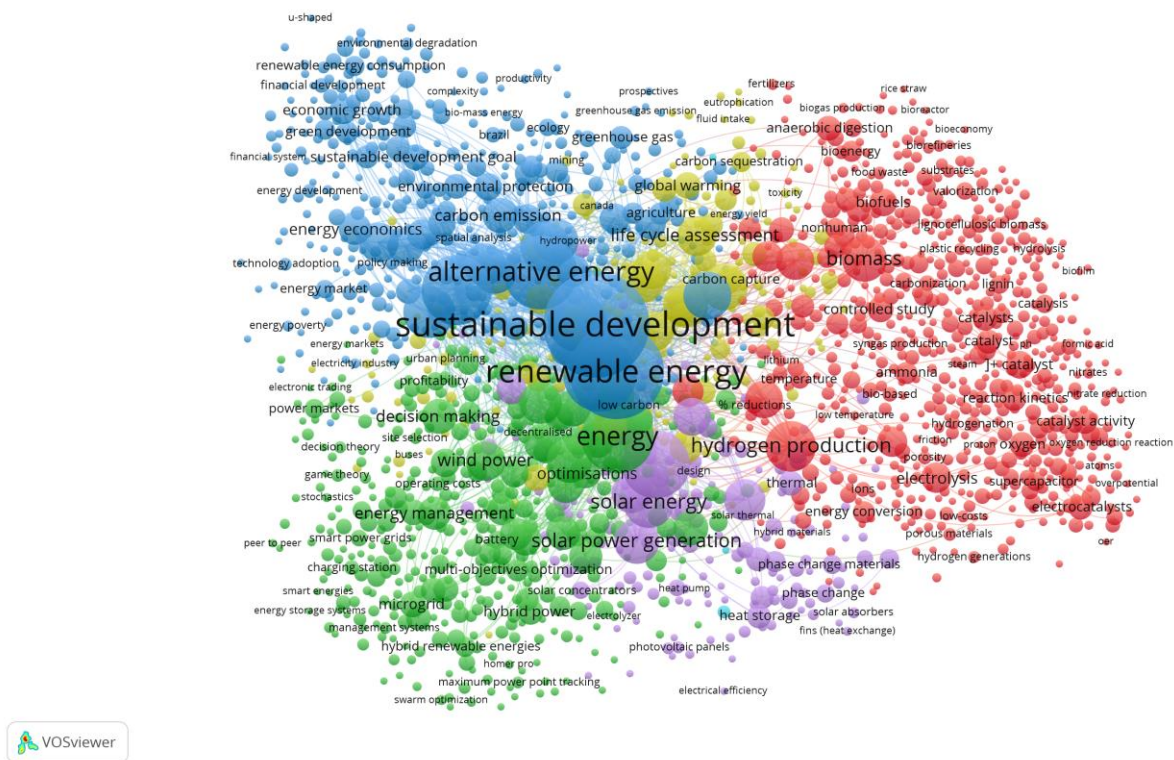


**Figure 2.** Co-occurrence network of renewable energy research keywords using VOSviewer

In addition, there are other clusters related to specific technologies, such as solar energy, wind power, and hydrogen production, reflecting the development of clean energy technologies. The red cluster indicates a focus on biomass, biofuels, and chemical processes such as catalysis, indicating attention to biomass-based energy conversion. Meanwhile, the green cluster relates to energy management, smart grids, and optimization, highlighting aspects of energy systems and management. The existence of these clusters demonstrates that renewable energy research is multidisciplinary and continues to evolve toward more complex integration of technologies and energy systems.

### Analysis of the co-authorship network

The co-authorship network visualization illustrates the collaboration patterns between authors in renewable energy research. Each node represents an author, while the lines connecting the nodes indicate collaborations in scientific publications. The analysis reveals several large clusters dominated by specific groups of researchers, indicating the presence of an active and structured research community (Rodrigues et al., 2026).

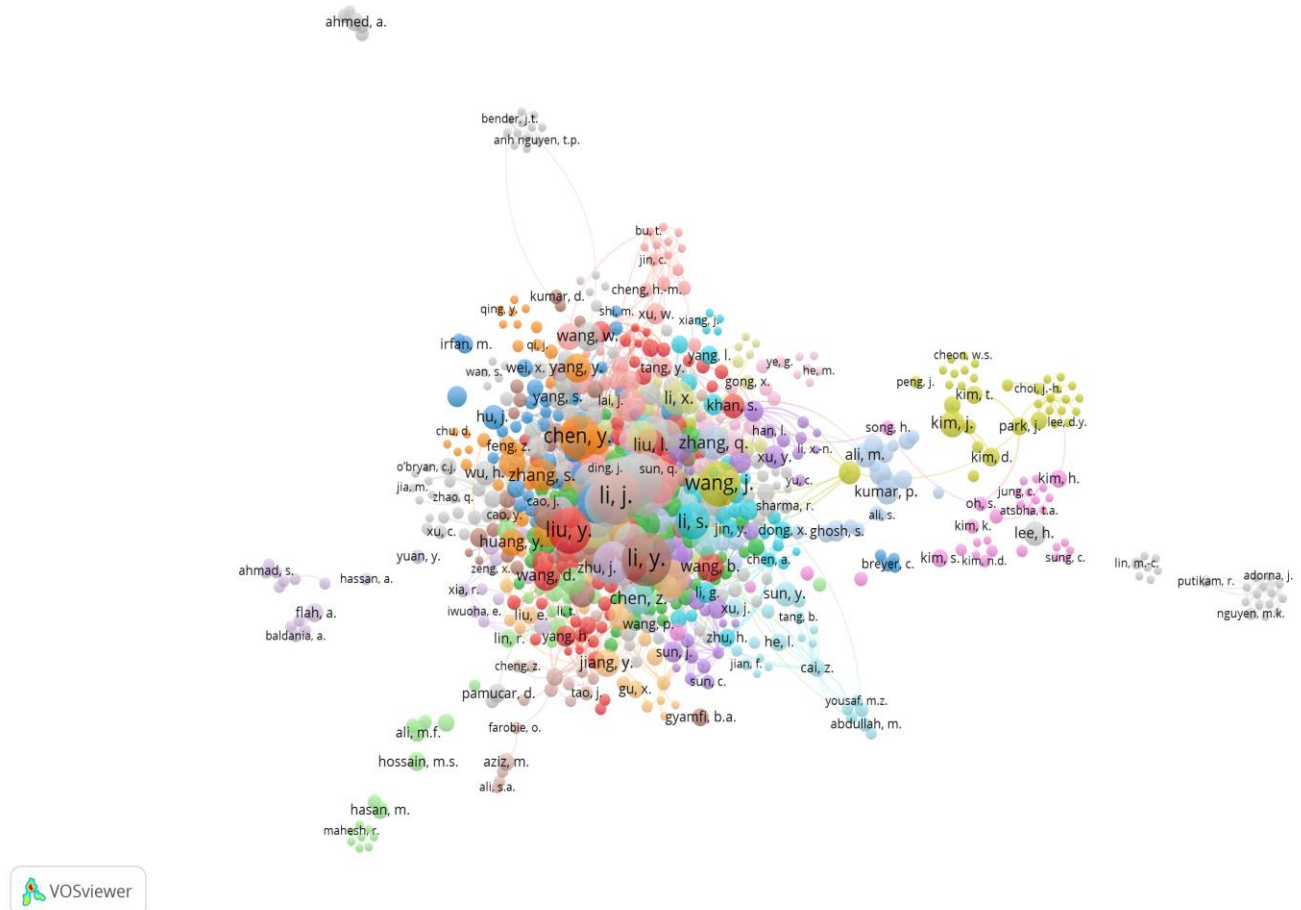


**Figure 3.** Author collaboration network (co-authorship) in renewable energy publications

Authors with larger node sizes demonstrate higher levels of productivity and influence in the field. Furthermore, it appears that most collaborations occur within relatively centralized clusters, although there are also connections between clusters indicating cross-cluster collaboration. This pattern indicates that renewable energy research is dominated by strong collaborative networks, but there is still scope for broader global collaboration, particularly across institutions and countries.

### Distribution of the most relevant journal sources in renewable energy research

Renewable energy research based on the number of documents in the analyzed dataset shows that the journal *Renewable Energy* occupies the top position with 93 publications, followed by *Sustainability* (Switzerland) with 92 publications, and the *International Journal of Hydrogen Energy* with 84 publications. The dominance of these journals indicates that renewable energy research is mostly published in journals that have a strong focus on sustainability, energy technology, and energy system innovation.

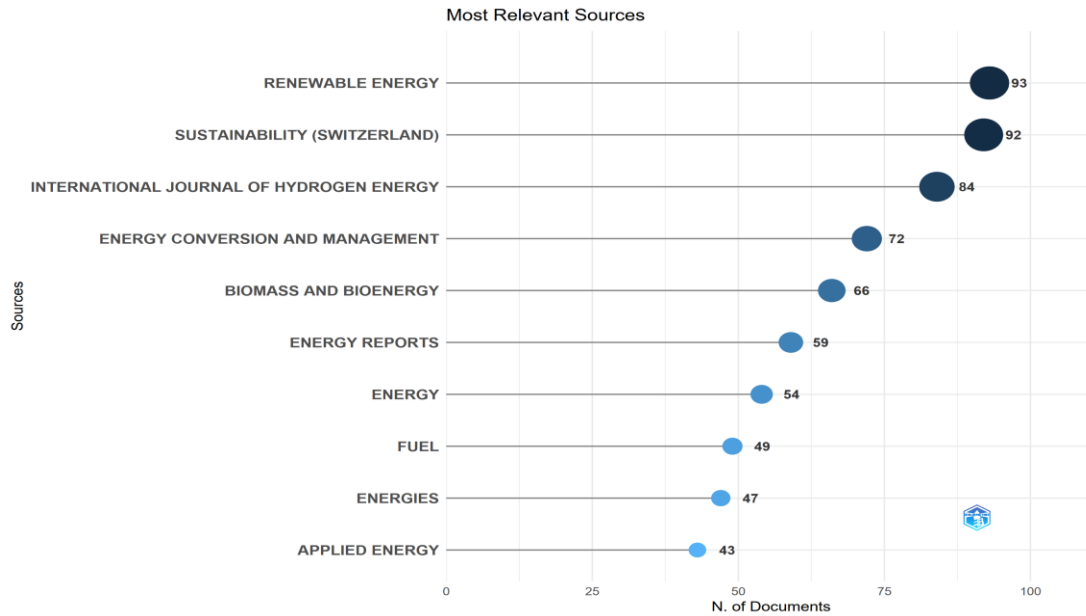


**Figure 4.** Distribution of the most productive journal sources in renewable energy research publications

In addition, journals such as Energy Conversion and Management, Biomass and Bioenergy, and Energy Reports also show significant contributions, indicating that research does not only focus on one type of energy, but covers various aspects such as energy conversion, bioenergy, and energy system efficiency (Sganzerla et al., 2026). The diversity of these journal sources reflects the multidisciplinary nature of renewable energy research, encompassing engineering, the environment, and energy policy. Thus, these results reinforce that the renewable energy publication landscape is dominated by highly reputable, global-based journals, which serve as hubs for knowledge dissemination and innovation in support of the sustainable energy transition.

#### Author productivity in renewable energy research

The most productive authors in the field of renewable energy research are based on the number of publications. The author with the highest contribution is Li J with 40 publications, followed by Li Y and Wang Y with 37 publications each. Next are Wang X (30 publications), Zhang Y (29 publications), and several other authors such as Liu Y, Wang J, and Zhang J with relatively high contributions (Li et al., 2026; Sun et al., 2026).

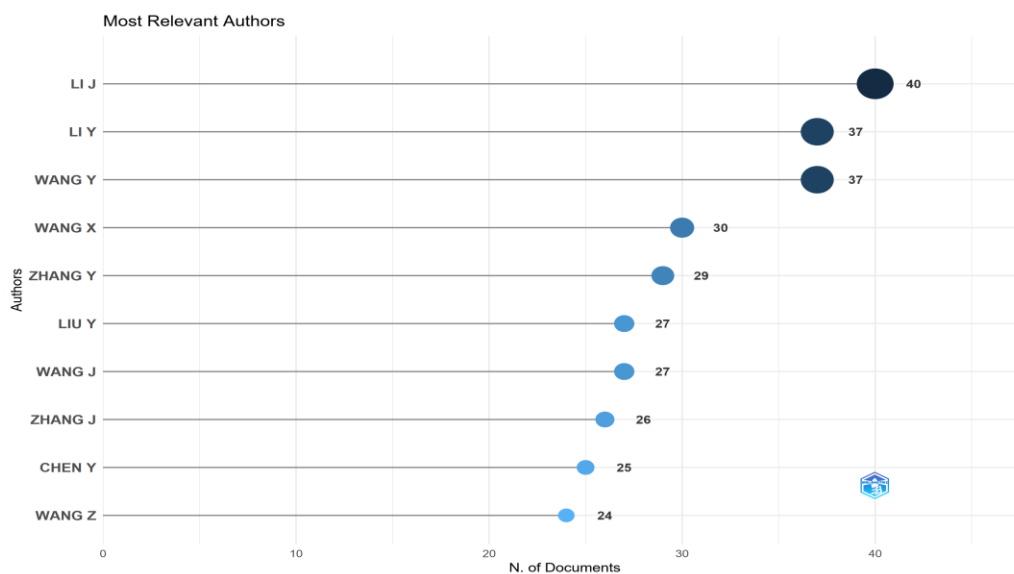


**Figure 5.** Author productivity based on the number of publications in the field of renewable energy

The dominance of authors' names from the Asian region, especially China, shows that this country has a very significant role in the development of renewable energy research globally (Luan et al., 2026). The high productivity of authors also indicates the presence of active and sustained research groups producing scientific publications. Furthermore, this pattern reflects strong concentrations of expertise (research clusters), which have the potential to become centers of collaboration and innovation in the field of renewable energy. Thus, these results not only indicate the most productive authors but also illustrate the dynamics of global academic power in driving the development of sustainable energy research.

#### **Map of global collaboration between countries in renewable energy research**

The global collaboration map shows the geographic distribution of research and collaborative relationships between countries in the field of renewable energy. Darker colored countries indicate higher publication productivity, while connecting lines indicate the intensity of collaboration.

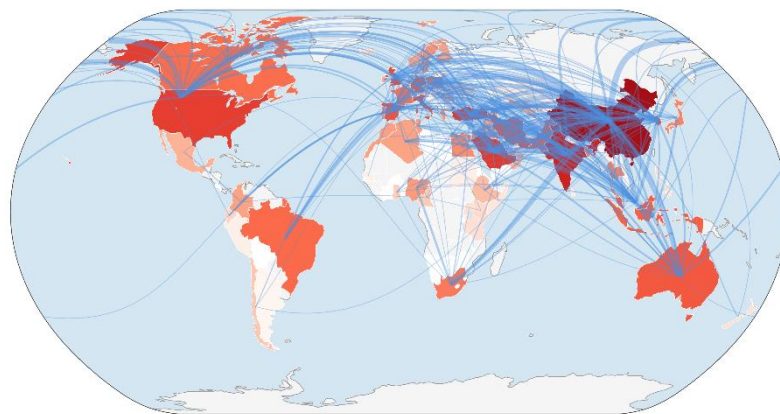


**Figure 6.** Map of global collaboration between countries in renewable energy research

The visualization results show that countries such as China, the United States, and India are the main contributors to renewable energy research (Ofori et al., 2026). Furthermore, a strong collaborative network exists between developed and developing countries, particularly in Europe, Asia, and North America. This international collaboration demonstrates that renewable energy research is a global issue requiring cross-border cooperation.

To comprehensively summarize the results of the analysis, a systematic and easy-to-understand presentation of the main findings is necessary. Therefore, Table 2 presents a summary of the research findings and their implications for the development of renewable energy research. Based on Table 2, renewable energy research is dominated by sustainability themes, with a focus on technologies such as solar, wind, biomass, and hydrogen. Global collaboration remains concentrated in a few countries, demonstrating the need for increased international cooperation.

**Table 2.** Summary of main findings and implications of renewable energy research based on the results of the bibliometric analysis

| Aspect                | Main Findings                                                                  | Implications                                                        |
|-----------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Research Trends       | Renewable energy publications increased significantly (2022–2026)              | Indicates growing global attention toward energy transition         |
| Dominant Topics       | Renewable energy, sustainable development, alternative energy                  | Research focus remains centered on sustainability and policy issues |
| Main Technologies     | Solar energy, wind power, biomass, hydrogen                                    | Clean energy technologies have become the primary research priority |
| Research Structure    | Several major clusters were identified (technology, energy systems, bioenergy) | The research field is multidisciplinary and integrated              |
| Author Collaboration  | Dominated by certain research groups                                           | Greater cross-institutional collaboration is needed                 |
| Country Collaboration | Dominated by China, the USA, and India                                         | Global research disparities are still evident                       |
| Research Direction    | Increasing focus on hydrogen energy and energy storage                         | Future research opportunities lie in emerging technologies          |

#### 4. Conclusion

This study analyzes global trends in renewable energy research through an integrative approach between a PRISMA-based Systematic Literature Review (SLR) and a bibliometric analysis of 2,500 Scopus documents for the 2022–2026 period. The results show a significant increase in publications, reflecting the high global attention to sustainable energy transitions. Keyword analysis reveals that the main themes are dominated by renewable energy, sustainable development, and alternative energy, while the research structure is developing into several main clusters covering clean energy technologies such as solar, wind, biomass, and hydrogen, as well as system aspects such as energy management and energy integration. In terms of collaboration, research is dominated by countries such as China, the United States, and India, although there is still a global gap in participation. Overall, this study provides a comprehensive mapping of the trends and structure of renewable energy research and emphasizes the importance of integrating SLR and bibliometric methods to produce more in-depth analyses. The implications of this research point to opportunities for developing emerging energy technologies such as hydrogen and energy storage, as well as the need for increased cross-disciplinary and cross-national collaboration to support the acceleration of the sustainable energy transition in the future.

#### References

- Al-Obaidi, A. S. M. (2026). The Journal of Engineering, Science and Technology (JESTEC): A Bibliometric Insight into Materials Research Trends and Innovation to Support Sustainable Development Goals (SDGs). *ASEAN Journal for Science and Engineering in Materials*, 5(1), 101–122.
- Callychurn, D. S., & Hurreeram, D. K. (2026). Redefining sustainability and sustainable manufacturing in the new age. *Discover Sustainability*, 7(1). <https://doi.org/10.1007/s43621-026-02825-6>
- Demir, G., Ecer, F., Yüksel, S., & Dinçer, H. (2026). A bibliometric mapping and trend analysis of MCDM in renewable energy research. *Energy Strategy Reviews*, 64. <https://doi.org/10.1016/j.esr.2026.102079>
- Desai, D., Si, Y., Bozhilova, D., Puffer, S. M., & Stephens, J. C. (2026). Renewable energy discourses of fossil fuel companies: obstruction and delay of climate action. *Energy, Sustainability and Society*, 16(1). <https://doi.org/10.1186/s13705-026-00565-z>
- Guzmán, J. I., Faúndez, P., & Carrión, M. (2026). Bibliometric and systematic analysis of literature on royalties in non-renewable resources. *Resources Policy*, 113. <https://doi.org/10.1016/j.resourpol.2026.105829>

- Juwana, W. E., Racmanto, R. A., Trisnoaji, Y., Prasetyo, S. D., & Arifin, Z. (2026). The role of fin-PCM integration in enhancing photovoltaic performance. *Green Technologies and Sustainability*, 4(2). <https://doi.org/10.1016/j.grets.2025.100306>
- Li, X., Li, Y., Zhao, Z., Ma, C., Chen, W., Hong, B., & Huang, C. (2026). Machine learning model for predicting geothermal in Xianning, China. *Results in Engineering*, 29. <https://doi.org/10.1016/j.rineng.2026.109137>
- Lu, M., Li, Y., Sun, Y., & Ma, Z. (2026). Integrated energy systems with hybrid renewables, battery storage, and electric vehicles: Uncertainty-aware optimization and grid-supportive management. *Energy Conversion and Management*, 350. <https://doi.org/10.1016/j.enconman.2025.120996>
- Luan, S., Ma, J., Gan, D., Urinov, B., Sultan, M. S., Zeynalova, A., & Agarzayev, A. (2026). Decarbonizing regional air transport: Strategic pathways for sustainable multi-airport systems in developing economies. *Journal of Air Transport Management*, 135. <https://doi.org/10.1016/j.jairtraman.2026.103023>
- Manirambona, E., Niyongere, A., Ndayizeye, M., Dusabe, B., Amissi, B. K., Talai, S. M., & Kimutai, S. K. (2026). Assessing power sector expansion and related emissions using the low emissions analysis platform: The case of Burundi in East Africa. *Energy Strategy Reviews*, 64. <https://doi.org/10.1016/j.esr.2026.102155>
- Nasirov, S. N., Mamedov, S. G., & Neymetov, S. R. (2026). Catalytic reforming in the process of hydrogen hydrocarbons, such as n-heptan, using catalysts and high temperatures. *International Journal of Hydrogen Energy*, 216. <https://doi.org/10.1016/j.ijhydene.2026.153857>
- Ofori, E. K., Asongu, S. A., Ali, E. B., Gyamfi, B. A., & Ahakwa, I. (2026). Environmental impact of ISO 14001 certification in promoting sustainable development: The moderating role of innovation and structural change in BRICS, MINT, and G7 economies. *Energy and Environment*, 37(2), 798–825. <https://doi.org/10.1177/0958305X241246193>
- Peter, S., Sunke, M. B., & Ibrahim, B. (2026). Solar-driven atmospheric water yields under climate stress: A 23-year global data analysis. *Environmental Earth Sciences*, 85(3). <https://doi.org/10.1007/s12665-025-12789-x>
- Rodrigues, E. L., Neto, F. S., Lopes, A. A. S., Sousa Junior, P. G. D., & dos Santos, J. C. S. (2026). Advances in photovoltaic module recovery and recycling: Technologies, policies, and circular economy perspectives. *Next Sustainability*, 7. <https://doi.org/10.1016/j.nxsust.2026.100302>
- Salari, S., Etmnan, A., & Jamil, M. (2026). Design and Performance Evaluation of a Hybrid Renewable Energy System Integrating Wind, Diesel Generators, and Battery Storage for Remote Communities. *Energies*, 19(7). <https://doi.org/10.3390/en19071676>
- Sganzerla, W. G., Tena, M., Castro, L. E. N., Forster-Carneiro, T., Solera, R., & Perez, M. (2026). Synergistic Effects of Subcritical Water Pretreatment and Anaerobic Digestion of Brewers' Spent Grains for Biogas Production. *Sustainability (Switzerland)*, 18(3). <https://doi.org/10.3390/su18031410>
- Singh, M., & Gupta, Y. (2026). Trends and Challenges in Renewable Energy and Economic Growth Research: A Bibliometric Study. *Environment, Development and Sustainability*. <https://doi.org/10.1007/s10668-026-07543-7>
- Siregar Mawardi; Alhadi, Rafli; Sembiring, Anita Christine, Z. H. M. (2023). Uji Karakteristik Briket Serbuk Kayu Terhadap Laju Pembakaran. *Jurnal Mekanova : Mekanikal, Inovasi Dan Teknologi*, (Vol 9, No 2 (2023): Oktober), 69–77. <https://doi.org/10.35308>
- Siregar, Z. H., Nasution, A. F., Fazri, M., Refiza, R., Puspita, R., Thamrin, H., & Nasution, A. S. (2024). The Effect of Fuel Mixture Composition on Gasoline. *Jurnal Ilmiah Teknik Mesin, Industri, Elektro,an Sipil*, 05(02), 394–402. <https://doi.org/10.54123/vorteks.v5i2.389>
- Siregar, Z. H., Siregar, S. L., & Effendi, A. (2021). From the experimental results of briquettes using a portable. *Jurnal Vorteks*, 02(02), 115. <https://doi.org/10.54123/vorteks.v2i2.89>
- Sun, X., Li, S., Pan, X., Ren, Y., Wang, N., & Guo, J. (2026). Functional role investigation of variable-speed pumped storage units in multi-market environments based on chronological production simulation. *Journal of Energy Storage*, 154. <https://doi.org/10.1016/j.est.2026.121335>
- Szamosi, Z., & Rosas-Casals, M. (2026). Safety aspects of torrefied biomass: Prosperous and dangerous process for green transition. *Journal of Loss Prevention in the Process Industries*, 101. <https://doi.org/10.1016/j.jlp.2026.105975>