

Muhtar, Entang Adhy; Rusli, Budiman; Karlina, Nina et al.

## Article

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## Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics  
Düsternbrooker Weg 120  
24105 Kiel (Germany)  
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)  
<https://www.zbw.eu/>

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# Bibliometric Analysis and Visualization of Energy Economics and Policy in Scopus from 2010 to 2021

**Entang Adhy Muhtar\*, Budiman Rusli, Nina Karlina, Candradewini Candradewini, Riki Satia Muharam**

Department of Public Administration, Faculty of Social and Political Science, Universitas Padjadjaran, Sumedang, Indonesia.

\*Email: [entang.apunpad@gmail.com](mailto:entang.apunpad@gmail.com)

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## ABSTRACT

The aim of this study was to analyse the bibliographic characteristics and content of articles on energy economics and policy published in journals indexed by Scopus written by researchers from throughout the world from 2010 to 2021. We conducted a bibliometric and content analysis of publication in the Scopus database. We only retrieved articles written in English. We conducted content analysis using the VOSviewer software and visualized the co-occurrence of keywords and bibliographic coupling of sources and countries. Following the study protocol, we found 838 articles on energy economics and policy over the past 11 years. The most productive journal that published these articles was Journal of Cleaner Production (n = 100). The most productive country was the United Kingdom (n = 353). Based on citations, the most influential authors were O. Ozel (n = 878). The keywords of research on energy economics and policy 8 clusters (e.g policy, energy policy, energy, china, analysis, impact, renewable energy policy and development). From a global perspective, energy economics and policy research in the past one decades has increased significantly. There were United Kingdom published journals dominated publications. Thus, Asian country need to conduct more active research on this topic.

**Keywords:** Bibliometric, Energy, Economics, Policy

**JEL Classifications:** B10, H00, H11, N10, O10

## 1. INTRODUCTION

This article discusses the discourse energy economics and policy during the last one decades (2010-2021). The discourse understanding is inseparable from bibliometric analysis (Lee, 2020; Mifrah et al., 2020; Omoregbe et al., 2020; Saravanan and Dominic, 2014), referring to the incorporation of various frameworks and methods to analyze citations from scientific publications. Such attempt leads to the development of different metrics to gain insight into the intellectual structure of a broad academic discipline and to evaluate the impact of a particular field of study (Akhavan et al., 2016; Putera et al., 2020).

Although some researchers have produced energy economics and policy articles, we have not found research in bibliometric articles

on energy economics and policy utilized social network analysis. This aim of this article was to provide useful data for understanding global publication trends regarding energy economics and policy. This study aimed to analyze the bibliographic characteristics and trends of articles on energy economics and policy published in journals indexed in Scopus written by researchers from throughout the world from 2010 to 2021 and to conduct an analysis of keyword co-occurrence using VOSviewer.

## 2. METHODS

This study did not involve human subjects; therefore, neither institutional review board approval nor informed consent was needed. This study was a descriptive and bibliometric analysis

based on a literature database. The data in this study were retrieved from the Scopus database. To obtain the necessary data, this study used the keyword “energy economics and policy” in the title, abstracts, and author’s keywords. We also limited the searching criteria by only including articles in the last 11 years (2010–2021). In this step, we found 838 articles. In the next step, we downloaded the articles from the scopus database and analyzed the 838 articles that had been sorted by relevance.

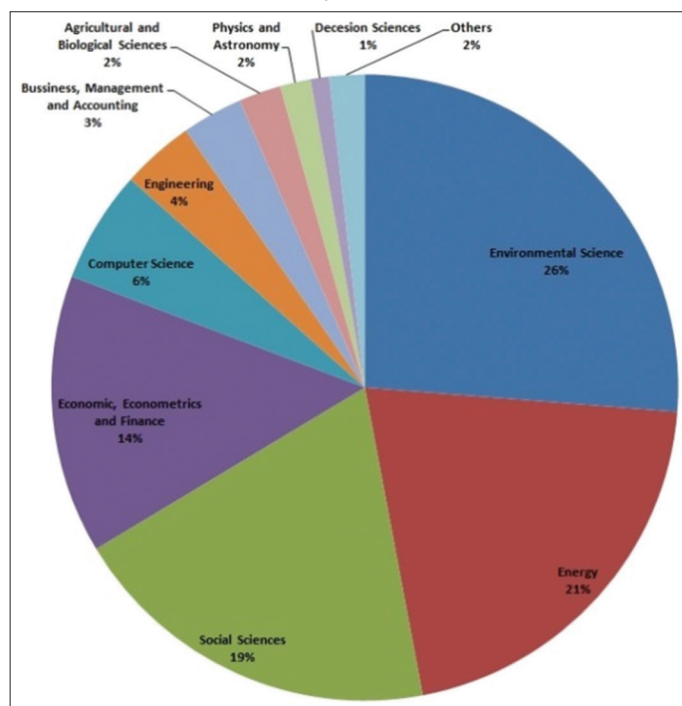
In this study, the metadata and refined Scopus result values were retrieved in the RIS dataset format. However, before the bibliometric analysis, the consistency and reliability of the data were checked to address issues such as a lack of consistency in country names and keywords. The data were also standardized to ensure consistency regarding key words that sometimes appeared in singular or plural, abbreviations, or other forms. The data obtained from the Scopus database were analyzed using VOSviewer software, and simple statistics were calculated using Microsoft Excel.

### 3. RESULTS

Based on a search with the keyword “energy economics and policy”, the result showed approximately 838 documents. Most articles were listed environmental science ( $n = 217$ , 26 %), Energy ( $n = 172$ , 21 %), Social Science ( $n = 160$ , 19 %), economic, econometrics and finance ( $n = 119$ , 14 %), and Computer Science ( $n = 48$ , 6 %). The full distribution of energy economics and policy articles across the top 10 subject areas is shown in Figure 1.

According to VOSviewer, the articles were published in 309 different journals. The highest number of articles were published

**Figure 1:** Distribution of energy economics and policy based on subject area



in Journal of Cleaner Production, with 100 publications, followed by International Journal of Energy Economics and Policy ( $n = 59$ ), Electricity Journal ( $n = 32$ ), Energy Journal ( $n = 20$ ), and Journal of Environmental Policy and Planning ( $n = 15$ ). The other most productive journals with the most publications are shown in Table 1. There were five journals from United States, fourth journals from United Kingdom, and one journals from Turkey.

In the period 2010 to 2021, the United Kingdom was the country with the most publications on energy economics and policy, with 353 articles, followed by the United States with 202 articles. China, India, and South Korea were the Asian countries ranked in the top 10 countries in terms of the most energy economics and policy publications. These three Asian countries ranked six, seven, and tenth, respectively. The top 10 countries can be seen in Figure 2.

Table 2 lists the most influential authors based on citations recorded by the Scopus database. The most influential author was O. Ozel, 878 citations, followed G. Kear ( $n = 431$ ), J. Xu ( $n = 223$ ), L. Nesta ( $n = 167$ ), K. Tutuncuoglu ( $n = 165$ ). Table 3 present the influential source (i.e journals) based on citations. Journal of Cleaner Production ( $n = 103295$ ) was the most influential journal, followed by Energy Journal ( $n = 2427$ ), International Journal of Energy Economics and Policy ( $n = 2009$ ), Journal of Environmental Policy and Planning ( $n = 633$ ), and Electricity Journal ( $n = 632$ ).

A content analysis was performed of the 878 publications sorted by relevance. Next, we performed a co-occurrence analysis with VOSviewer, using the “all keyword” analysis unit and the “full counting” method. We limited the frequency of keyword occurrence to 5 times; out of 2410 keywords VOSviewer found 89 keywords that met the threshold. The results of this analysis are presented in Figure 3.

**Table 1: The most production journals based on the number of publications**

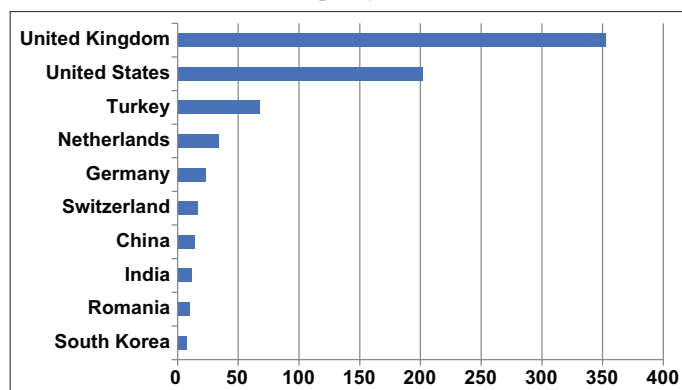
Rank	Journal	No. of Publication	Country
1	Journal of Cleaner Production	100	United Kingdom
2	International Journal of Energy Economics and Policy	59	Turkey
3	Electricity Journal	32	United States
4	Energy Journal	20	United States
5	Journal of Environmental Policy and Planning	15	United Kingdom
6	Journal of Renewable and Sustainable Energy	15	United States
7	Journal of Environmental Management	12	United States
8	Chinese Journal of Population Resources and Environment	10	United Kingdom
9	IEEE Journal on Selected Areas in Communications	10	United States
10	Journal of Physics: Conference Series	10	United Kingdom

**Table 2: The most influential authors and source based on citation analysis**

No	Citations	Authors	Title
1	878	O. Ozel	Transmission with energy harvesting nodes in fading wireless channels: Optimal policies
2	431	G. Kear	Development of the all-vanadium redox flow battery for energy storage: A review of technological, Financial and policy aspects
3	223	J. Xu	Throughput optimal policies for energy harvesting wireless transmitters with non-ideal circuit power
4	167	L. Nesta	Environmental policies, competition and innovation in renewable energy
5	165	K. Tutuncuoglu	Sum-Rate Optimal Power Policies for Energy Harvesting Transmitters in an Interference Channel
6	111	R.W. Malmshiemer	Managing forests because carbon matters: Integrating energy, products, and land management policy
7	96	H. Allcott	Energy policy with externalities and internalities
8	95	P. Linares	Energy efficiency: Economics and policy
9	94	D.R. Bassett	Estimated energy expenditures for school-based policies and active living
10	93	C. Bataille	A review of technology and policy deep decarbonization pathway options for making energy-intensive industry production consistent with the Paris Agreement
11	91	G.A. Blengini	Energy-saving policies and low-energy residential buildings: An LCA case study to support decision makers in piedmont (Italy)
12	90	H. Lu	Integrated energy, energy and economic evaluation of rice and vegetable production systems in alluvial paddy fields: Implications for agricultural policy in China
13	85	J. Li	A comprehensive analysis of building energy efficiency policies in China: Status quo and development perspective
14	78	K. Tutuncuoglu	Optimum Policies for an Energy Harvesting Transmitter under Energy Storage Losses
15	76	M.L. Ku	Data-Driven Stochastic Models and Policies for Energy Harvesting Sensor Communications
16	74	A. Aprem	Transmit power control policies for energy harvesting sensors with retransmissions
17	72	Y. Yuyin	The effect of governmental policies of carbon taxes and energy-saving subsidies on enterprise decisions in a two-echelon supply chain
18	70	K. Novan	Valuing the wind: Renewable energy policies and air pollution avoided
19	68	B. Huang	Analysis of existing building energy saving policies in Japan and China
20	67	H. Yi	Renewable energy politics: Policy typologies, policy tools, and state deployment of renewables

**Table 3: The most influential countries and source based on citation analysis**

Rank	Journal	Country	Citations
1	Journal of Cleaner Production	United Kingdom	103295
2	Energy Journal	United States	2427
3	International Journal of Energy Economics and Policy	Turkey	2009
4	Journal of Environmental Policy and Planning	United Kingdom	633
5	Electricity Journal	United States	632

**Figure 2: Top 10 countries with publication of energy economics and policy**

Policy (314), Energy Policy (159), and Energy (109) were the top three keywords that appeared most frequently. Moreover, we found 8 clusters in this analysis. Figure 3 shows these keywords divided into 8 clusters (each with a different number of keywords), which are represented by colors.

The first cluster (red, 16 keywords) with the most frequent terms being “energy policy” (159 occurrences), “renewable energy policy” (40), and “case” (36). The second cluster (green, 14 keywords) centered on renewable energy (35 occurrence), implication (20 occurrence) and climate policy (18 occurrence). The third cluster (blue, 12 keywords) related to energy efficiency (30 occurrence), tool (13 occurrence), and state (13 occurrence). The fourth cluster (yellow, 12 keywords) related to policy (314 occurrence), China (77 occurrence), and case study (23 occurrence). The five cluster (purple, 12 keywords) focused on energy (109 occurrence), effect (35 occurrence), and policy implication (32 occurrence). The sixth cluster (light blue, 11 keywords) dealt with analysis (69 occurrence), perspective (25 occurrence), and energy efficiency policy (17 occurrence). The seventh cluster (orange, 8 keywords) focused on impact (53 occurrence), role (26 occurrence), and technology (19 occurrence). The eight cluster (brown, 4 keywords) focused on erratum (8 occurrence), forest (7 occurrence), and land management policy (5 occurrence).

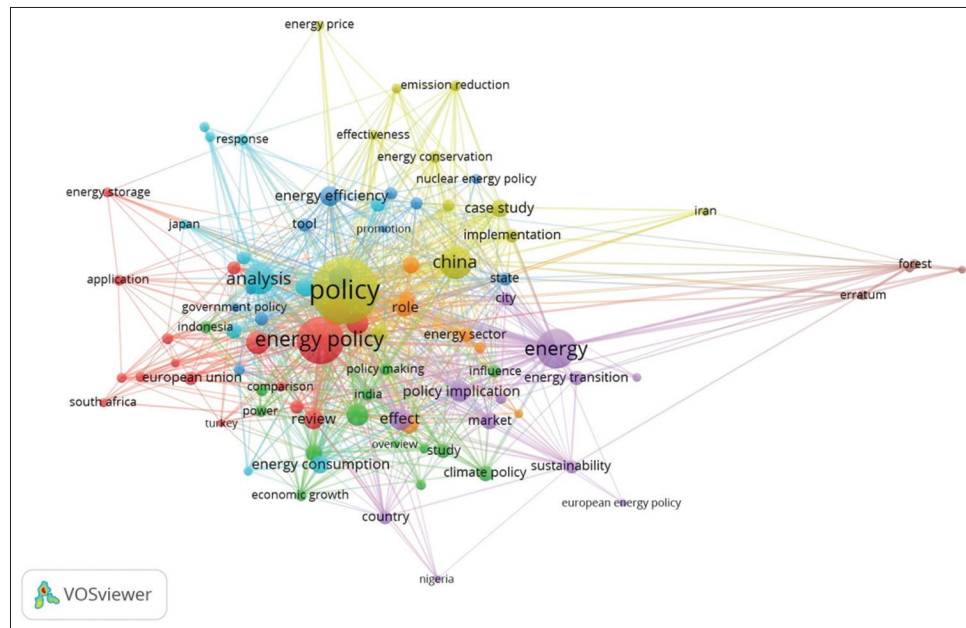
Figure 4 shows an overlay visualization of energy economics and policy literature with the average number of publications from 2010 to 2021. There was a shift in topics; around 2017, the literature on energy economics and policy contained extensive discussions of the terms “Policy,” “Energy Policy,” and “Energy,” and then the last 3 years discussed “evidence,” “environmental policy,” and “perspective.”

## 4. DISCUSSION

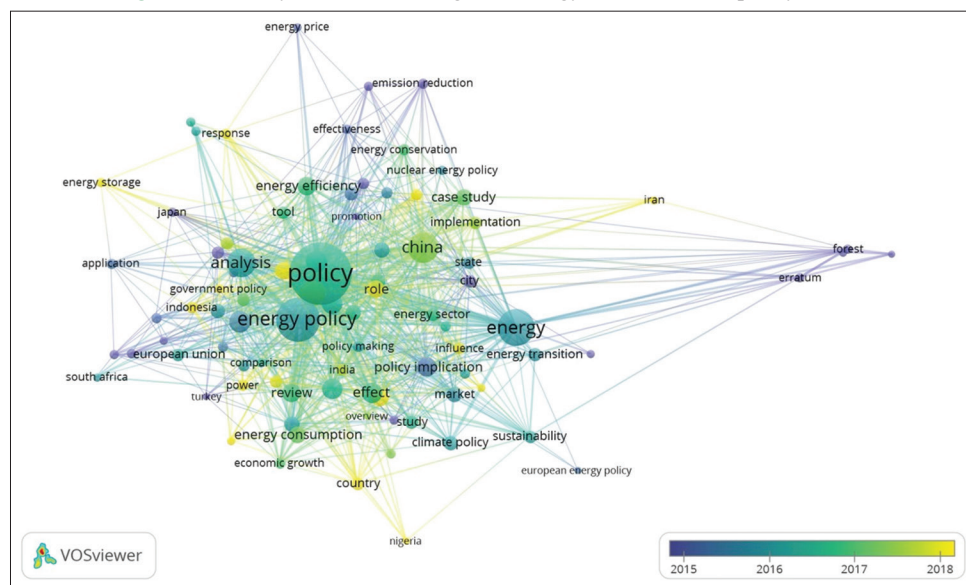
Based on data from Scopus, the publication trends, journal performance, content analysis, and bibliographic coupling of countries and sources were analysed for research on energy



**Figure 3:** Network visualization of energy economics and policy articles published globally in the Scopus database from 2010 to 2021



**Figure 4:** Overlay visualization of global energy economics and policy articles



economics and policy issues throughout the world. The current study focused on articles published in energy economics and policy. This study aimed to provide information on the status of publications in these fields. A total of 878 studies published were recorded in the scopus database. The data showed the rapidity of article publications and the responsiveness of researchers in analyzing on energy economics and policy around the world. However, limited research from a global perspective on energy economics and policy in the past 3 years has discussed energy economics and policy and its relationship with governance within the scope of social science.

Based on Figure 2, the most productive and influential country was United Kingdom followed by United States and Turkey. Although country from United Kingdom dominated the top 10 countries with

the most publications by affiliated researchers, China, India, and South Korea is the country from Asia in the top 10.

The current study has limitations, we only retrieved studies from Scopus and did not use other source such as Web of Science, Crossref, or PubMed Central. Finally, we did not use other analyses in VOSviewer, such as co-citation or co-authorship. Thus, we hope that bibliometric research on this topic will expand in terms of the databases used, the subject areas, and the analyses conducted in order to provide a broader overview of the issue.

## 5. CONCLUSION

In the past two decades, global research on energy economics and policy has increased significantly. The theme of research on

energy economics and policy related to public administration, policy implementation, and local government could be interesting for future discussions.

There are also opportunities to foster discussion about energy economics and policy in social science journals related to public administration. Finally, Europe and United States dominated this field in terms of publications, while research from Asia on this topic remains limited, and further research is therefore necessary.

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