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An Organized Review of Public Attitudes, Technologies, and Renewable Energy Sources: Towards Sustainable Energy

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Abstract - *Renewable energy sources like solar, wind, and biomass won't become less accessible as a result of use. The ever-increasing need for energy is met by using sunlight, a reliable source of energy. This assessment addresses global energy requirements, domestic renewable energy technology, and popular perceptions of renewable energy. From 2009 to 2018, a thorough assessment of the literature was done. More than 300 articles were categorized during this process, and 42 papers were filtered for critical review. The review of the literature revealed that in spite of significant efforts at all levels to promote renewable energy as a viable alternative to fossil fuels and reduce dependency on them, in 2017 fossil fuels still made up 73.5% of the world's electricity output. On the other hand, renewable energy sources only made up 26.5%. This study also shows that one of the biggest obstacles to the adoption of renewable energy technology is a lack of public knowledge. The findings of this study demonstrate that incorporating renewable energy sources into power generation can help to handle the current global energy crisis. Additionally, this systematic research has emphasized the significance of public opinion and carried out a real-time analysis of public tweets in order to aid the development of renewable energy technology.*

Key Words: Energy policies, public opinion, renewable energy sources (RES), renewable energy technology (RET), solar energy, wind energy.

1.INTRODUCTION

Experts and the general public are becoming more concerned about the topic of renewable energy (RE). In absolute and relative terms, research on renewable energy sources (RES) has increased in recent years [1]. By tackling the problems of fossil fuel depletion and global warming, RES can play a significant role [2]. The three primary sources of energy are nuclear power, renewable energy, and fossil fuels. similar RES Liandong Zhu served as the assistant editor who oversaw the evaluation of this manuscript and gave final approval for publication. Since solar, wind, biomass, geothermal, and hydropower are all used to generate energy, they are all extremely helpful in the fight against energy shortages [3]–[5]. The attitude of the general people and their readiness to pay for electricity from renewable electricity sources were the topic of a recent research [6] of villages in Western Greece. Because they are beneficial to the environment, renewable energy sources are regarded as clean energy sources [7] and are crucial [8], [9]. Traditional reliance on fossil fuels is thought to have contributed to carbon dioxide (CO2) emissions, greenhouse gas (GHG) issues, and environmental damage as environmental consciousness has grown [10], [11]. With the ability to supply energy services with zero or almost zero emission of air pollutants and GHGs, RES can meet domestic energy needs. With the growth of RE, crucial issues including the sustainable development of isolated desert and mountain regions as well as the fulfilment of the requirements to fulfil international agreements relating to environmental protection are anticipated to be resolved. There is currently a global trend to replace conventional fuels with RES in order to meet the excessive energy demand . The need for RE is expanding in the current environment due to a variety of issues, including GHG emissions, CO2 emissions, climate change, and energy security. In contrast to fossil fuels, RES offers economic advantages, environmental benefits, and a pollution-free environment. Therefore, it is crucial for both the present and future generations to rely on RES in order to meet the energy need. To do this, policy-making and public opinion research are needed to encourage the adoption of RE. The impact that public opinion on RE may have on the formulation of policy makes analysis of that opinion essential. Through computer-mediated environments like Web 2.0, public attitudes, a hot area of research, are intensifying. These allow a growing number of individuals to interact and communicate with one another via social media sites like Twitter, Amazon, the blogosphere, etc. By analysing public opinion on social media, this survey hopes to gain insightful information about the use of RE, the difficulties encountered therein, awareness of utilising RES, and acceptance of renewable energy technology (RET) for home use. The purpose of this survey paper is to examine the global demand for RE, the many types of RES used domestically, and to draw practical conclusions on the use and acceptance of RET and RES by the general public.

1.1 Planning the review

The review is organized by putting out the research questions pertinent to our study goal. We also determined the search technique, the search terms, and the inclusion/exclusion standards.

1) Research Questions

The primary goal of this effort is to increase understanding of the importance of RE, RES, and RET. To accomplish the research goals, we have created the following research questions (RQs).

RQ1: Why is Renewable energy needed worldwide?

RQ2: What kinds of renewable energy sources are used for domestic purposes?

RQ3: What are people's opinions about renewable energy technologies, according to?

2) Search Strategy

For this SLR, the study followed Kitchenham's recommendations. In order to investigate the papers pertinent to our study purpose and the research questions, we first used the formal search method. The search field is set up to encompass the well-known databases provided in Table 1 in order to find relevant articles. The papers were initially collected, and then further studies were looked at for significance (snowballing).

Database	Retrieved	Round 1		Round 2	
		Included	Excluded	Included	Excluded
ACM Digital Library	25	10	15	1	9
IEEE Xplore	22	5	17	3	2
ScienceDirect	260	110	150	35	75
SpringerLink	55	10	45	3	7
Total	**362**	**135**	227	**42**	93

Table 1: Count of publications that met the inclusion/exclusion criteria.

3) Search String

The essential terms used in the issue area and the review's goal were used to create the search terms. Using trial and error, a number of pilot searches were carried out to improve the search string's keywords. The following search string was used: (''renewable energy'' OR ''public opinions'' OR ''use of renewable energy'' OR ''solar systems for domestic use'' OR ''solar heaters'' OR ''solar cooker'' OR ''solar cooler'' OR ''biomass'' OR ''hydropower'', OR ''wind'') AND (''energy sources'' OR ''energy demand'' OR ''public opinions'' OR ''domestic products'' OR ''home systems'' OR ''acceptance'' OR ''attitude'' OR ''effects'' OR ''motivation'') AND (''energy crises'' OR '' energy demand'' OR ''clean energy'' OR ''electricity need'' OR ''greenhouse gas emission'').

2. RESULTS

A. Overview of Studies

The stages of the study selection procedure for the systematic review provided in this article are shown in Figure 1. These studies concentrated on three main topics: the need for RES (9 of the 42 research); RES on a home scale (14 of the 42 studies); and public opinion on RES (19 of the 42 studies). The findings are then further addressed in relation to the three research questions (RQ1, RQ2, and RQ3).

1) Why is Renewable energy needed worldwide?

In order to fulfil the demands of the expanding global population and prevent energy crises, it is imperative to introduce methods to meet the rising need for energy.

By 2030, the demand is anticipated to rise by 65% at the current pace of energy use, considering 2004 as the base year. Most of the energy utilized now in the world comes from non-renewable sources like coal-fired power plants. These are recognized to produce significant issues, such as GHG emissions (CO2, NOx, and Sox), as well as contribute to global warming.

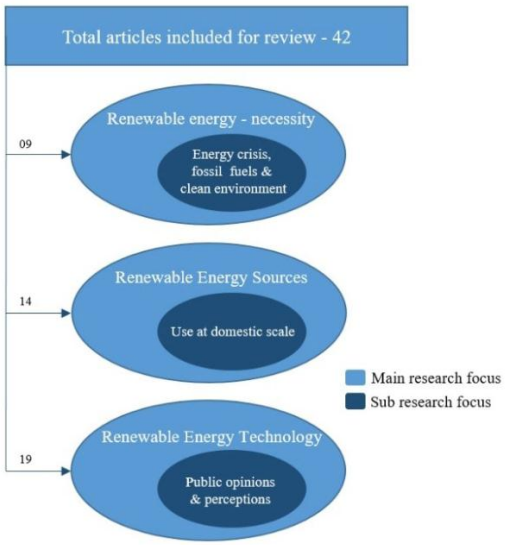

Figure 1: Study Selection Phase

In contrast to industrialized nations, energy crises, particularly those involving electricity, are severe in developing nations. Shakeel et al.'s study laid out a plan for overcoming Pakistan's energy challenges by incorporating RES into power generating. According to a research study, Iran's rural areas are heavily dependent on fossil fuels to supply their energy needs. The report states that a significant portion of the world's electrical production in 2017 came from fossil fuels.

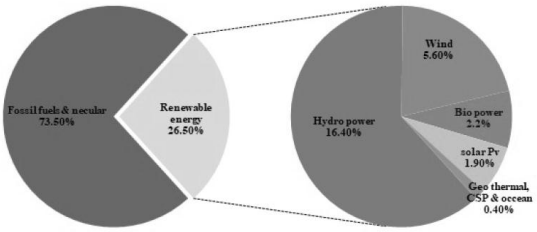

Figure 2: Estimated percentage of electricity production worldwide

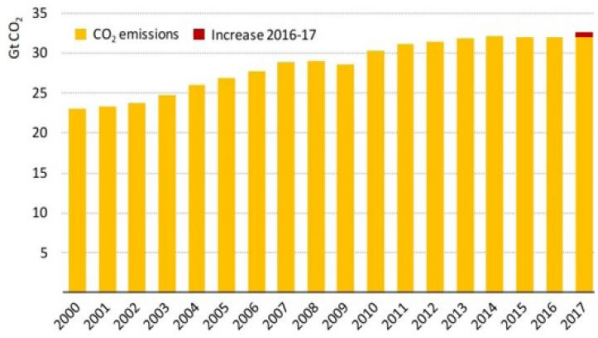

Figure 3: Total CO_2 emissions resulting from energy use

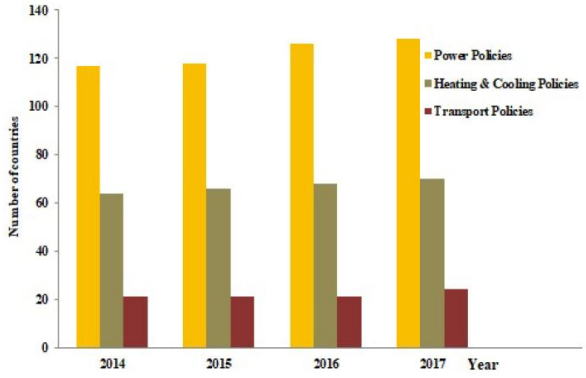

Figure 4: Number of nations with policies promoting renewable energy

2) What kinds of renewable energy sources are used for domestic purposes?

Reliable energy sources, like RES, can significantly improve quality of life. The most prevalent kind of RE, solar thermal energy can be obtained both directly and indirectly. Thermal applications of solar energy include solar water heaters, air conditioners, solar home systems, cookers, and refrigeration. These can provide for a family's requirements and provide a sustainable future. Numerous nations employ solar thermal-based technologies extensively to generate hot water. Both a closed loop and an open loop are built into them. Extremely cold regions are suited for the closed loop solar system. RES applications (solar and biomass) are utilized to reduce a household's electricity usage and meet the energy needs of a single-family detached home. An investigation of household energy use revealed that the installation of a solar water heater might cut overall household energy use by about 13%. The study investigated the possibilities of a hybrid solar Photovoltaic/Thermal (PV/T) collector linked with a thermochemical sorption thermal storage system for a hot water heater in order to enhance the utilization of solar energy on a home scale. Examples of inventions that address domestic energy poverty in developing nations include LED lighting and energy-efficient multi-cookers. Another study revealed that household energy management systems (HEMS) batteries can be recharged using a solar photovoltaic system as a secondary source.

3) What are people's opinions about renewable energy technologies, according to?

According to our analysis of the literature, using RE will be necessary to address upcoming energy-related concerns. To do this, it is essential to raise public acceptability of RET and RES and enhance public awareness of them. In order to increase public acceptability of RES and prevent the serious issue of global warming (caused by the energy produced by fossil fuels), it is essential to analyze popular attitudes towards RES. In this case, RE serves as a good substitute for environmental protection. In order to gauge secondary school students' interest in RE-based systems, a poll was undertaken in Turkey. The vast majority of students were aware of RES that use solar and wind power to generate electricity. These pupils were aware of the problem of global warming, and they believed that using RE would help to mitigate it. Portuguese people have been shown to generally support the growth of new RE projects in their nation, however they are not well-versed in all RES, such as biomass. Malaysia is one of the developing nations that is making a big contribution to attaining a sustainable environment and slowing down climate change. According to a case study conducted in Japan, the local respondents are unwilling to permit wind farms in their back yards. Being the greatest GHG emitter in the world, China is conscious that its policies have a significant impact on international efforts to halt climate change. 2086 Chinese internet users participated in a poll, and it was very well received.

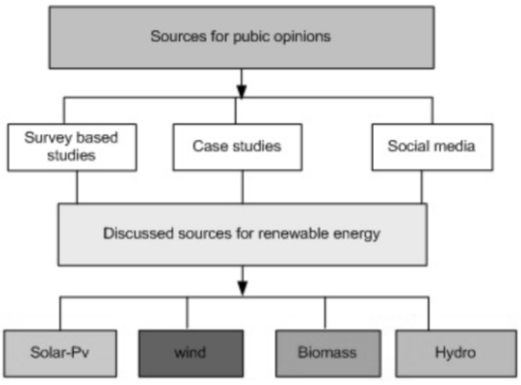

Figure 5: Opinions & Renewable Energy Sources

The sources of public opinion and the sources of RE on which public opinion in this review study is based are explained in Figure 5.

3. OPINION RESEARCH ON RENEWABLE ENERGY POSTED ON SOCIAL MEDIA

An examination of comments made on RE that were received via Twitter is done in order to give a general picture of how

social media is used today for RE. Research on RE has found a great potential to build a sustainable environment and provide today's energy needs, driven by the need for clean energy and the global need for energy. Results for a hybrid renewable energy integration system showed that, due to high upfront expenditures, a grid-connected-only system is not as economically viable as a large-scale renewable energy integration system (wind/PV/connected to the grid). For Denmark and Finland, the Granger non-causality test shows a one-way causal relationship between RE and CO2 emissions, while Sweden and Norway show a two-way relationship between these variables. Interestingly, the findings failed to support any link between RE and growth. The study found that costs for renewable energy, nuclear energy, and fossil fuels are about the same in terms of costs, emissions, and energy security, although energy security of up to 60% of variable renewable capacity is attainable with little cost increase. It is claimed that the existing energy mix is heavily weighted towards thermal energy, with hydrocarbons making approximately 87% of the overall primary energy supply and ultimately leading to higher GHG emissions. Pakistan must transition to RES in order to address these concerns as it has abundant land reserves totaling 800,000 km2 with several prospects for solar, wind, bio, and hydro energy. A different study shows the necessity of RES to address Iran's rural areas' energy difficulties. Iran is thought to receive between 1800 and 2200 kWh/m2 of solar radiation annually, which is more than the average for the world. Despite having productive land, the installation of RES has some infrastructural, managerial, socio-cultural, and economic hurdles. In terms of RET for home use, the production of hot water was one of the aspects taken into account while determining the needs of the general population. With a requirement for 277 kWh of thermal energy to produce residential hot water at a rate of 80 L/min, the direct solar with thermal storage integration (DSTSI) configuration demonstrated great efficiency. The primary factors preventing the widespread adoption of solar water heaters (SWH) for homes are cost, household size, and house design, which affects where a SWH can be installed. The solar cooker is considered to be one of the most significant and practical appliances among RES-powered household products. Solar cookers come in three basic varieties: solar panel cookers, solar box cookers, and parabolic solar cookers. A box-style hybrid solar cooker that is lightweight (weighing only 4.8 kg) and compact in size has been created with a small family in mind.

3.1 EXAMPLE FROM TWITTER

Twitter offers helpful, up-to-date information on a range of subjects, including serious, funny, and social issues. Based on the opinion data results for RE that were made accessible on social media (Twitter), it was found that consumers' perceptions of RE are expressed through significant opinion categories. We have discovered that there are a lot of tweets available about renewable and sustainable energy sources. This gives a general idea of how effective social media is at raising knowledge about various events that could aid in promoting RE. As was covered in the sections above, understanding public opinion is an essential quality for the successful outcome of RE acceptance. It was determined that the efficiency is 38% greater when thermal and photovoltaic energy are combined than when compared to the baseline model. It has appealing properties such being user-friendly, convenient (unattended cooking is allowed at any time), quick to cook, economical, and able to prepare 4-5 meals per day.

3. CONCLUSIONS

The goal of this post was to draw attention to the significance of RES and the RET. The majority of RES, such as solar, wind, and biomass, are utilized in the production of domestic goods, such as water pumps, heat and power generation, and windmills that produce electricity. Solar energy is the most widely accessible renewable energy source worldwide. This is why solar energy is the best replacement for fossil fuels and why most everyday items use solar energy in RET. It is crucial to spread awareness about RES in order to guarantee sustainable development for future generations. Numerous items that are used daily, such solar dryers, coolers, and cookers, can be made using RE. RES, like solar, are used all over the world. In addition to helping to absorb harmful gases like CO2, biomass can also be utilized as a fuel and a source of electricity. Another effective RES resource that may be exploited to generate electricity is wind. Our research confirms that raising the public's awareness of RES and RET can contribute to the success of RE. The introduction of RE-related educational programs through domestic and international platforms can help achieve this. This SLR was conducted in an effort to concentrate on RES & RET in light of public attitudes, which are crucial for promoting the development of RES & RET. Even though

the results evidently contribute to the RE literature, the study has certain some limitations. First, included articles discussed the need of RE, RE at domestic level and public opinions about the use of RET through the use of well-established keywords. However, the current SLR may not have taken into account all essential terms. Second, non-English papers have been removed in order to ensure that the study remained focused and quality conscious. Overall, our study provides an aggregated summary of the research and a qualitative assessment of RES & RET practices among the public, enabling us to systematically identify new research directions.

REFERENCES

[1] F. Rizzi, N. J. van Eck, and M. Frey, "The production of scientific knowledge on renewable energies: Worldwide trends, dynamics and challenges and implications for

management,'' Renew. Energy, vol. 62, pp. 657–671, Feb. 2014.

[2] D. C. Momete, ''Analysis of the potential of clean energy deployment in the European Union,'' IEEE Access, vol. 6, pp. 54811–54822, 2018.

[3] A. Raheem et al., ''Renewable energy deployment to combat energy crisis in Pakistan,'' Energy, Sustainable. Soc., vol. 6, no. 1, p. 16, 2016.

[4] A. Ashfaq and A. Ianakiev, ''Features of fully integrated renewable energy atlas for Pakistan; wind, solar and cooling,'' Renew. Sustain. Energy Rev., vol. 97, pp. 14–27, Dec. 2018.

[5] N. A. Ludin et al., ''Prospects of life cycle assessment of renewable energy from solar photovoltaic technologies: A review,'' Renew. Sustain. Energy Rev., vol. 96, pp. 11–28, Nov. 2018. J. A. Paravantis, E. Stigka, G. Mihalakakou, E. Michalena, J. M. Hills, and V. Dourmas, ''Social acceptance of renewable energy projects: A contingent valuation investigation in Western Greece,'' Renew. Energy, vol. 123, pp. 639–651, Aug. 2018.

[6] Q. Xu, P. Lan, B. Zhang, Z. Ren, and Y. Yan, ''Energy sources, part A: Recovery, utilization, and environmental effects,'' Energy Sources, vol. 35, pp. 848–858, Mar. 2013.

[7] A. M. Saleh, A. Bin Haris, and N. B. Ahmad, ''Towards a UTAUT-based model for the intention to use solar water heaters by Libyan households,'' Int. J. Energy Econ. Policy, vol. 4, no. 1, pp. 26–31, Dec. 2014.

[8] M. Qu, P. Ahponen, L. Tahvanainen, D. Gritten, B. Mola-Yudego, and P. Pelkonen, ''Chinese university students' knowledge and attitudes regarding forest bioenergy,'' Renew. Sustain. Energy Rev., vol. 15, pp. 3649–3657, Oct. 2011.

[9] H. Lucas, S. Pinnington, and L. F. Cabeza, ''Education and training gaps in the renewable energy sector,'' Sol. Energy, vol. 173, pp. 449–455, Oct. 2018.

[10] P. Trop and D. Goricanec, ''Comparisons between energy carriers' productions for exploiting renewable energy sources,'' Energy, vol. 108, pp. 155–161, Aug. 2015.

[11] F. Fornara, P. Pattitoni, M. Mura, and E. Strazzera, ''Predicting intention to improve household energy efficiency: The role of value-belief-norm theory, normative and informational influence, and specific attitude,'' J. Environ. Psychol., vol. 45, pp. 1–10, Mar. 2016.