Revista Ibero-Americana de Ciências Ambientais
Ibero-American Journal of Environmental Sciences

Set 2022 - v.13 - n.9

ISSN: **2179-6858**

This article is also available online at:
www.sustenere.co

The importance of solar energy for the environment: a bibliometric analysis

From the Industrial Revolution to the present day, energy consumption has been increasing linearly, which has caused worldwide concern for the environment, since much of the generation comes from thermal sources such as coal, oil and gas, which are major emitters of greenhouse effect gases. Therefore, studies based on new forms of energy are promoted, thus emerging renewable energies, including photovoltaic energy, which has the advantage of being an inexhaustible, non-polluting and free source, as it comes from solar energy, being able to contribute in an intense and efficient way in the diversification of the world energy matrix. This work aims to carry out a study of bibliometric analysis and the perception of the population regarding the use of this source for society. For this, the present work carries out a review in the literature, with reading of published material, books, articles and others, for that matter, based on the survey and analysis of scientific articles, the results showed a trend of growth in the numbers of published articles, which reveals a concern to deepen the reflection on this theme.In the textual analysis of the consulted publications, the use of words; solar energy; carbon dioxide mitigation, were highlighted according to the analyzed studies. Bearing the results in mind, studies on the subject are an area that must be analyzed and studied to better understand solar energy, especially in recent years, followed by data collection encompassing data collection with the population with research application that is based on data collection through a questionnaire, seeking to identify some transformation in the use of this technology that has been highlighting and expanding its use in the Brazilian electrical matrix.

Keywords: Bibliometry; Solar Energy; Mitigation of Environmental Damage.

A importância da energia solar para o meio ambiente: uma análise bibliométrica

Da Revolução Industrial até os dias atuais, o consumo de energia vem aumentando linearmente isso tem provocado a nível mundial, uma maior preocupação com o meio ambiente, visto que grande parte da geração vem de fontes térmicas como carvão, óleo e gás que são grandes emissoras de gases de efeito de estudo. Desta forma, promove-se estudos baseados em novas formas de energia, surgindo assim, as energias renováveis, dentre elas a energia fotovoltaica, que apresenta como vantagem tratar-se de uma fonte inesgotável, não poluente e gratuita, pois advém da energia solar, podendo contribuir de forma intensa e eficaz na diversificação da matriz energética mundial. Este trabalho tem como objetivo realizar um estudo de análise bibliométrica e a percepção da população em relação ao uso dessa fonte para a sociedade. Para isso, o presente trabalho realiza uma revisão na literatura, com leitura de material publicado, livros artigos e outros, neste sentido, com base no levantamento e análise de artigos científicos, os resultados evidenciaram uma tendência de crescimento nos números de artigos publicados, o que revela uma preocupação em aprofundar a reflexão desta temática. Na análise textual das publicações consultadas ressaltou o emprego das palavras; energia, solar; mitigação de dióxido de carbono, conforme os estudos analisados. Com vistas aos resultados, os estudos sobre o tema é uma área que deve ser analisada e estudada para melhor compreender a energia solar, principalmente nos últimos anos. seguido por levantamento de dados englobando coleta de dados junto a população com aplicação de pesquisa que se baseia em coletas de dados através de questionário, buscando identificar alguma transformação no uso dessa tecnologia que vem se destacando e ampliando o seu uso na matriz elétrica brasileira.

Palavras-chave: Bibliometria; Energia Solar; Mitigação de danos Ambientais.

Topic: **Sistemas de Energia Sustentável**

Reviewed anonymously in the process of blind peer.

Received: **08/09/2022**
Approved: **25/09/2022**

Flávio Romero Bezerra de Caldas
Universidade Católica de Pernambuco, Brasil
http://lattes.cnpq.br/9753252875419113
http://orcid.org/0000-0002-0586-8920
frbc661@gmail.com

Luiz Filipe Alves Cordeiro
Universidade Federal de Pernambuco, Brasil
http://lattes.cnpq.br/4004156784497834
http://orcid.org/0000-0001-8146-9465
filipecordeiro@gmail.com

Waléria Guerreiro Lima
Universidade Federal Rural de Pernambuco, Brasil
http://lattes.cnpq.br/4366295977643638
waguelima@gmail.com

Liliana Andréa dos Santos
Universidade Federal de Pernambuco, Brasil
http://lattes.cnpq.br/2082746083681399
http://orcid.org/0000-0002-6889-5352
liliana.andrea.santos@gmail.com

DOI: 10.6008/CBPC2179-6858.2022.009.0009

Referencing this:
CALDAS, F. R. B.; CORDEIRO, L. F. A.; LIMA, W. G.; SANTOS, L. A.. The importance of solar energy for the environment: a bibliometric analysis. **Revista Ibero Americana de Ciências Ambientais**, v.13, n.9, p.111-120, 2022. DOI: http://doi.org/10.6008/CBPC2179-6858.2022.009.0009

INTRODUCTION

Technological development, industrial growth, and the improvement in the standard of living in a given society are accompanied by the evolution of energy consumption through the increase of energy resources. According to scientists, the problem is that we are emitting greenhouse gases (GHGs) at a very fast pace, causing a great imbalance, and thus promoting a marked heating in a short period of time. This phenomenon began in the Industrial Revolution, when humanity started to use fossil fuels more intensively to move its machines and since then, GHG emissions have increased more and more, raising the average temperature of the planet. Without energy, the activity's socioeconomic status does not develop. By enabling the development of new products and infrastructure, energy also brings quality of life. Since energy is so vital for development, it is necessary to plan its consumption (SILVA et al., 2017).

Many of the current human activities use energy and most of this energy comes from burning fossil fuels. Fossil fuels are coal, petroleum derivatives (such as gasoline and diesel oil) and natural gas. The main GHGs emitted when burning these fuels are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and water vapor (H_2O). CO_2, also called carbon dioxide, is the most relevant GHG, as it is the largest in these emissions (CORDEIRO, 2018).

In addition to the high use of electro/electronic products in the current century, one can clearly see the concern of scholars around the world, with the consequences on our planet from climate change, which have occurred due to human practices (BLANK, 2015).

In this scenario, we need to adopt measures to avoid climate change. In addition to fighting deforestation and fires, the solution involves adopting technologies that can minimize GHG emissions into the atmosphere, including replacing fossil fuels with other energy sources. The big challenge is the fact that our society is very dependent on energy. We use it in everything: in our home, schools, offices, cars, buses, planes, companies, and industries (MAO et al., 2020).

In the world, concerns about the climate reinforced a series of reflections and initiatives towards an Energy Transition, that is, a transformation in the energy matrix. For this transition to occur, countries are focused on reducing the participation of fossil sources in their matrices, as well as promoting actions to increase energy efficiency, energy storage and encourage sources that do not emit GHG in their operation. Technologies to remove emitted carbon (such as carbon capture, storage and use and forestry compensation) are adopted. That way, the trend is that the world will reduce the use of non-renewable or emitting sources, especially coal, fuel oil and diesel oil in electricity generation and increase the use of renewable and non-emitting sources, such as wind, solar, bioenergy (liquid biofuels and thermoelectric plants using biomass and waste), hydraulic and nuclear. Other possibilities that have been discussed a lot are: the use of renewable or zero-carbon hydrogen (especially green and blue hydrogen) in various industrial processes and the use of large batteries for energy storage (MOURATIDIS et al., 2021).

In Brazil, the energy sector is not primarily responsible for GHG emissions. In addition, our Energy Matrix and, mainly, our Electric Matrix, have a greater share of renewable and zero carbon energies than the

world matrices. In order to maintain the high renewability of the Brazilian electricity matrix, wind and solar sources have increased their contribution to the country's electricity generation. Due to the variation in the availability of wind and sun, the electricity generated by these sources also varies. Therefore, it is understood that thermoelectric plants are still important to guarantee stability to the electrical system, due to the possibility of being activated more immediately. In this context, a fuel that has been increasingly used for thermoelectric plants is natural gas which, despite being a fossil fuel, its burning emits less GHG than the burning of oil and coal, and therefore it represents an Energy Transition fuel. With the diffusion of the use of biomethane and hydrogen, natural gas can be replaced by these renewable fuels, creating a progressive trajectory of sustainability over time (MAIELLARO, 2016).

One of our biggest challenges is in the transport sector, which mainly uses fossil fuels. To reduce GHG emissions from this sector in Brazil, one of the initiatives is to encourage the use of biofuels (remember ethanol and biodiesel and learn about RenovaBio). Electric vehicles, such as the electric bus, which do not emit GHGs when operating, are also discussed. The Fuel of the Future program is also being developed, which proposes measures to increase the use of sustainable, low-carbon fuels. In addition, in recent years there have been advances in Energy Efficiency in the sectors that consume the most energy: transport and industrial (SCARINCI et al., 2017).

Finally, it is also important to mention that the Energy Transition will have to be fair and inclusive to be successful, considering the priorities and possibilities of each country, aligned with the Sustainable Development Goals (SDGs).

Gradually, solar energy is becoming a reality in our society. Quite common, this migration in homes and businesses has also aroused the interest of educational institutions, mainly to obtain financial gains using this important source of natural resources.

Brazil was the 4th country that added the most photovoltaic solar capacity in 2021 in the world, with new 5.7 GW in the last year, according to a calculation by the Brazilian Association of Photovoltaic Solar Energy (ABSOLAR) based on updated data by the National Electric Energy Agency (ANEEL) and the recent publication by the International Renewable Energy Agency (IRENA).

The solar energy market in Brazil has shown itself to be increasingly resilient in the face of the challenges posed by the Covid-19 pandemic and more recently by Russia's war in Ukraine.

This research focuses on mapping the knowledge about solar energy in a day care center, aiming to promote knowledge and seeking to mitigate electricity costs in the school under study, encouraging awareness of environmental preservation and sustainability through education. The implementation of a solar energy system in the nursery will provide students with a wealth of knowledge combined with practice. In the future, this implementation could make this renewable energy source bring economic benefits to the school.

Faced with the changes resulting from globalization, society inserted in this process seeks to accompany these technological advances by changing paradigms and transforming the environment in which it lives, seeking to adapt to changes and the environmental and energy crisis. Humanity has evolved through

time and sources of energy have emerged, configuring the main driving force for modern society, according to Goldemberg (1998) constituting the key to economic development.

THEORETICAL REVIEW

Electric Energy And Its Importance

Due to the growing demand for energy in several countries around the world, and especially the fluctuation in oil prices, this perspective is driving different sectors of the industry every day to change the way these changes come, especially regarding the environment, climate changes and future prospects for energy generation. Seen as an indispensable good for human development (CORDEIRO et al., 2013)

Solar Energy Panorama

When the first photovoltaic cells appeared, the cost of producing them was very high, this fact made the application of this technology widespread, mainly due to the practicality of installation and the benefits granted by governments for installation.

The rapid growth through government incentives generated some noise points between distributors and generating agents, due to non-payment for the use of the electricity grid, leaving this cost exclusively for distributors and consumers who do not have their own generation. Faced with this dilemma, the National Electricity Agency - ANEEL launched a public consultation in 2018, aiming to equalize tariffs and improve the performance of distributed generation.

Top 10 countries in annual increase in installed capacity and total installed capacity in 2017 (Figure 2).

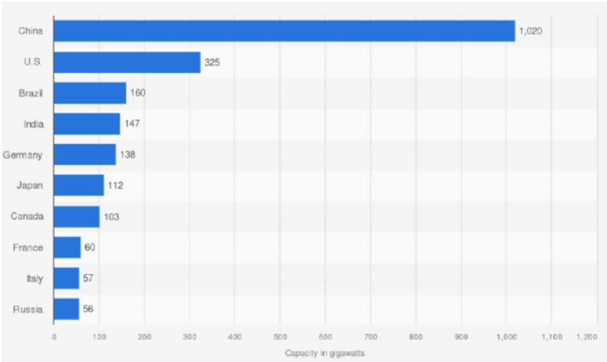

Figure 2: Countries Solar Energy. **Source:** IRENA (2022).

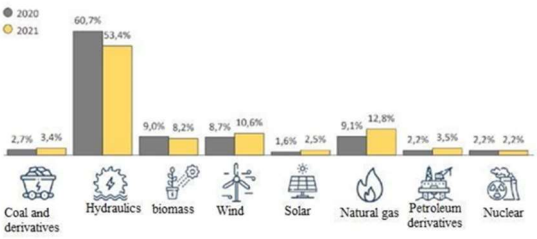

Figure 3: Brazilian Energetic Matrix. **Source:** (EPE, 2022).

The use of solar power to generate electricity provides several benefits from an electrical, environmental, and socioeconomic point of view (ABSOLAR, 2016).

METHODOLOGY

Bibliometric Analysis Methodology

Data collection was carried out on May 17, 2022, by Portal de Periódicos Capes, and due to the large volume of publications, seeking documents published between 1994 and 2022 on the subject.

The bibliometric analysis for this study was carried out through a survey of the *Scopus* database, using them in the English language, where the keywords TITLE-ABS-KEY ("solar energy" AND "CO_2" AND "mitigation") were used as criteria for selection of articles, from 1994 to 2022. Indicators related to solar energy and CO_2 mitigation were used, to investigate how the scientific community has been dealing with this issue. The search for indicators was applied to the title, abstract and keywords, using the indicators "solar energy", "CO2" and "mitigation", using the Boolean operator 'AND'". After applying the Boolean operators, a total of 220 documents were obtained. In this study, data were collected from the Scopus database, and extracted in "CSV. excel'' format. The choice of the Scopus platform was because it provides access to the main citation databases in the world (VILAS et al., 2017), considered the largest company for the dissemination of scientific, technical, and medical information in the world (KHISTE et al., 2017), another criterion was to be a journal with great impact in the field of knowledge.

For the bibliometric analysis of the found documents related to the indicators researched, the *VOSviewer* software was used, a free program used to build maps (clusters) based on networks, using data cluster mapping techniques (VAN et al., 2010). The *Vosviewer* software was used to map the bibliometric networks for citation of documents, citation of journals, citation of countries and occurrence of keywords. In Figure 4, the methodology of bibliometric analysis is summarized.

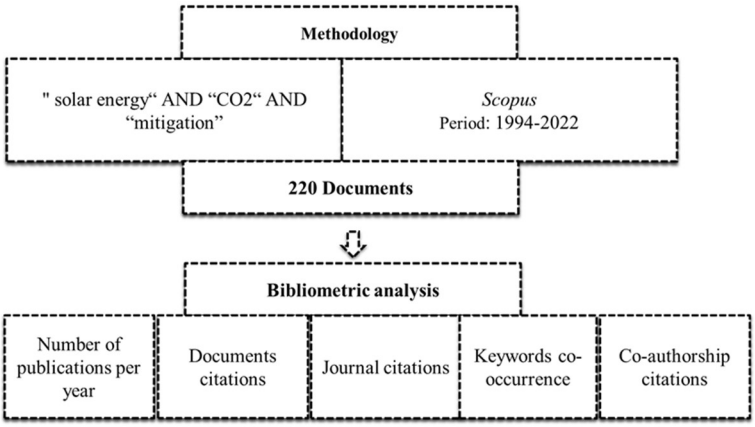

Figure 4: Methodologic steps.

RESULTS AND DISCUSSION

Publications per year

Aiming to quantify the number of publications per year, the words *solar energy* and *carbon dioxide* were applied in the *Scopus* search, obtaining a result of 220 publications, after choosing the filters: period 1994 to 2022. Figure 5 shows the number of publications and the evolution over the years of the articles considered for the study.

The first article related to the solar energy theme was identified in the *Scopus* database, it was from 1994 and was published in the journal Energy with the title "*Solar combined thermochemical processes for CO_2 mitigation in the iron, cement, and syngas industries*". As for annual productivity, only 4 articles were published between 1994 and 1996. In 1999 and 2002 there were no published articles on the subject. In

2014, 2016, 2017, 2020, 2021, 2022, there was a significant increase in publications, ranging from 17 to 25 articles. The number of publications peaked in 2021 with 25 published articles. The search on the Scopus platform was carried out on May 17, 2022, to date, 20 articles had been published in the year 2022.

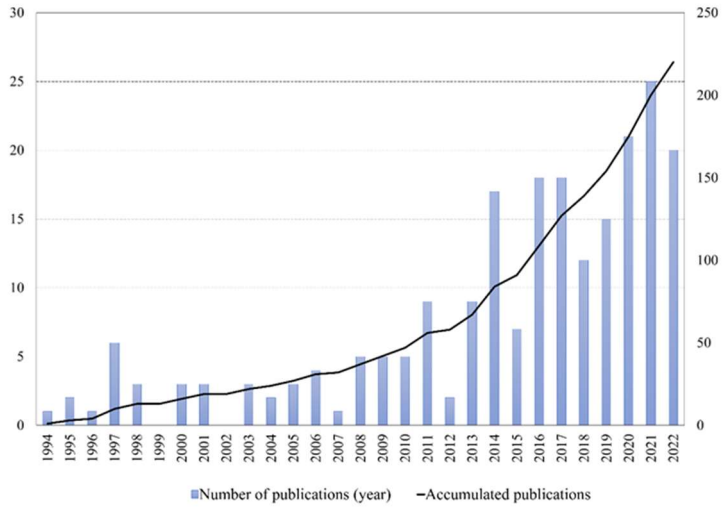

Figure 5: Publications on solar energy from 1994 to 2022.

Documents citations

Figure 6, shows the number of scientific publications registered in *Scopus* through the thematic axis of the study, reaching a total of 220 documents. Of this total, using the filter of 10 citations per document.

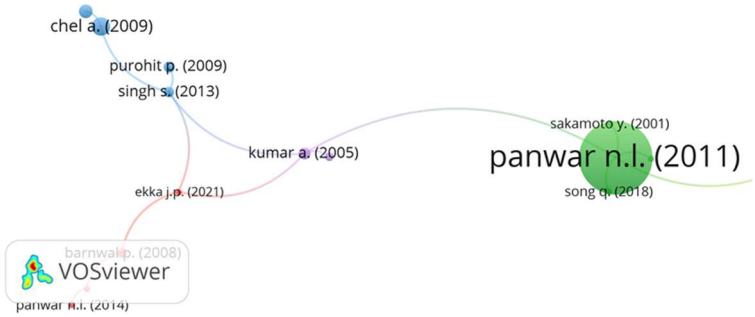

Figure 6: Documents citations.

The ranking of most cited documents was Panwar (2011), Chen (2011), Chel (2009), Yettou (2014), Chel (2010) (Table 1).

Table 1: Ranking of most cited documents.

Ranking	Document title	Author (Year)	Citations Number	Journal	DOI
1º	Role of renewable energy sources in environmental protection: A review	Panwar n.l. (2011)	1848	Renewable and Sustainable Energy Reviews	http://doi.org/10.1016/j.rser.2010.11.037
2º	Nonrenewable energy cost and greenhouse gas emissions of a 1.5 MW solar power tower plant in China	Chen g.q. (2011)	91	Renewable and Sustainable Energy Reviews	http://doi.org/10.1016/j.rser.2010.12.014
3º	Thermal performance and embodied energy analysis of a passive house - Case study of vault roof mud-house in India	Chel a. (2009)	90	Applied Energy	http://doi.org/10.1016/j.apenergy.2008.12.033
4º	Solar cooker realizations in	Yettou f.	66	Renewable and	http://doi.org/10.1016/j.rser.2014.05.018

	actual use: An overview	(2014)		Sustainable Energy Reviews	
5º	Stand-alone photovoltaic (PV) integrated with earth to air heat exchanger (EAHE) for space heating/cooling of adobe house in New Delhi	Chel a. (2010)	48	Energy Conversion and Management	http://doi.org/10.1016/j.enconman.2009.10.001

The most cited document was Panwar (2011), entitled "*Role of renewable energy sources in environmental protection: A review*", with 1848 citations, published in Renewable and Sustainable Energy Reviews (Table 1). The second most cited document was by Chen (2011), entitled "*Nonrenewable energy cost and greenhouse gas emissions of a 1.5 MW solar power tower plant in China?*", cited 91 times, published Renewable and Sustainable Energy Reviews. The third most cited document was by Chel (2009), entitled "*Thermal performance and embodied energy analysis of a passive house - Case study of vault roof mud-house in India*", with 90 citations and published in the journal Applied Energy. The fourth most cited document was Yettou f. (2014), entitled "*Teleworking: benefits and pitfalls as perceived by professionals and managers*", with 66 citations and published in Renewable and Sustainable Energy Reviews. The fifth most cited article was Chela (2010), entitled "*Stand-alone photovoltaic (PV) integrated with earth to air heat exchanger (EAHE) for space heating/cooling of adobe house in New Delhi*", with 48 citations and published in the journal Energy Conversion and Management.

Number of publications by journals

Of the 220 articles that are part of the sample obtained on the *Scopus* platform, they were published in 130 journals, with at least one article published in each one. Of these, 11 journals had three or more published articles in the field. According to Table 2, these journals together published 85 articles, which represents 38.6% of the articles in the total sample.

The journal "energy" is the leader in the number of published articles (13 articles), which represents 5.9% of the total sample, followed by the journals "*energy conversion and management*" and "*renewable and sustainable energy reviews*" with 4, 54% (10 articles) each, "*applied energy*" and "*solar energy*" with 3.58% (8 articles).

Table 2: Ranking of publications and citations per journals.

Ranking	Journal	Documents number	%220	Citations number
1	energy	13	5,9	627
2	energy conversion and management	10	4,54	575
3	renewable and sustainable energy reviews	10	4,54	2603
4	applied energy	8	3,63	322
5	solar energy	8	3,63	229
6	renewable energy	7	3,18	215
7	journal of cleaner production	6	2,72	91
8	energies	5	2,27	53
9	aiche annual meeting, conference proceedings	3	1,36	3
10	energy procedia	3	1,36	90
11	energy sources, part b: economics, planning and policy	3	1,36	25
12	international journal of hydrogen energy	3	1,36	83
13	studies in surface science and catalysis	3	1,36	0
14	sustainable energy technologies and assessments	3	1,36	17

Geographic analysis of publications

Analyzing the country of affiliation of the authors, this research topic is global, since the 220 articles that are part of the sample are distributed in 59 countries, with at least one published article in each of these countries. The bibliometric map presented in Figure 7 shows that 45 countries have a co-authorship cooperation network with other countries represented in 8 clusters.

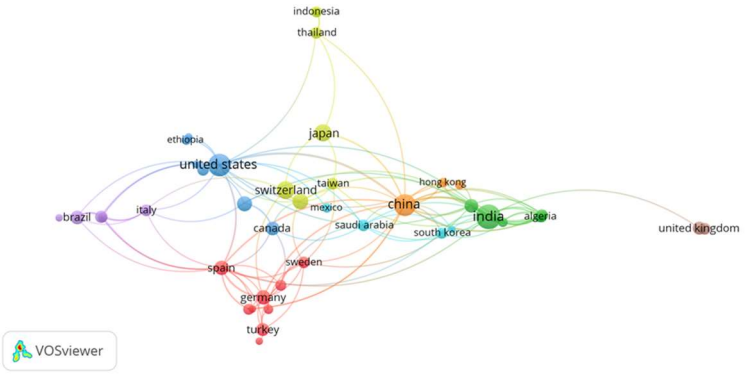

Figure 7: Countries.

Table 3 lists the 10 countries that produced the most academic work in the research area; together, they account for 87.4% of all published documents. According to table 3, India is the country with the highest number of publications, totaling 50 documents, followed by the United States of America (37 documents) and China (33 documents). Brazil is in 10th place with 7 published documents, behind only Spain (8 documents).

Table 3: Number of author's publications by country (1994–2022).

Ranking	Country	Documents Number	%220
1	India	50	22,7
2	United States	37	16,8
3	China	33	15
4	Switzerland	16	7,2
5	Japan	14	6,3
6	Australia	11	5
7	Iran	9	4,0
8	Germany	8	3,6
9	Spain	8	3,6
10	Brazil	7	3,2

Keywords occurrence

The most used keywords were identified and analyzed to classify the 220 articles obtained as a final sample. The bibliometric map represented in Figure 8 groups the keywords into four clusters, represented by the colors red (cluster 1), green (cluster 2), blue (cluster 3) and yellow (cluster 4).

Of the 220 articles, 2357 keywords were identified in total, of which 463 words appeared only once, which means a prevalence of 19.64%. Another 32 keywords occurred at least 15 times (Figure 8), which means a prevalence of only 1.35%. Table 4 shows the keywords with the highest number of occurrences (Top 5). The keyword "solar energy" occurred 172 times, being the most used word to summarize the main theme of the analyzed articles, followed by carbon dioxide (124), greenhouse gases (49), solar power (46) and solar power Generation (35).

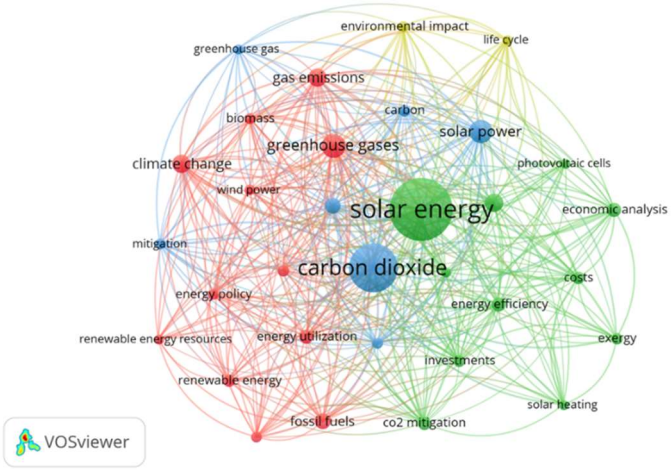

Figure 8: Keywords occurrence.

Table 4: Keywords Ranking.

Ranking	Keywords	Occurrence	Cluster
1º	solar energy	172	**1**
2º	carbon dioxide	124	**1**
3º	greenhouse gases	49	**4**
4º	solar power	46	**2**
5º	solar power generation	35	**4**

Analysis by author

Of the 220 analyzed documents, a total of 700 authors were identified, of which 357 authors had at least one document and 10 citations. Of the 357 authors, 57 authors had a cooperation network among them. The bibliometric map represented in Figure 9 represents the 57 authors with the highest number of documents grouped into eight clusters, identified by the colors red (cluster 1), green (cluster 2), blue (cluster 3), yellow (cluster 4), lilac (cluster 5), light blue (cluster 6), orange (cluster 7) and brown (cluster 8).

Figure 9: Most cited authors.

Table 5 identifies the authors with the most publications on the subject. Swiss professor Steinfeld, A., from Paul Institute of Technology-Switzerland, ten of the 220 publications, followed by Indian professor Reddy K.S., professor at Madras Institute of Technology-India.

Tabela 5: TOP 5 dos autores com mais publicações sobre a temática.

Ranking	Author	Institution/Country	Number of documents	%220
1	steinfeld a.	Paul Institute of Technology, Switzerland	10	4,54
2	reddy k.s.	Indian Institute of Technology Madras, India	8	3,63
3	tiwari g.n. (professor)	Shri Ramswaroop Memorial University, India	5	2,27
4	kandpal t.c.	Indian Institute of Technology Delhi, India	5	2,27
5	sharon h.	Andhra Pradesh National Institute of Technology, India	5	2,27

CONCLUSIONS

This bibliometric study had as its main objective to carry out an analysis of the scientific production about solar energy. The search allowed the analysis of 220 articles indexed to the Sciencedirect database,

clarifying the state of the art in the world.

The analyzed works point out the countries' policies on solar energy, impacts on climate change, increase in investment in renewable energies. This work was limited to the use of the Sciencedirect database, it is suggested for further studies the use of other scientific bases to complement the data explained here.

REFERENCES

BLANK, D. M. P.. O contexto das mudanças climáticas e as suas vítimas. **Mercator,** v.14, n.2, p.157-172, 2015.

CHEL, A.; TIWARI, G. N.. Stand-alone photovoltaic (PV) integrated with earth to air heat exchanger (EAHE) for space heating/cooling of adobe house in New Delhi (India). **Energy Conversion and Management**, v.51, n.3, p.393-409, 2010. **DOI:** http://doi.org/10.1016/j.enconman.2009.10.001

CHEL, A.; TIWARI, G. N.. Thermal performance and embodied energy analysis of a passive house–case study of vault roof mud-house in India. **Applied Energy**, v.86, n.10, p.1956-1969, 2009. **DOI:** http://doi.org/10.1016/j.apenergy.2008.12.033

CHEN, G. Q.; YANG, Q.; ZHAO, Y. H.; WANG, Z. F.. Nonrenewable energy cost and greenhouse gas emissions of a 1.5 MW solar power tower plant in China. **Renewable and Sustainable Energy Reviews**, v.15, n.4, p.1961-1967, 2011. **DOI:** http://doi.org/10.1016/j.rser.2010.12.014

CORDEIRO, L. F. A.. Planejamento do Setor Elétrico Brasileiro com foco na mitigaçãodas emissões de CO2 In: CONGRESSO INTERNACIONAL DETECNOLOGIA PARA O MEIO AMBIENTE, 6. **Anais.** 2018.

CORDEIRO, L. F. A.; AQUINO, R. R. B.; LINS, Z. D.; LIRA, M. M. S.. An Artificial Intelligence Approach to the Energy Efficiency Improvement of a Pump System In: INTERNATIONAL CONFERENCE ENERGYEFFICIENCY IN MOTOR DRIVEN SYSTEMS. **Anais.** Rio de Janeiro. 2013.

KHISTE, G. P.; PAITHANKAR, R. R.. Análise do Termo bibliométrico na Web de Ciência. **Área de Impressão,** v.32, n.1, p.78-83, 2017.

MAIELLARO, V. R.. Um estudo sobre o uso do teletrabalho como ferramenta de redução de custos e melhoria da produtividade. **Revista SADSJ**, v.2, n.4, 2016.

MAO, C.; KOIDE, R.; BREM, A.; AKENJI, L.. Technology foresight for social good: Social implications of technological innovation by 2050 from a Global Expert Survey. **Technological Forecasting and Social Change,** v.153, 2020.

MOURATIDIS, K.; PETERS, S.; VAN WEE, B.. Transportation technologies, sharing economy, and teleactivities: Implications for built environment and travel**. Transportation Research Part D: Transport and Environment**, v.92, p.102-716, 2021. **DOI:** http://doi.org/10.1016/j.trd.2021.102716

PANWAR, N. L.; KAUSHIK, S. C.; KOTHARI, S.. Role of renewable energy sources in environmental protection: a review. **Renewable and Sustainable Energy Reviews,** v.15, n.3, p.1513-1524, 2011. **DOI:** http://doi.org/10.1016/j.rser.2010.11.037

SCARINCI, R.; BAHRAMI, F.; OUREDNIK, A.; BIERLAIRE, M.. Uma exploração das esteiras rolantes como sistema de transporte em centros urbanos. **European Journal of Transport and Infrastructure Research,** v.17, n.2, p.191-206, 2017. **DOI:** http://doi.org/10.18757/ejtir.2017.17.2.3190

VAN E., N. J.; WALTMAN, L.. Software survey: VOSviewer, a computer program for bibliometric mapping. **Scientometrics,** v.84, p.523–538, 2010. **DOI:** http://doi.org/10.1007/s11192-009-0146-3

VILAS, A. K.; RAHUL, K. D.; GAJANAN P. K.. Um Levantamento Bibliométrico da Literatura Publicadapor Web of Science em 'Consortia' de 1989-2016. **NovoMan International Journa de Estudos Multidisciplinares**, v.4, n.10, p.75-82, 2017.

YETTOU, F.; AZOUI, B.; MALEK, A.; GAMA, A. PANWAR, N.. Solar cooker realizations in actual use: An overview. **Renewable and Sustainable Energy Reviews**, v.37, p.288-306, 2014. **DOI:** http://doi.org/10.1016/j.rser.2014.05.018