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A STUDY TO ANALYSE HOW TO USE RENEWABLE ENERGY SOURCES AND PUT SENSORS IN SOLAR PANELS TO TRACK THE AMOUNT OF HEAT PRODUCED

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ABSTRACT

Currently available and future energy requirements may both be satisfied by renewable energy sources. Scopus is a global index for scientific publications, and the primary objective of this work is to present a bibliometric positioning overview of the current status of research on solar panels and clean energy in Scopus. To compile its conclusions, this research used bibliometric approaches. data visualisation and analysis are both present. Employing the Scopus function in conjunction with the VOS Viewer program to assess the results of the search. 1 598 papers that were published between the years 1989 and 2020 are the subject of the data that was utilised in this research. According to the findings of the researchers, the National University of China was the most active institution and nation in the world when it came to studying solar panels and renewable energy. Research and information sources for solar panels and clean energy sources were mostly focused on engineering and energy approaches. These were the key areas of examination. The collaborative efforts of academics resulted in the creation of eight worldwide group maps. In the course of this investigation, the objective was to compile a list of all the published works on solar panels and renewable energy that have been produced over the last 32 years. The information was arranged into categories by utilising the term SERMPTE, which is an abbreviation that stands for Solar energy, Energy, Renewal power, Leadership portion of Power, Technology, and Environmental.

Keywords: Renewable energy, Engineering, Solar panels, Economic development

INTRODUCTION

On a global scale, energy is acknowledged as the driving force behind economic growth. Nuclear power, renewable energy, and fossil fuels are the three primary categories into which the world's energy resources fall. Wind, sun, geothermal power, ocean, hydropower, biomass biogas, etc. are all examples of renewable energy sources that

are defined in Appendix 1 of the document Directive 2009/28 / EC. As a result of rising demand, most of the present energy sources will eventually run dry (Abazari, 2020). To lessen the reliance of the Indonesian people on fossil fuels, particularly to provide for their electrical needs, the government is promoting the development of renewable energy sources. Biogas, a byproduct of methane fermentation, serves dual use as both a fuel and a replacement energy source. Power generation, heat generation, and the creation of a significant volume of LPG gas for domestic consumption are all accomplished via its utilisation as an alternative energy source. There are several advantages to using renewable energy sources, and the technology itself is vital, safe, and developing quickly. Renewable energy is a means to meet present and future demands, improve technology, boost energy efficiency worldwide, and lessen the burden on transmission capacity. Geographical considerations and available resources have prompted a transition to renewable energy in several nations. For instance, as an example of a country with a climate and weather characteristic of tropical or equatorial regions, Indonesia experiences two distinct seasons the dry and the rainy and is thus annually exposed to sunlight, which can be harnessed to generate electricity through solar radiation, a renewable energy source. Renewable energy sources in Indonesia include solar and wind power, water, biomass, biodiesel, biogas, and other similar technologies. The government should have a plan to transition away from non-renewable energy sources in the long run. Both the global energy consumption rate and the environmental effect of this consumption are on the rise, and this is a concern for many different groups, including scientists, engineers, and politicians. Specifically, to ascertain military tactics, including power quality to meet the ever-increasing demand for electricity (Gupta, 2020).

BACKGROUND OF THE STUDY

Increasing electricity production via the use of scattered charging stations based on sources of renewable energy is one ecologically responsible option. More and more households are generating their electricity from small-scale distributed renewable sources, such as solar panels and wind turbines, thanks to rising environmental consciousness and the government's ongoing support (Fatima, 2019). As a result, various forms of distributed generation are likely to drive this technology's rapid expansion in the next years. In addition, a smart grid system that incorporates renewable energy sources to generate power might be a great option for ensuring reliable energy in the future. To increase the efficiency of electricity distribution and prevent resource breakdowns, smart network systems use contemporary information technology for communication. On the other hand, this renewable energy will most likely come from both large-scale industrial facilities (such as state or private companies) and smaller-scale residential installations. Because of the impact that humans have on the climate, renewable energy sources are essential. Lastly, we investigate the potential of using solar energy as a means to reduce reliance on non-renewable resources (Hasan, 2020).

While renewable and other forms of energy have the potential to significantly reduce reliance on fossil fuels, their adoption is still in its infancy in the majority of developing nations. Research carried out by JX Sun, JN Wang, WX Yu, ZH Wang, and YH Wang demonstrates that the suggested algorithm is used for the accurate and dependable sorting of electrical loads in residential areas using solar panels. When it comes to renewable energy and solar panels, much of the prior work has focused on only one area, nation, or association. Despite the tiny proportion of records or metadata, the generation and administration of records by people or organisations is expanding at a fast pace, particularly with the shift from print to electronic. Regrettably, there is a dearth of literature on solar panels and renewable energy sources, even though it presents a worldwide picture map that is updated annually with facts from several published research. Additionally, no publication has directly addressed the substantial beneficial association between affiliation, academics, and the influence of scientific works. The purpose of this research is to examine the bibliometric standing of articles published in English and indexed by Scopus that deal with solar panels and renewable energy on a worldwide scale. From 1989 through 2020, we tracked the growing number of scholarly articles published and ranked by Scopus that pertain to solar panels and renewable energy (Rakhshani, 2018).

PURPOSE OF THE STUDY

The research team behind this project hopes to learn more about how to put solar power and other renewable energy sources to good use. This study intends to track and evaluate the heat produced by solar panels by incorporating sensor technologies into them. To find ways to make solar panels work better, this study is trying to figure out how heat generation relates to energy efficiency. The study's ultimate goal is to provide useful information that will encourage renewable energy sources and lessen the need for fossil fuels.

LITERATURE REVIEW

Renewable energy sources include solar power, wind power, hydropower, fuel cells, and more. Among them, solar power stands out as an eco-friendly option that can reliably and promisingly supply the increasing demand without causing pollution (Sukoco, 2021). Researchers have come up with a novel way to use renewable energy sources in response to be rising energy demands, worries about conventional fuels running out, and the need to preserve the environment from pollution. Keeping all of this in mind. By using the photovoltaic effect, the PV system can transform solar energy into usable electrical power. The photon energy is converted into usable charge whenever light hits

the photovoltaic cell. The electric field across the junction causes the charge carriers to separate into holes, which are positively charged, and electrons, which are negatively charged. When a load is connected to the circuit, creating a closed route, current flows. The global use of solar energy has grown at an exponential rate. The overall growth rate of solar energy output and utilisation is 29.6 per cent, and the pace of rise for both produced and consumed energy is exponential. Whether the solar power panels are moved horizontally, vertically, or along both axes determines the level of complexity in the tracking system. There are broadly two categories of solar tracking devices (Widjaja, 2019). One option is single-axis tracking, which allows for horizontal and vertical movement of the solar panel. Second, there are solar tracking systems that can modify both the azimuth and tilt angles at the same time; these are called dual-axis tracking or two-axis tracking. The cost and ease of side-to-side movement of solar tracking devices are of equal importance. With the use of cantilevers, gears, or motors, solar tracking systems may be mechanically moved by hand. Calculating the obtained energy relative to the expended energy by the tracker modules is the most crucial element to aid the suggested solar tracking systems. Gain is dependent on many factors, including motors, hardware, resistors, and solar panel size. There are two broad categories of solar tracking systems distinguished by the methods used to regulate the photovoltaic module. Active tracking systems and inactive tracking systems are the two primary categories. The solar panel is guided towards the sun by electric motors and gear trains in an active tracking system. An example of a non-electric energy source used by passive tracking systems is a gas fluid with a low boiling point that expands when exposed to solar heat or another phase transition material (Yansri, 2020).

RESEARCH QUESTIONS

What improvements may be made to the surveillance and productivity of heat generation from renewable energy sources by the addition of electronics in solar panels?

RESEARCH METHODOLOGY

China's many different organisations were responsible for carrying out the research. The researcher chose a quantitative technique because of the limited resources and the limited time available. Using a random sampling process, every respondent was contacted for the survey. Following this, a sample size of 754 was determined using Rao Soft. Individuals confined to wheelchairs or who were unable to read and write would have the survey questions read aloud by a researcher, who would then record their answers word for word on the survey form. While participants waited to complete their surveys, the researcher would inform them about the project and field any questions

they may have. On occasion, it was asked that people finish and send back questionnaires simultaneously.

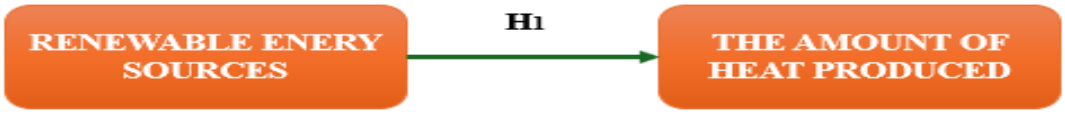
Sampling: Research participants filled out questionnaires to provide information for the research. Using the Rao-soft programme, researchers determined that there were 754 people in the research population, so researchers sent out 852 questionnaires. The researchers got 980 back, and they excluded 22 due to incompleteness, so the researchers ended up with a sample size of 958.

Data and measurement: A questionnaire survey was used as the main source of information for the study. Two distinct sections of the questionnaire were administered: Both online and offline channels' (A) demographic information, and (B) replies to the factors on a 5-point Likert scale. Secondary data was gathered from a variety of sites, the majority of which were found online.

Statistical Software: SPSS 25 was used for statistical analysis.

Statistical tools: To get a feel for the data's foundational structure, a descriptive analysis was performed. A descriptive analysis was conducted to comprehend the fundamental characteristics of the data. Validity was tested through factor analysis and ANOVA.

CONCEPTUAL FRAMEWORK



RESULT

FACTOR ANALYSIS

“The process of verifying the underlying component structure of a set of measurement items was a widely used application of Factor Analysis (FA). The observed variables' scores were believed to be influenced by hidden factors that were not directly visible. The accuracy analysis (FA) technique was a model-based approach. The primary emphasis of this study was on the construction of causal pathways that connect observable occurrences, latent causes, and measurement inaccuracies. The appropriateness of the data for factor analysis may be assessed by using the Kaiser-

Meyer-Olkin (KMO) Method. The adequacy of the sampling for each model variable as well as the overall model was assessed. The statistics quantify the extent of possible common variation across many variables. Typically, data with lower percentages tends to be more suited for factor analysis.

KMO returns integers between zero and one. Sampling was deemed adequate if the KMO value falls within the range of 0.8 to 1.

It is necessary to take remedial action if the KMO is less than 0.6, which indicates that the sampling is inadequate. Use their best discretion; some authors use 0.5 as this, therefore the range is 0.5 to 0.6.

• If the KMO is close to 0, it means that the partial correlations were large compared to the overall correlations. Component analysis is severely hindered by large correlations, to restate.

Kaiser's cutoffs for acceptability are as follows:

A dismal 0.050 to 0.059.

• 0.60 - 0.69 below-average

Typical range for a middle grade: 0.70–0.79.

Having a quality point value between 0.80 and 0.89.

The range from 0.90 to 1.00 is stunning."

Table 1: KMO and Bartlett's

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.891
Bartlett's Test of Sphericity	Approx. Chi-Square	3252.968
	df	190
	Sig.	.000

"The overall significance of the correlation matrices was further confirmed by using Bartlett's Test of Sphericity. A value of 0.891 was the Kaiser-Meyer-Olkin sampling adequacy. By using Bartlett's sphericity test, researchers found a p-value of 0.00. A significant test result from Bartlett's sphericity test demonstrated that the correlation matrix was not a correlation matrix."

TEST FOR HYPOTHESIS

Dependent Variable

The Amount of Heat Produced

The efficiency and functionality of solar panels are greatly affected by the quantity of heat they generate. There is an inevitable energy loss in the form of heat when solar panels transform sunshine into electricity. Some variables, including solar cell materials, solar radiation angle, ambient temperature and wind speed and direction, contribute to this heat output. Solar panels lose efficiency and life expectancy when exposed to too much heat, thus it's crucial to understand the mechanisms of heat creation. Using sensors to measure heat output allows scientists to collect useful information that improves energy management methods and aids in solar panel optimisation. By keeping an eye on things, we can catch problems like overheating in their tracks and fix them quickly to make the system work better. To maximise the advantages of sources of renewable energy and promote more sustainable energy solutions, it is essential to have a thorough grasp of how heat is produced in solar panels n (Abdullah, 2020).

Independent Variable

Renewable Energy Sources

Renewable energy is defined as electricity that comes from naturally occurring sources that can be sustained for an extended period since they are renewed regularly. Renewable energy sources, in contrast to limited fossil fuels, are plentiful and do little damage to the environment. Solar power, wind power, hydropower, geothermal power, and biomass are the five most prevalent forms of renewable energy. Photovoltaic cells and solar thermal systems are the building blocks of solar energy. The term "wind energy" refers to the process of harnessing the power of the wind through turbines. The generation of electricity by the use of flowing water, usually from dams, is known as hydroelectric power. One way to use the Earth's natural heat for electricity or warmth is via geothermal energy. Organic wildlife products, including those from plants and animals, are the source of biomass energy, which may be used to generate power or fuel. Renewable energy can greatly decrease emissions of greenhouse gases, which helps in the fight against climate change; this is its principal benefit. Additionally, it provides energy security by decreasing reliance on foreign fuels and diversifying the energy source. Renewable energy sources may also be employed in the construction,

installation, and maintenance industries, which in turn boosts economic development (Hariyanto, 2019).

A Relationship between Renewable Energy Sources and the Amount of Heat Produced

An important part of energy performance and effectiveness is the link between the quantity of heat generated and renewable energy sources. As an example, when sunlight is transformed into electricity in solar energy systems, heat is also produced as a byproduct of the process. The amount of heat produced depends on some variables, such as the solar technique used, the angle of the sun, and the surrounding environment. A decrease in efficiency may occur if the temperature of the solar panels rises while they are operating. Knowing how to efficiently control heat is crucial since it lowers the electrical output of solar cells. Research into the parameters that influence solar systems' thermal performance and energy output may be advanced by the use of integrated sensors to track heat production (Sukoco et al., 2021).

“Based on the above discussion, the researcher formulated the following hypothesis, which was to analyse the relationship between Renewable Energy Sources and the Amount of Heat Produced.”

“H01: There is no significant relationship between Renewable Energy Sources and the Amount of Heat Produced.”

“H1: There is a significant relationship between Renewable Energy Sources and the Amount of Heat Produced .”

Table 2: H_1 ANOVA Test

ANOVA					
Sum					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	38452.260	563	5655.517	1123.872	.000
Within Groups	532.241	394	5.356		
Total	38984.501	957			

“In this study, the result is significant. The value of F is 1123.872, which reaches significance with a p-value of .000 (which is less than the .05 alpha level). This means

the “H1: There is a significant relationship between Renewable Energy Sources and the Amount of Heat Produced.” is accepted and the null hypothesis is rejected.”

DISCUSSION

The incorporation of sensors into solar panels stands out as a significant advancement in the conversation around the efficient utilisation of renewable energy sources, namely solar power. Knowing how solar panels work is becoming more important as the need for renewable energy sources increases. Although solar panels are efficient in converting sunlight into energy, the heat they produce during this process reduces their overall efficiency. Solar panels' working conditions may be better understood with the use of sensors that measure the amount of heat they generate. With the help of these sensors, we can keep tabs on the temperature fluctuations that happen as we generate energy in real-time. Various elements, including the atmosphere or the orientation of the panels, might affect heat generation, and this data can show you how. Additionally, problems may be caught before they cause major performance drops by keeping an eye on heat levels. Take solar panels as an example; when they become too hot, their efficiency drops and their lifetime is reduced. Adjustments, such as increasing airflow around the panels or using cooling technology, may be made to optimise energy production by understanding these dynamics. Broader methods for managing renewable energy may also be informed by the data obtained by sensors. As an example, it may aid in the creation of smart grids, which distribute energy differently depending on measurements measured in real-time. This all-encompassing method helps renewable energy become more integrated into bigger energy networks while also improving the efficiency of standalone solar installations. Efficiency, environmental sustainability and energy management may all be enhanced via research into clean energy sources and the integration of solar panels with sensor technologies. Stakeholders can optimise solar energy systems, encourage greater resource utilisation, and contribute to an environmentally conscious energy future by harnessing the data collected to make educated choices.

CONCLUSION

Ultimately, there is a great chance to improve energy effectiveness as well as sustainability by studying how to make the most of renewable energy sources, especially by adding sensors to solar panels. To comprehend the working dynamics of solar panels, it is essential to be able to measure the heat that is generated during the energy conversion process. Using the latest sensors, we can collect data in real time that shows how heat generation affects the system's performance and where inefficiencies may be lurking. By taking preventative measures, solar systems may be

managed in a way that keeps panels from overheating and reduces their efficiency and lifespan. In addition, by improving design and operating techniques, the monitoring data may help optimise renewable energy systems as a whole. Combining renewable energy sources with modern monitoring technology will be crucial in maximising energy collection and enhancing the efficiency of our energy infrastructure as we transition to a future that relies more and more on sustainable energy. The overarching objective of this integration is to promote an energy environment that is more robust and sustainable.

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