

# Renewable energy: a bibliometric analysis

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**Abstract.** The aims of this paper are to identify existing research on renewable energy; identify the most influential publications, authors, organizations to understand the research areas. The paper is centered on the bibliometric analysis based on the Web of Science database for the key phrase 'renewable energy' in the article title until 2020. We analyzed the publications about renewable energy by years, by research areas, by geography, by research organizations and research sponsors, by journals, by citations of journals, authors, publications, co-occurrence by keywords. Analysis of the most cited publications and authors, analysis of co-occurrence by keywords was performed using VOSviewer. We performed hierarchical cluster analysis, and clusters were selected using VOSviewer. We found 17805 scientific publications on renewable energy published in scientific journals (51.7% of publications were published during 2016-2020). The most popular research areas are energy fuels, engineering, science technology, environmental sciences, ecology, and business economics. The majority of papers was published by the scientists from the United States, China, and India. In addition, we identified six main research clusters. They are related to an optimizer, renewable energy, biomass, co2 emissions, model, desalination. *Conclusions:* This analysis confirmed the author's hypothesis about the definition of new scientific horizons of renewable energy research. Our results can help scientists interested in renewable energy looking for research funding and research project risks based on renewable energy.

## 1 Introduction

All over the world, the study of renewable energy draws interest of various scientific schools, economics, and especially stakeholders, who can benefit from the use of renewable energy technologies [1–7]. Resource constraints, sustainable energy, biomass, co2 emissions make it possible to establish the hypothesis of the transfer of scientific interests from energy fuels and environmental sciences ecology to other areas. The definition of the role and place of renewable energy in business economics, mechanical engineering, science technology and compute science is gaining more and more popularity [8–17].

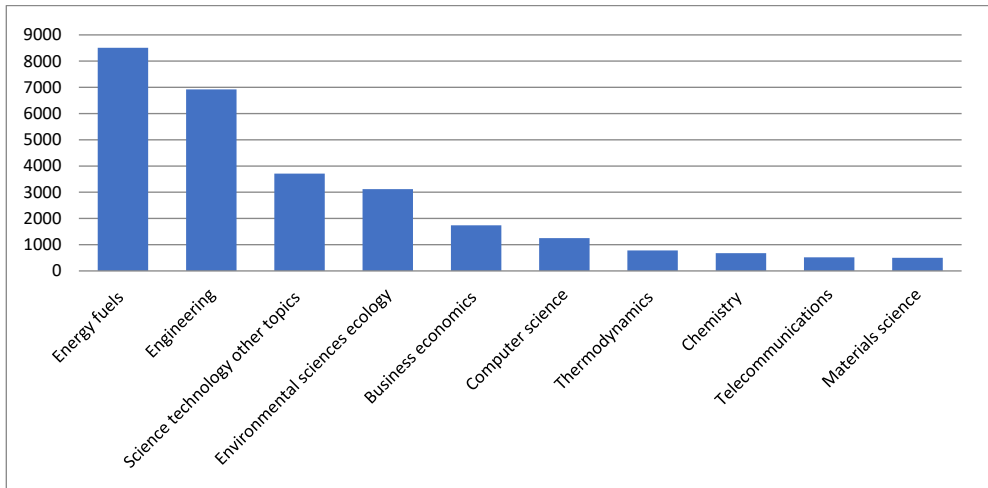
In addition, the essential study of modern scientific schools on renewable energy has a number of patterns, confirming that it is possible to obtain sound theses to determine the

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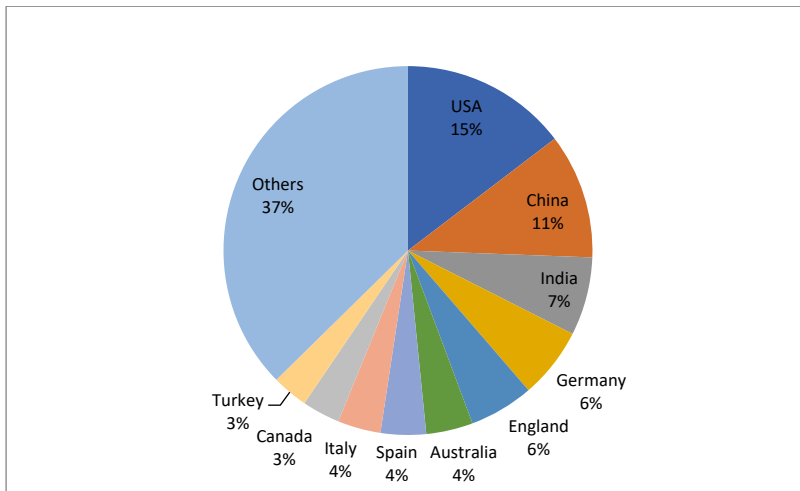




**Fig. 2.** The most popular areas of research based on the Web of Science database (created by the authors)

As can be seen from Fig. 2, most research concerns Energy fuels (47.8%), Engineering (38.9%), Science technology other topics (20.9%), Environmental sciences ecology (17.5%) and Business economics (9.8%).

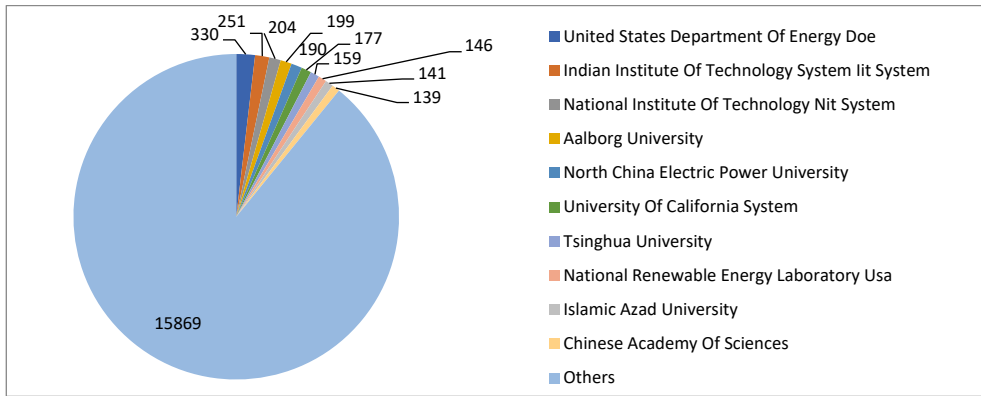
Researchers from around the world deal with renewable energy issues. In fig. 3 presents the countries whose scientists have written the most scientific works.



**Fig. 3.** Number of publications on renewable energy by country based on the Web of Science database (generated by the authors)

As can be seen from Fig. 3, most papers have been published by researchers from the United States (2606 papers), China (1951 papers) and India (1223 papers). At the same time, in some regions, including Ukraine, this topic is insufficiently studied (59 works).

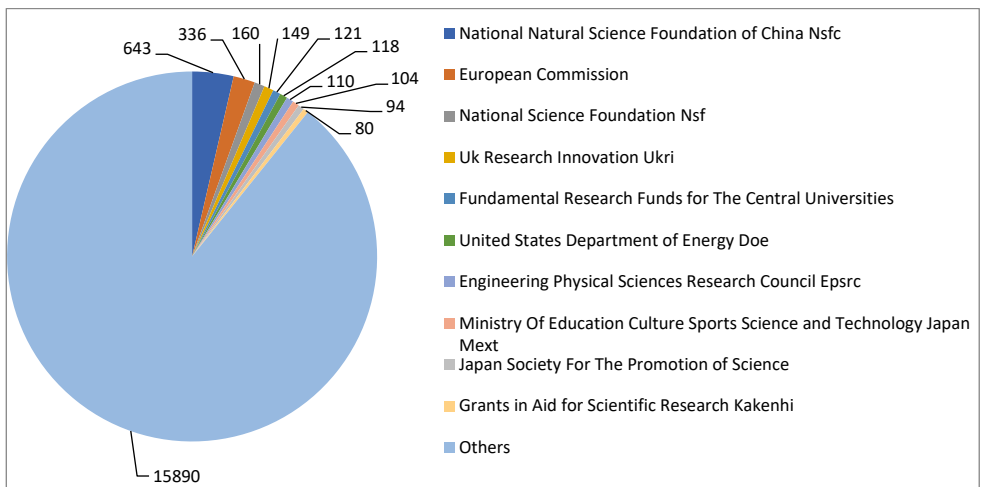
More than 500 organizations conduct research on selected topics. The ten organizations that conduct the most research on selected topics are presented in Fig.4.



**Fig. 4.** The organizations that conduct the most research on the basis of the Web of Science database (formed by the authors)

According to Fig. 4, the most renewable energy issues are dealt with by the United States Department of Energy Doe (1.9%), Indian Institute of Technology System Iit System (1.4%), National Institute of Technology Nit System (1.1%), Aalborg University (1.1%), North China Electric Power University (1.0%).

The research is sponsored by more than 500 organizations. In Fig. 5 presents the ten organizations that most often invest in the development of research of renewable energy.



**Fig. 5.** Organizations that sponsor renewable energy research based on the Web of Science database (created by the authors)

The most frequent sponsors of the research are the National Natural Science Foundation of China Nsfc (3.6%), the European Commission (2.1%), the National Science Foundation Nsf (0.9%) and Uk Research Innovation Ukri (0.8%). (Figure 5).

Renewable energy publications were published in more than 100 publications, with almost a quarter of all publications were published in ten journals (Figure 6).













