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Evolution of global research on renewable energy policy: A bibliometric and content analysis (2010–2024)

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Abstract

This study presents a comprehensive bibliometric and content analysis of global research on renewable energy law and policy, utilizing 845 peer-reviewed documents indexed in the Scopus database from 2010 to 2024. Employing a rigorous PRISMA-guided methodology, the research first mapped the field's temporal evolution through keyword co-occurrence analysis. An in-depth content analysis was then performed on a selected subset of 32 core documents to model the policy trajectory. Quantitative results indicate steady growth in publication volume, with European countries such as Italy and Switzerland leading the field. Qualitatively, the analysis mirrors a four-stage global policy evolution, shifting from the Mass Deployment phase, characterized by the dominance of the Feed-in Tariff, toward the Market Integration and Corporate Decarbonization phases, marked by the emergence of competitive instruments like Auction, Power Purchase Agreement (PPA), and Policy Mix. The study contributes a data-backed knowledge map of the field, offering stage-specific policy implications for jurisdictions navigating the energy transition, and identifying critical future research directions.

Keywords: Auction, Bibliometric analysis, Content analysis, Feed-in tariff (FIT), Policy mix, PPAs, Renewable energy policy.

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1. Introduction

The transition toward renewable energy (RE) has become central to global strategies for mitigating climate change and advancing sustainable development. Legal and policy frameworks play a foundational

Parallel to this policy momentum, scholarly research on RE law and policy has expanded significantly, especially in interdisciplinary contexts linking law, economics, and environmental governance. However, while considerable attention has been paid to technical, economic, and environmental dimensions of the energy transition, comprehensive syntheses that systematically map the intellectual structure and track the evolutionary trajectory of global RE policy through a dual-method approach remain scarce. Existing reviews often focus on specific policy instruments or regional case studies, failing to provide a data-driven, longitudinal overview of how policy thinking has evolved on a global scale.

This study addresses this gap by employing a combined bibliometric and content analysis to map global research on RE policy, using Scopus documents from 2010 to 2024. Specifically, the research aims to:

- Provide a comprehensive bibliometric overview, identifying the most productive and influential journals, authors, and countries, and mapping the intellectual structure of the field through keyword co-occurrence analysis.
- Conduct a rigorous content analysis of the core literature to synthesize and model the evolution of global RE policy, revealing distinct stages of development, from initial deployment mechanisms to modern market-integration frameworks.
- Based on the findings, identify the critical research frontiers and offer evidence-based, stage-specific policy implications for jurisdictions at varying levels of energy transition maturity.

By combining quantitative structure mapping with qualitative content synthesis, this paper offers a significant contribution by providing a robust, data-backed foundation for understanding the legal and political dynamics of the global energy transition. The remainder of the paper is organized as follows: Section 2 outlines the methodology, including the PRISMA protocol; Section 3 presents the bibliometric results; Section 4 details the four-stage policy evolution model; and Section 5 and 6 discusses the findings and presents future research directions.

2. Materials and Methods

2.1. PRISMA and Bibliometric Mapping

This study adopts a systematic bibliometric review design to explore global research trends on legal and policy dimensions of renewable energy from 2010 to 2024. The approach combines the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol for transparent document selection with bibliometric analysis techniques to examine the intellectual structure of the field. The methodological process consists of four main stages: database selection and search strategy, eligibility screening based on PRISMA, bibliometric data processing, and network analysis.

The data were retrieved from the Scopus database, widely recognized for its broad coverage of interdisciplinary research, including energy studies, environmental policy, and legal scholarship. A targeted search string was constructed to capture relevant documents based on a combination of legal, regulatory, and policy-related terms associated with renewable energy. The search was conducted using the TITLE-ABS-KEY function, and the final query was: "*renewable energy law*" OR "*legal framework for renewable energy*" OR "*renewable energy regulation*" OR "*renewable energy policy*" OR "*feed-in tariff*" OR "*power purchase agreement*" OR "*feed-in premium*" OR "*renewable energy auction*". To ensure relevance, the search was limited to articles published in English, within the subject areas of Social Sciences; Economics, Econometrics and Finance; Business, Management and Accounting; and Decision Sciences. The publication period was restricted to 2010–2024.

The document selection process followed the PRISMA framework and is summarized in the flow diagram Figure 1. Initially, 6,775 records were identified. After limiting the publication years to 2010–2024, the dataset was reduced to 5,792 records. Applying subject area filters yielded 1,670 documents. Restricting to peer-reviewed journal articles reduced the count to 1,185. Limiting to English-language publications resulted in 1,140 articles. Finally, after screening titles and abstracts for relevance to renewable energy law and policy, 845 documents were retained for bibliometric analysis.

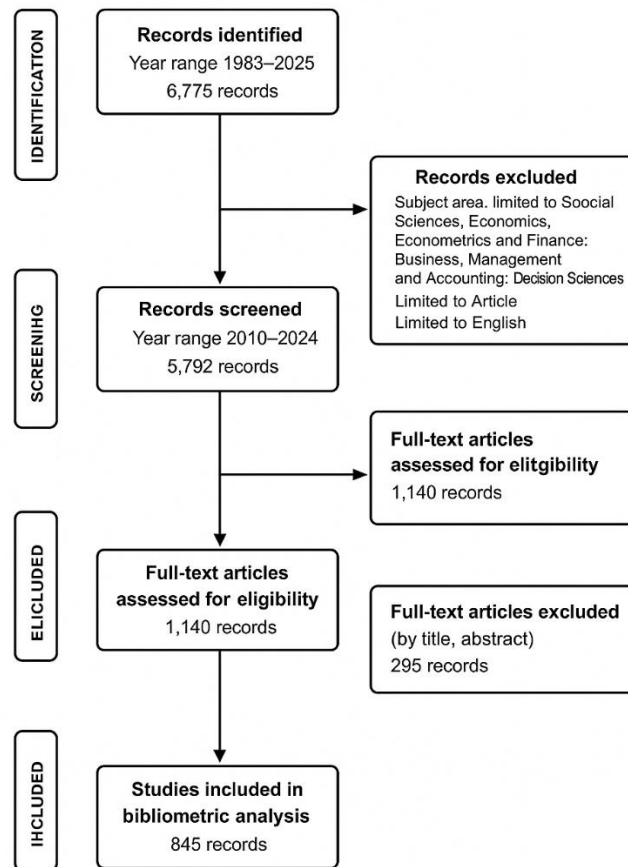


Figure 1.
PRISMA flow diagram.

The bibliographic data—including author names, affiliations, publication years, keywords, citations, and source titles—were exported in CSV format for analysis. VOSviewer was used to generate visualizations of co-authorship networks, country collaborations, and keyword co-occurrence maps. Microsoft Excel was used to generate descriptive statistics and rankings of authors, journals, countries, and institutions.

Key bibliometric indicators applied in this study include the number of documents (Articles), total citations (TC), average citations per article (TC/Art), and total link strength (TLS), which reflects the intensity of collaboration between authors or countries. This integrated methodological framework allows for a comprehensive assessment of both the productivity and the structural evolution of renewable energy law and policy research over the past 15 years.

2.2. Content Analysis for Policy Evolution Modeling

In addition to the bibliometric mapping, this study employed a qualitative content analysis approach to synthesize the substantive findings of the scholarly literature and model the global evolution of renewable energy policy. The content analysis was performed on a selected subset of 32 core documents (from the initial 845 reviewed articles) that focused specifically on comparative policy evaluation and longitudinal policy reviews across various jurisdictions. The selection criteria prioritized papers discussing the design, implementation outcomes, and historical sequencing of key instruments like Feed-in Tariffs (FITs), Renewable Portfolio Standards (RPS), Auctions, and Power Purchase Agreements (PPAs). The analysis utilized an inductive-deductive approach to: (1) systematically extract and categorize dominant policy instruments and their respective rationales such as energy security, cost efficiency and (2) construct the four-stage model of global RE policy evolution (Foundational, Mass Deployment, Market Integration, and Corporate Decarbonization), which serves as the core framework for Section 4.

3. Mapping Global Research on Renewable Energy Policy: A Bibliometric Analysis

The following section explicitly describes the results of the bibliometric analysis of the 845 documents found, published from 2010 through 2024.

3.1. Trends in the Number of Publications

Figure 2 illustrates the annual distribution of publications on legal and policy aspects of renewable energy between 2010 and 2024. The research output in this domain has shown a steady increase over the past 15 years, reflecting a growing scholarly interest in the governance frameworks surrounding renewable energy deployment.

During the early 2010s, the field experienced modest growth, with an average of fewer than 40 publications per year. This relatively low level of output may be attributed to the nascent stage of renewable energy legislation in many regions

and the dominance of technical over policy-focused energy research. From 2015 onwards, however, there was a notable uptick in publication volume. This trend coincides with the global ratification of the Paris Agreement and the subsequent emergence of policy tools such as feed-in tariffs (FiTs), power purchase agreements (PPAs), and competitive auctions.

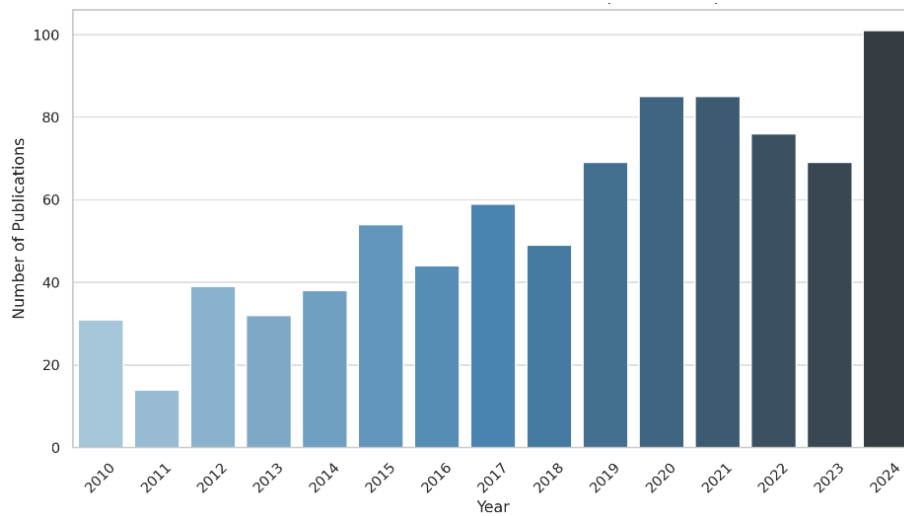


Figure 2.
Trends in the number of publications during the period 2010-2024.

3.2. Geographic Distribution of the Publications

This section analyzes the global patterns of scholarly collaboration in the field of renewable energy law and policy by integrating insights from both co-authorship network mapping and quantitative country-level metrics.

Figure 3 presents the co-authorship network among 34 countries that met the minimum threshold of two publications and 20 citations during the period 2010–2024. Each node in the network represents a country, where node size reflects the number of documents published and node color indicates the average publication year—from dark blue (earlier years) to yellow (more recent). Edges between nodes denote co-authored publications, and thicker edges signify stronger collaborative ties, as measured by Total Link Strength (TLS).

The visualization highlights a moderately interconnected global research structure, with European countries forming the dominant collaboration hub. Italy, Switzerland, Sweden, Belgium, and Denmark are among the most central and productive countries. Italy stands out as the most prolific contributor, publishing 34 articles and actively collaborating with other European countries, particularly Belgium and Sweden. Switzerland, while slightly less productive, received the highest number of citations (1,474), underscoring the substantial impact of its contributions. Sweden exhibits the strongest collaborative intensity, with a TLS of 11, positioning it as the most interconnected country in the network.

In contrast, countries such as Malaysia, South Korea, and Vietnam appear on the network's periphery but show signs of increasing engagement, particularly in recent years. These countries have begun establishing research ties primarily with European institutions. Although their Total Link Strength remains modest, their growing presence indicates a positive trajectory toward deeper integration. Meanwhile, countries like Qatar, Iraq, and Colombia remain isolated nodes, contributing few documents and maintaining limited international collaboration.

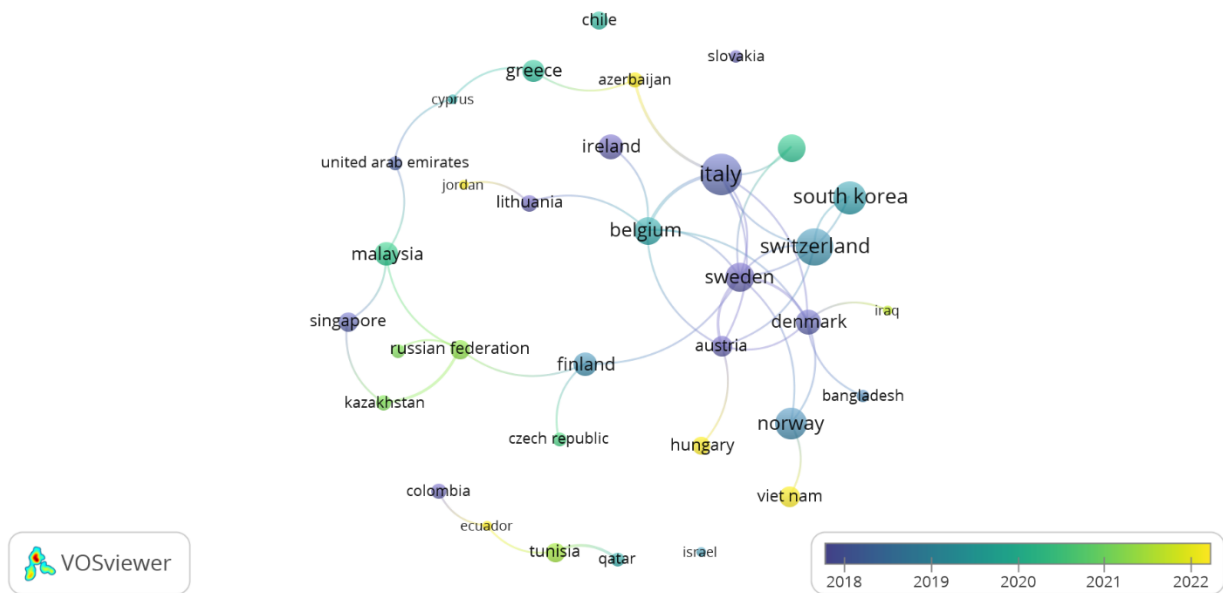


Figure 3.
The co-authorship network among 34 countries during the period 2010–2024.

To complement the network analysis, Table 1 summarizes the top contributing countries based on the number of documents, total citations, average citation impact (TC/Art), and Total Link Strength. Italy leads with 34 publications and a TLS of 10, followed by Switzerland (28 articles) and South Korea (23 articles). Notably, Switzerland also ranks highest in citation impact per article (52.64), followed by Denmark (44.92), Norway (38.33), and Italy (37.79), confirming their significant influence in the field. Other countries such as Sweden (31.06), Ireland (27.08), Finland (27.09), and Malaysia (22.45) also demonstrate respectable average impact, while South Korea (17.61) and Hong Kong (19.94) reflect more modest citation performance.

Overall, the analysis reveals that while European countries continue to dominate both in output and collaboration, there is a growing presence of emerging countries from Asia and the Global South. This evolution points to an increasingly inclusive and globally connected research community in renewable energy law and policy. Strengthening these transnational partnerships could accelerate knowledge exchange, diversify perspectives, and foster more effective global governance strategies for sustainable energy transitions.

Table 1.
Leading countries in renewable energy law and policy research (2010–2024).

Country	Articles	Total Citations	TC/Art	Total Link Strength
Italy	34	1,285	37.79	10
Switzerland	28	1,474	52.64	4
South Korea	23	405	17.61	2
Norway	21	805	38.33	3
Sweden	17	528	31.06	11
Belgium	16	347	21.69	8
Hong Kong	16	319	19.94	2
Denmark	13	584	44.92	8
Ireland	12	325	27.08	1
Finland	11	298	27.09	3
Malaysia	11	247	22.45	3

3.3. Journal Productivity and Scholarly Influence

An examination of the most prolific and most cited academic journals (Table 2) reveals important insights into the dissemination and academic impact of research on renewable energy law and policy. *Sustainability* (Switzerland) emerges as the most prolific journal, publishing 68 articles on the topic between 2010 and 2024. However, despite its publication volume, the average citation per article remains modest (approximately 16), suggesting that while it serves as a key outlet for disseminating research, it may prioritize breadth over depth.

In contrast, *Journal of Cleaner Production* demonstrates both high productivity (51 articles) and outstanding citation impact (2,473 total citations), averaging over 48 citations per article. This indicates a strong alignment with high-quality, policy-relevant research that resonates broadly within the academic community. Similarly, journals such as *Environmental and Resource Economics* (10 articles, 1,739 citations) and the *Journal of Environmental Economics and*

articles, 778 citations) exhibit a high citation-per-article ratio, underlining their role as elite venues for theoretically grounded and methodologically rigorous contributions.

A dual pattern emerges: some journals exhibit high volume with moderate impact (e.g., *International Journal of Energy Economics and Policy*, *Electricity Journal*, *Utilities Policy*), while others demonstrate selective publishing strategies with greater academic influence. This suggests that authors targeting high impact should consider publishing in journals known for their rigorous peer-review processes and broader interdisciplinary readership.

Furthermore, the presence of both economics-oriented and sustainability-oriented journals in the citation rankings illustrates the interdisciplinary nature of renewable energy law and policy research. While legal scholarship per se remains less centralized in any one legal journal, the integration of legal perspectives into broader policy and environmental discourse is evident across multiple top-cited outlets.

Table 2.

Most prolific and most cited academic journals.

Top 10 most prolific journals	Articles	Citations	Top 10 most cited journals	Articles	Citations
Sustainability (Switzerland)	68	1088	Journal of Cleaner Production	51	2473
Journal of Cleaner Production	51	2473	Environmental and Resource Economics	10	1739
International Journal of Energy Economics and Policy	30	183	Sustainability (Switzerland)	68	1088
Energy Research and Social Science	27	989	Energy Research and Social Science	27	989
Energy for Sustainable Development	22	899	Energy for Sustainable Development	22	899
Energy Journal	20	413	Journal of Environmental Economics and Management	6	778
Electricity Journal	18	179	European Journal of Operational Research	6	495
Utilities Policy	14	322	Resource and Energy Economics	8	490
Economic Analysis and Policy	10	369	Technological Forecasting and Social Change	6	420
Environmental and Resource Economics	10	1739	Energy Journal	20	413

3.4. Analysis of Authors

Figure 4 visualizes the co-authorship network of 168 authors who have published at least two articles and have received a minimum of 10 citations. The nodes represent individual authors, where node size indicates productivity and color reflects the average year of publication. Erik Gawel (Helmholtz Centre for Environmental Research – UFZ, Germany) leads the group with six publications, followed by Christoph Böhringer (University of Oldenburg, Germany), Johannes Urpelainen (Columbia University, USA), Paul Lehmann (University of Leipzig, Germany), and Pablo del Río (Spanish National Research Council – CSIC, Spain), who each have five. Additionally, Sanya Carley (Indiana University, USA), Elizabeth Baldwin (University of Arizona, USA), Paul Simshauser, and Tim Nelson (North Sydney, Australia) all have four publications. These results also indicate a geographically diverse core of authors, with strong representation from Europe (particularly Germany and Spain), North America, and Australia.

The lines between nodes denote co-authored publications, and clusters denote groups of authors who frequently collaborate. The map reveals a moderately fragmented collaboration structure, comprising 90 distinct clusters. While collaboration exists, especially within regional or institutional research groups, the field lacks strong integration across clusters. This visual evidence supports the idea that the field is composed of multiple semi-autonomous research teams, with room to foster broader inter-group collaboration, especially across geographic and disciplinary lines.

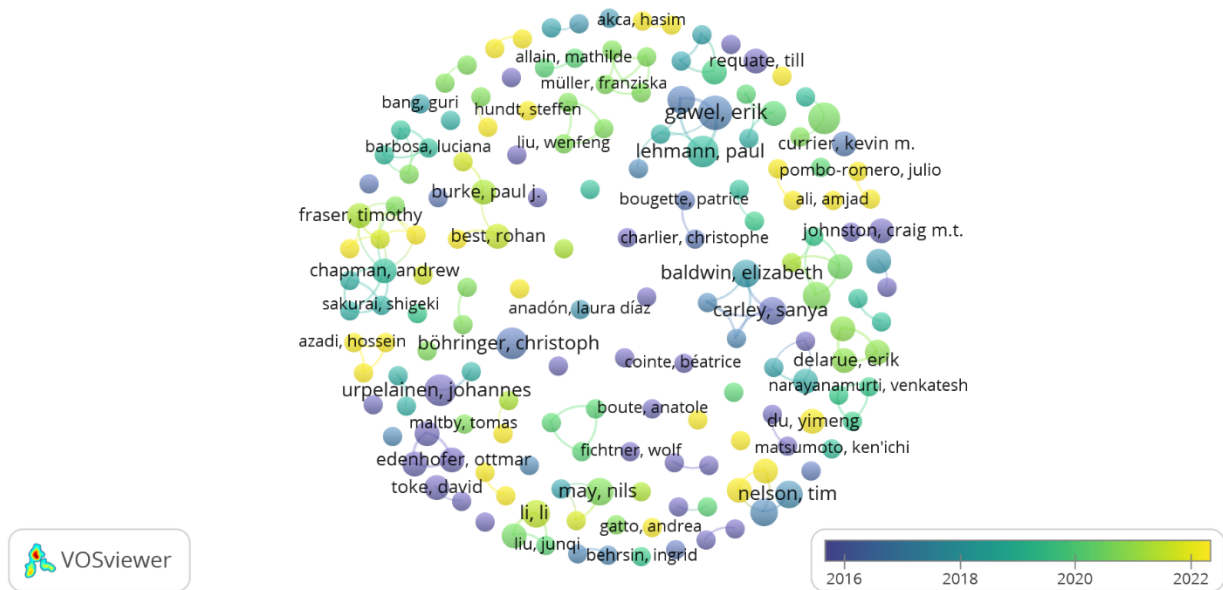


Figure 4.
Co-authorship network of 168 authors (2010 – 2024).

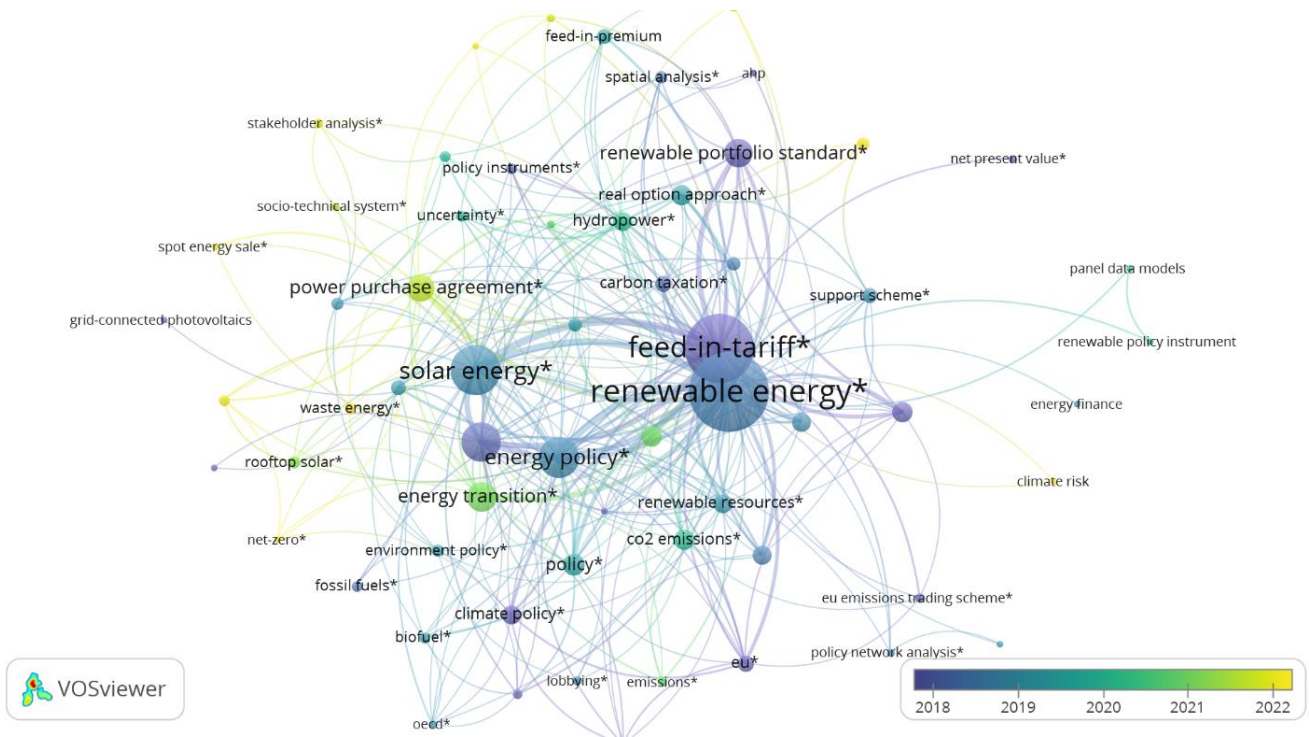
3.5. Keywords and Clusters Analysis

Before conducting the co-occurrence analysis using VOSviewer, a comprehensive keyword cleaning and normalization process was carried out to enhance the accuracy and interpretability of the mapping. Author keywords across the 845 selected articles were manually reviewed, and multiple variants referring to the same concept were merged under unified labels. For instance, keywords such as “feed-in-tariffs,” “feed-in-tariff policy,” “FIT policy,” and “electricity tariff” were all standardized as “feed-in-tariff.” Similarly, “power purchase agreements (PPA),” “short-term power purchase agreements,” and “corporate PPAs” were grouped under the term “power purchase agreement.” The same strategy was applied to technical and thematic terms, e.g., “solar photovoltaic,” “PV systems,” and “solar energy development” were unified as “solar energy.” This preprocessing step ensured semantic coherence and reduced fragmentation in the resulting co-occurrence map, thereby allowing more meaningful cluster identification and thematic interpretation.

To explore the intellectual structure and key topics in the field, we conducted a co-occurrence analysis of author keywords using VOSviewer. A total of 1,335 unique author keywords were extracted from the dataset of 845 documents. Applying a threshold of minimum 2 occurrences, 62 keywords met the inclusion criteria, providing a robust yet focused overview of dominant and emerging concepts in the literature.

The keyword co-occurrence map (Figure 5) visualizes relationships among the 62 most frequently used keywords. Each node represents a keyword, with the node size reflecting its frequency, and the connecting lines indicating co-occurrence strength. The color gradient (ranging from purple to yellow) represents the average publication year, allowing us to observe temporal trends in keyword usage.

Central to the co-occurrence network are a group of high-frequency keywords that serve as pivotal nodes in the scholarly discourse on renewable energy. The term “renewable energy” appears most prominently with 207 occurrences, underscoring its position as the overarching theme in this body of literature. Closely following is “feed-in-tariff” with 169 mentions, reflecting its critical role as a widely studied policy mechanism for promoting renewable energy deployment. Other frequently occurring terms include “solar energy” (95), “energy policy” (67), “energy transition” (60), “power purchase agreement” (59), and “carbon taxation” (39). These keywords not only appear with high frequency but also function as conceptual hubs, connecting various thematic clusters. Their centrality highlights their foundational role in framing the key debates, policy discussions, and technological considerations within the renewable energy research landscape.



4. The Global Evolution of Renewable Energy Policy: A Content-Based Synthesis

Building upon the quantitative findings from the bibliometric analysis, this section shifts the focus to a qualitative content analysis of the research output, in order to construct a chronological and thematic model of global renewable energy policy development. This synthesis is critical for translating the bibliometric data into meaningful policy insights, revealing that the global legal and political landscape for renewable energy has progressed through four distinct evolutionary stages, characterized by the dominant policy instruments employed and the underlying societal goals they sought to address. The global evolution of renewable energy policy reflects a dynamic adaptation to shifting economic, technological, and environmental priorities, moving generally from initial government-driven initiatives focused on energy security to sophisticated market-based mechanisms emphasizing efficiency and cost parity [4].

4.1. Phase 1: Foundational Policy and Energy Security (1970s – Early 2000s)

The earliest drivers for RE policy adoption were primarily rooted in securing domestic energy supplies, particularly following the oil crises of the 1970s [4, 5]. Countries severely deficient in domestic fossil fuels, such as Japan, South Korea, and Taiwan, began promoting RE as an alternative to mitigate their significant dependence on imported fuels [4]. In Japan, this early focus translated into large, multi-decade Research and Development (R&D) initiatives, such as the "Sunshine Project" initiated in 1974, and its successor, the "New Sunshine Project," launched in 1993 [4].

However, during this initial phase, the deployment of RE often remained conservative. In countries like Japan, South Korea, and Taiwan, pro-nuclear energy policies often hindered broader RE development [4]. Policy efforts worldwide concentrated on developing and disseminating technologies, with R&D subsidies or equivalent instruments for knowledge spillovers through learning-by-doing [6].

4.2. Phase 2: Mass Deployment Driven by Generation Incentives (Early 2000s – Mid-2010s)

The decisive period for stimulating mass RE capacity deployment globally began with the widespread adoption of generation-based economic instruments, primarily Feed-in Tariffs (FITs) and Renewable Portfolio Standards (RPS) [7, 8]. These tools shifted the policy objective from mere R&D to achieving significant installation capacity and building low-carbon economies.

The Ascendancy of Feed-in Tariffs (FITs): FITs emerged as one of the most favored policies for driving the deployment of renewable energy worldwide [9]. A FIT is fundamentally a price regulation mechanism, guaranteeing RE generators a specified, fixed tariff (e.g., USD/kWh) for the energy they produce and feed into the grid for a set duration, often 10 to 20 years [10, 11]. This fixed price structure significantly reduces market risks and uncertainties for investors, enhancing the profitability and attractiveness of RE projects [12].

The implementation of FITs led to demonstrable success in deployment. In Germany, the FIT policy rapidly increased the share of renewable electricity from 6.2% in 2000 to 28% in 2014 [12]. The system was sometimes seen as having the potential to "democratize" energy markets by allowing diverse participation from smaller actors like small and medium-sized companies, farmers, and private persons [11]. In East Asia, the Fukushima nuclear catastrophe in 2011 renewed political interest in RE as an alternative to nuclear power in Japan, South Korea, and Taiwan [4]. Following this, comprehensive FIT programs, such as Japan's post-2012 schemes and Taiwan's 2009 Renewable Energy Development Act, attracted substantial investment [4].

In Vietnam, generous FITs, alongside income tax and land lease payment exemptions, were key drivers for the country's rapid solar and wind power expansion [13]. China's RE policies entered a "Vigorous Promotion Phase" between 2009 and 2017, heavily relying on enhanced governmental incentives and FITs to achieve explosive growth, making China the global leader in newly installed PV capacity [14, 15].

Phase" (2017–present), heavily emphasized the role of market mechanisms and gradually reduced reliance on subsidies [14]. The use of auctions in China led to significant price reductions, with FITs typically dropping 10–44% for solar PV projects and 20–28% for onshore wind projects [7]. Globally, countries started using auctions either as the main support scheme or complementary to FIT or RPS [8]. For example, South Korea supplements its RPS main scheme with auctions for long-term supply contracts [8].

The Dominance of Policy Mixes: The modern policy landscape is characterized by complex combinations, or "policy mixes," designed to leverage the strengths of multiple instruments while mitigating the shortcomings of relying on a single approach [8, 19].

Analysis of China's RE policies shows that while various tools are used (Targets & Planning, Industrial Development, Financial Support, Price Regulation, and Operations Management), the most influential policy categories affecting total RE capacity in the period studied were Policy Support + Regulatory Instruments (PS + RI), followed by Economic Instruments + Research, Development, and Deployment (EI + RD&D) [20]. This reflected the government's reliance on strategic plans and legislation. Conversely, for the USA and Brazil, economic instruments tended to be more effective in promoting installed RE capacity [20].

For developing countries with volatile economic conditions, the rigid fixed-price FIT model proved challenging. Policy analysts suggest that the design of FITs must be adjusted to local conditions, often requiring a shift from a fixed price model to a fixed price model incorporating full or partial inflation adjustment to address high macroeconomic risks [12]. Vietnam, for example, is currently considering transitioning from FITs to reverse auctions for offshore wind but remains reliant on FITs due to its lack of technical and management resources for complex policy management and to diversify project scale [21, 22].

4.4. Phase 4: Corporate Decarbonization and the Rise of PPAs (Ongoing)

A recent, significant development is the growth of Power Purchase Agreements (PPAs), particularly Green Corporate PPAs (GC PPAs), which provide a contractual mechanism for purchasing renewable electricity directly from producers [17, 23].

PPAs gain importance as government support schemes mature or expire [17]. In France, many projects authorized in the 2000s are soon exiting the FIT regime (e.g., approximately 1,200 MW of wind parks) and need new market opportunities; PPAs are seen as an attractive solution [17]. Similarly, PPAs are emerging as a necessary tool faced with the disappearance of FIT and FIP systems once RE becomes competitive enough to expand without public support [17].

PPAs are flexible contractual tools that provide long-term price certainty for sellers and reduce energy cost volatility for corporate buyers [24]. They are driven by companies' desire to control energy costs and, critically, reduce their carbon footprint [17, 23]. PPAs are considered effective tools for developing green energy and are widely recognized as a sustainable and green tool [24, 25]. The PPA market has expanded significantly, especially in Europe with over 2.5 GW of offsite PPAs signed in 2019 alone [23]. The ability to acquire associated Guarantees of Origin (GOs) through GC PPAs allows corporate buyers to formally prove their green energy supply [17].

This shift toward PPAs reflects a policy evolution where government interventions move from direct subsidies (FIT/FIP) to creating frameworks that facilitate long-term private commercial arrangements, thereby promoting sustainability and economic efficiency simultaneously [17, 26].

The evolution of RE policy is shaped by a complex interplay of internal and external factors [10]. Initially, *Energy Security* served as the catalyst, compelling countries highly dependent on foreign fuels such as Japan, Korea, Taiwan, Germany, and Turkey to explore domestic alternatives [4, 5]. This foundational driver was later amplified by increasing *Environmental Pressure*, with global commitments

mechanism was the prevailing legal instrument for incentivizing early, large-scale deployment across jurisdictions globally [1], naturally making it the primary subject of academic inquiry on economic efficacy and policy risk during the period 2010–2017.

Conversely, the emergence of 'Auction', 'Feed-in Premium' (Cluster 4), and a focus on 'Policy Mix'—all characterized by warmer colors on the temporal map—coincides precisely with Stage 3 (Market Integration) and the subsequent research surge from 2018 onwards. As RE technologies matured and costs dropped, policy moved from guaranteed returns to competitive, market-based mechanisms, driving scholarly attention toward complex market designs and the optimization of policy portfolios [3]. Furthermore, the persistent focus on 'Regulation' and 'Energy Security' (Cluster 3) underscores the enduring institutional challenges inherent in the Energy Transition, especially as the world moves into Stage 4 (Corporate Decarbonization), where the focus shifts from stimulating generation to managing grid integration, stability, and corporate demand via mechanisms like PPAs. This demonstrates that the academic literature effectively maps and validates the four-stage policy evolution model derived from the content analysis, reflecting a responsive and data-driven scholarly landscape.

The observed four-stage policy evolution provides concrete, stage-specific guidance for policymakers globally, particularly those in emerging and developing economies.

Firstly, for jurisdictions in or approaching Stage 2 (Mass Deployment), the primary implication is the need for stability and predictability. While Feed-in Tariffs (FITs) are effective for initial investor confidence, policymakers must learn from the early adopters' experiences such as Spain, Germany by implementing pre-announced, predictable degression rates and technology-specific caps from the outset. This mitigates the financial risks of excessive, unsustainable subsidies [27] preventing sovereign debt issues and safeguarding the long-term credibility of the policy environment.

Secondly, for markets ready to transition into Stage 3 (Market Integration), the policy focus must shift toward cost-efficiency and market coupling. This necessitates the gradual phasing out of FITs and the strategic introduction of Auctions and Feed-in Premiums (FIPs). Policy design must be robust, ensuring transparency, adequate project pipeline development, and non-discriminatory grid access to encourage genuine competition and continue lowering the Levelized Cost of Energy (LCOE).

Finally, advanced economies in Stage 4 (Corporate Decarbonization) face the imperative of system optimization and regulatory innovation. Policy should move beyond direct financial support for generation to focus on regulatory enablement of grid flexibility. This includes creating legal frameworks that incentivize investment in energy storage, facilitate demand-side response mechanisms, and standardize the contracting environment for Corporate Power Purchase Agreements (PPAs). Enabling PPAs is crucial for leveraging corporate buying power to accelerate decarbonization without relying solely on public financing.

6. Conclusion and Future Research Directions

6.1. Conclusion

This study mapped the global research landscape of renewable energy law and policy from 2010 to 2024, utilizing a PRISMA-guided bibliometric approach applied to 845 Scopus-indexed documents. The analysis confirms the field's increasing academic maturity, marked by a steady growth in publications since 2015. Geographically, research remains anchored by European countries, with Italy leading in output and Switzerland demonstrating the highest citation impact, while emerging Asian economies like Malaysia and South Korea show increasing, albeit peripheral, engagement.

Crucially, the synthesis of the quantitative keyword analysis and the qualitative content review validate an evolution in scholarly focus, which is the global shift in policy priorities. The high frequency of the keyword 'Feed-in Tariff' in the pre-2018 temporal spectrum corresponds to the Stage 2 (Mass Deployment) era, where the academic community prioritized analyzing the dominant instrument for capacity installation. The subsequent emergence of terms like 'Auction', 'Feed-in Premium', and 'Policy Mix' aligns perfectly with Stage 3 (Market Integration) and Stage 4

communities. Legal scholarship must increasingly focus on the justice and equity implications of policy phase-outs and formulate legal mechanisms, for example grandfathering, compensation, retraining programs, to ensure a smooth and just transition that protects vulnerable stakeholders.

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