

Green Hydrogen Economy: A Bibliometric Analysis

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Article Info	ABSTRACT
Article history: Received Sep, 2026 Revised Sep, 2026 Accepted Sep, 2026 Keywords: Bibliometric Analysis Energy Transition Green Hydrogen Hydrogen Economy VOSviewer	This study presents a bibliometric analysis of research on the green hydrogen economy to map its intellectual structure, thematic evolution, and collaboration patterns. A total of 121 Scopus-indexed documents published between 2006 and 2026 were analyzed using VOSviewer through keyword co-occurrence, citation, co-authorship, institutional, and country-level networks. The results show that the field is organized around “hydrogen economy,” “hydrogen production,” and “green hydrogen,” which form five interrelated clusters covering hydrogen production technologies and emissions, renewable energy integration, economic and policy frameworks, decarbonization and techno-economic assessment, and energy systems. The overlay map indicates a thematic shift from technology- and resource-oriented topics toward life cycle, carbon economy, public policy, energy transition, and green development issues in the most recent period. Citation analysis reveals that the most influential works address carbon-neutral hydrogen pathways, the role of green hydrogen in a renewable energy society, water constraints, and electrolysis catalysts. Collaboration networks remain small and cohesive, led by a Nigerian author group centered on Ajiboye and a multinational institutional group linked to Vietnam, while India, China, Germany, Australia, and the United States emerge as leading countries. The findings offer a reference for researchers and policymakers in directing future studies toward integrated techno-economic, environmental, and governance perspectives on the green hydrogen economy. <i>This is an open access article under the CC BY-SA license.</i> 
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1. INTRODUCTION

The global energy system is under growing pressure to decarbonize as climate change intensifies and dependence on fossil fuels exposes economies to environmental and security risks. Hydrogen has long been proposed as a clean energy carrier able to replace carbon-intensive fuels, giving rise to

the concept of the hydrogen economy, in which hydrogen is produced, stored, distributed, and used across the power, transport, and industrial sectors [1], [2]. Its climate value, however, depends on how it is produced, because most current hydrogen supply is still derived from natural gas and coal [3]. Green hydrogen, generated through water electrolysis powered by renewable

electricity, is therefore positioned as the core of a low-carbon hydrogen economy [4].

Technological progress remains a key determinant of green hydrogen deployment. Research has focused on electrolyzer materials, catalysts, and membranes to improve conversion efficiency and reduce costs [5], as well as on storage and carrier options such as liquid organic hydrogen carriers and ammonia [6]. At the same time, resource requirements, including the water demand of large-scale electrolysis, show that the technical pathway cannot be separated from environmental constraints [7].

Beyond technology, the green hydrogen economy has strong economic, social, and political dimensions. Previous studies have examined production costs and industrial decarbonization [8], subsidy and rollout policies [9], and social impacts and geopolitical implications [10]. Country-level assessments, such as those in Vietnam and India, illustrate how renewable resource endowment, infrastructure, and policy readiness shape national hydrogen strategies [11], [12].

These developments have produced a rapidly growing and multidisciplinary literature spanning chemical engineering, energy systems, economics, environmental science, and public policy. Recent studies apply machine learning, techno-economic modelling, life cycle assessment, and circular economy frameworks to evaluate green hydrogen pathways [13], [14]. Consequently, the volume of publications has expanded sharply in recent years, making it increasingly difficult to follow the overall direction of the field through individual studies alone.

Bibliometric analysis provides a quantitative approach to examining publication patterns, influential documents, collaboration networks, and thematic structures within a research domain [15]. Unlike narrative reviews, bibliometric mapping visualizes the relationships among keywords, authors, institutions, and countries, offering a comprehensive picture of how knowledge is organized and how research priorities evolve over time.

Although several reviews have discussed the technologies, financing mechanisms, and sustainability of green hydrogen [16], most of them concentrate on specific aspects or regions, while debates on equity and the environmental soundness of the hydrogen transition remain open [17]. A systematic mapping of the intellectual structure, thematic evolution, and collaboration patterns of green hydrogen economy research is therefore needed. This study conducts a bibliometric analysis of Scopus-indexed publications to identify the dominant themes, emerging topics, influential works, and collaboration networks in this field.

2. METHODS

This study adopted a bibliometric approach to examine the scientific development of research on the green hydrogen economy. Data were retrieved from the Scopus database on 14 September 2026, as Scopus offers broad coverage of peer-reviewed literature in engineering, energy, environmental, economic, and social sciences. The search was conducted using the terms “green hydrogen” and “economy” in document titles, without restriction on publication year or document type. The final dataset consisted of 121 documents published between 2006 and 2026, comprising 59 articles, 30 reviews, 14 conference papers, 14 book chapters, two editorials, and two notes. Bibliographic information, including titles, abstracts, keywords, authors, affiliations, sources, publication years, and citation counts, was exported in RIS format and screened for duplicate and incomplete records before analysis.

Bibliometric mapping was performed using VOSviewer to construct and visualize networks based on keyword co-occurrence and co-authorship at the author, institution, and country levels. In the network visualization, node size represents the frequency of occurrence, link thickness reflects the strength of co-occurrence, and colors indicate thematic clusters. The overlay visualization was used to trace the temporal

evolution of themes based on the average publication year, while the density visualization was applied to identify well-developed and emerging research areas. In addition, citation analysis was carried out using Scopus citation counts to identify the

ten most influential documents in the field [15]

3. RESULTS AND DISCUSSION

3.1 Keyword Co-Occurrence Network Visualization

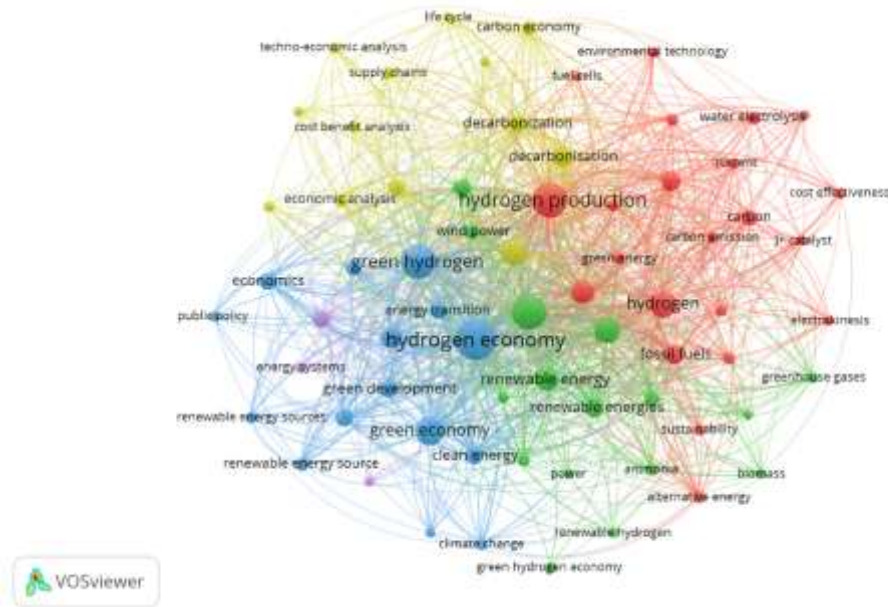


Figure 1. Network Visualization

Source: Data Analysis, 2026

Figure 1 illustrates the intellectual structure of green hydrogen economy research. The terms “hydrogen economy,” “hydrogen production,” and “green hydrogen” appear as the largest and most connected nodes, showing that the literature is centered on the production of low-carbon hydrogen and its role within a broader economic system. The dense links among these nodes indicate that technological, economic, and environmental perspectives are closely intertwined rather than developing as isolated subtopics.

The red cluster represents hydrogen production technologies and their emission outcomes. It contains terms such as hydrogen production, hydrogen, water electrolysis, catalyst, fuel cells, electrokinetics, fossil fuels, carbon emission, cost effectiveness, and environmental technology. This cluster reflects studies on electrolysis performance, catalyst and membrane development, and the

comparison between electrolytic and fossil-based hydrogen in terms of cost and emissions.

The green cluster is associated with renewable energy integration and hydrogen derivatives. Keywords such as renewable energy, renewable energies, wind power, power, ammonia, biomass, greenhouse gases, renewable hydrogen, and green hydrogen economy indicate research on coupling hydrogen production with variable renewable electricity and on alternative feedstocks and carriers, including ammonia and biomass-based routes.

The blue cluster captures the economic and policy dimensions of the transition. It includes hydrogen economy, green hydrogen, green economy, economics, energy transition, green development, clean energy, public policy, climate change, and renewable energy sources. This cluster reflects studies on national strategies,

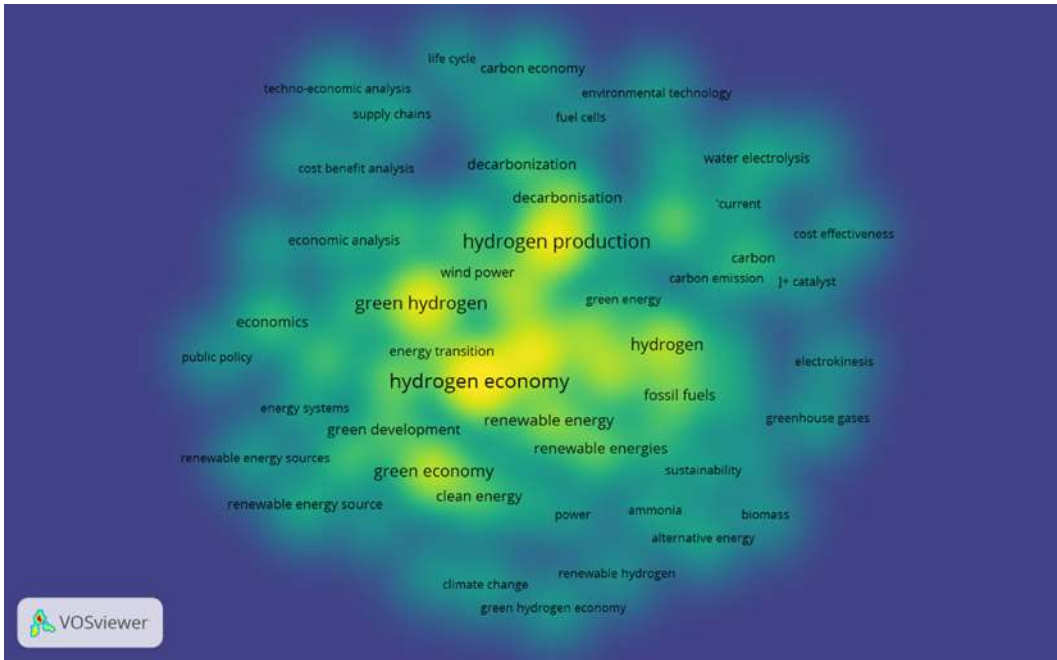


Figure 3. Density Visualization
Source: Data Analysis, 2026

Figure 3 shows that research on the green hydrogen economy is concentrated in several high-density areas. The brightest regions surround hydrogen economy, hydrogen production, and green hydrogen, followed by green economy, clean energy, hydrogen, and decarbonisation. These areas represent the most established research topics and form the conceptual core of the field.

The density gradually decreases toward peripheral terms such as

electrokinetics, cost effectiveness, greenhouse gases, biomass, public policy, life cycle, supply chains, and techno-economic analysis. These lower-density areas indicate topics that are still developing or less frequently studied, and therefore offer opportunities for further investigation, particularly on techno-economic evaluation, supply chains, and policy analysis.

3.2 Citation Analysis

Table 1. Top Cited Documents

Citations	Author and Year	Title
940	[1]	"Green" path from fossil-based to hydrogen economy: An overview of carbon-neutral technologies
895	[4]	A green hydrogen economy for a renewable energy society
267	[7]	Does the Green Hydrogen Economy Have a Water Problem?
201	[5]	Waste-Derived Catalysts for Water Electrolysis: Circular Economy-Driven Sustainable Green Hydrogen Energy
192	[18]	Green hydrogen production potential for developing a hydrogen economy in Pakistan
179	[8]	Green hydrogen for industrial sector decarbonization: Costs and impacts on hydrogen economy in qatar
156	[10]	Green hydrogen and sustainable development – A social LCA perspective highlighting social hotspots and geopolitical implications of the future hydrogen economy
143	[2]	A green hydrogen economy

Citations	Author and Year	Title
142	[19]	Prospects and Challenges of Green Hydrogen Economy via Multi-Sector Global Symbiosis in Qatar
124	[20]	Synergy of green hydrogen sector with offshore industries: Opportunities and challenges for a safe and sustainable hydrogen economy

Source: Scopus, 2026

3.3 Co-Authorship Analysis

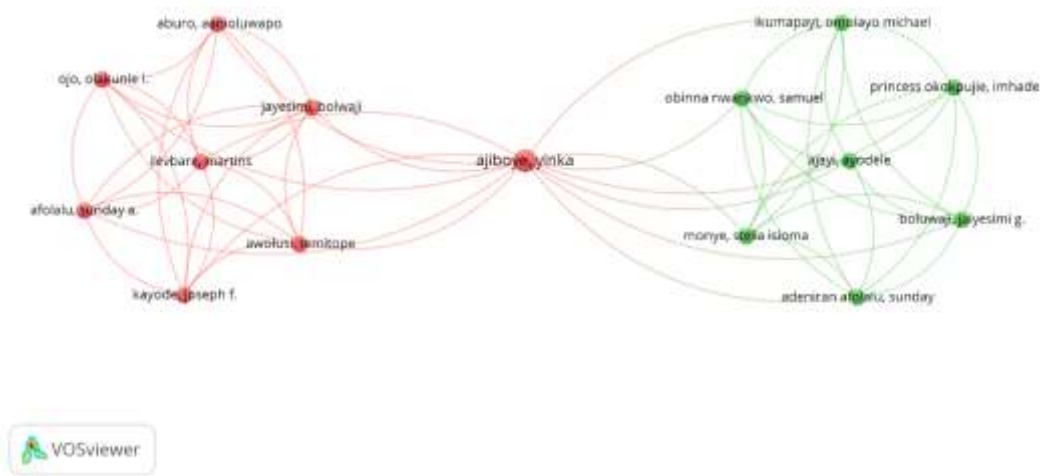


Figure 4. Author Visualization
Source: Data Analysis, 2026

Figure 4 shows a co-authorship network consisting of two cohesive clusters connected by a single central author. Ajiboye, Yinka occupies the central position and links both groups, acting as the main bridge in the network. The red cluster includes Aburo, Ojo, Jayesimi, Ilevbare, Afolalu, Awolusi, and Kayode, while the green cluster includes Ikumapayi, Obinna Nwankwo, Okokpujie,

Ajayi, Boluwaji, Monye, and Adeniran Afolalu. Both groups are affiliated with the Hydrogen Research Institute of Afe Babalola University, Nigeria, and focus on the opportunities of green hydrogen for the global economy and the power sector in Sub-Saharan Africa. The pattern indicates strong intra-group collaboration, but a limited number of collaborating teams in the field.

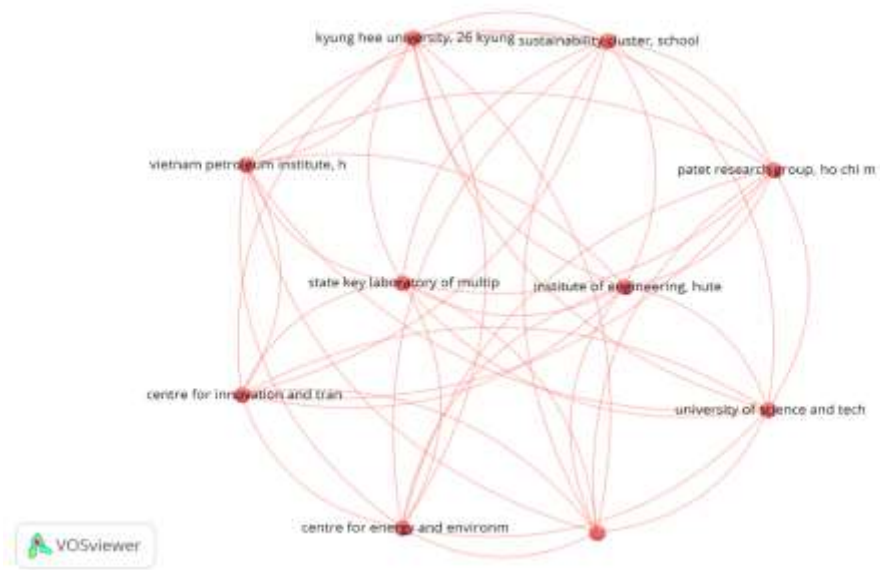


Figure 5. Institution Visualization

Source: Data Analysis, 2026

Figure 5 presents an institutional co-authorship network in which all nodes belong to a single, fully interconnected cluster. The network includes Kyung Hee University, the Sustainability Cluster of the University of Petroleum and Energy Studies, the Vietnam Petroleum Institute, the PATET Research Group of Ho Chi Minh City University of Transport, the Institute of Engineering of HUTECH University, the State Key Laboratory of Multiphase Flow in Power Engineering, the Centre for Innovation and

Translational Research, the University of Science and Technology of the University of Danang, and the Centre for Energy and Environmental Sustainability. This structure originates from a multinational collaboration on the prospects and policies of the green hydrogen economy in Vietnam [11], showing that institutional collaboration is formed mainly through project-based international co-authorship rather than a broad institutional network.

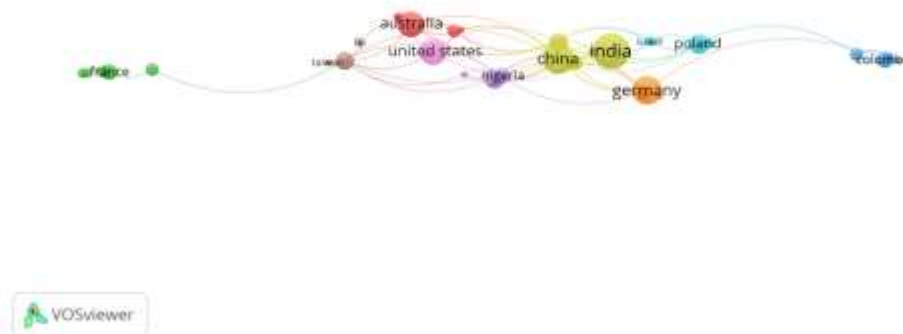


Figure 6. Country Visualization

Source: Data Analysis, 2026

Figure 6 shows that India is the most prominent country in green hydrogen economy research, followed by China, Germany, Australia, and the United States. India and China form a central hub with extensive links to Poland, Israel, Nigeria, Germany, and Australia, reflecting strong research activity on national hydrogen strategies and decarbonization pathways [12]. Australia and the United States form another connected group with links to Taiwan and Fiji, while Germany maintains cooperation related to international hydrogen partnerships. Colombia and France appear at the periphery with only a few links, indicating limited collaboration from Latin America and part of Europe.

4. CONCLUSION

The bibliometric analysis of the green hydrogen economy reveals a rapidly growing and multidisciplinary research field centered on hydrogen economy, hydrogen production, and green hydrogen. The keyword map is

structured into five clusters covering production technologies and emissions, renewable energy integration, economic and policy frameworks, decarbonization and techno-economic assessment, and energy systems. Recent research has shifted toward life cycle, carbon economy, public policy, energy transition, and green development issues, while techno-economic analysis, supply chains, and policy evaluation remain less developed. The most influential documents address carbon-neutral hydrogen pathways, the role of green hydrogen in a renewable energy society, water constraints, and electrolysis catalysts. Collaboration at the author and institutional levels is concentrated in small cohesive groups, particularly in Nigeria and a Vietnam-oriented multinational network, while India, China, Germany, Australia, and the United States lead country-level research. Future studies are encouraged to strengthen cross-regional collaboration and to integrate techno-economic, environmental, and governance perspectives in assessing green hydrogen economy development.

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