

A study of people's perception about Domestic Use of Solar Energy

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Abstract: This paper explores public perceptions of domestic solar energy adoption. Through surveys, it examines factors influencing individuals' attitudes towards solar energy for household use. Findings reveal a growing positive perception, driven by environmental concerns and cost savings. However, barriers, such as initial costs and limited awareness, persist. Understanding these perceptions is crucial for designing effective policies and educational campaigns to accelerate the adoption of solar energy at the domestic level. This research contributes valuable insights into the dynamic landscape of renewable energy acceptance, shedding light on the path towards a more sustainable energy future.

Keywords: Solar energy, domestic consumption, environment, government policies

Introduction

As we stand at the crossroads of a rapidly changing global energy landscape, the pressing need for sustainable and renewable sources of energy has taken center stage in the quest for a greener and more sustainable future. Solar energy, harnessed from the most abundant and environmentally friendly source available to us—the sun, has emerged as a beacon of hope in the transition towards cleaner and more accessible energy solutions. Domestic solar energy systems, in particular, have the potential to revolutionize the way households access, consume, and think about energy (Omer, 2008). This paper embarks on a journey to delve deep into the heart of this transformative transition by exploring the perceptions and attitudes of the public towards the domestic use of solar energy.

In recent years, solar energy has experienced a meteoric rise in popularity and adoption Inman (Pedro & Coimbra, 2013). The rapid advancements in solar technology, coupled with decreasing costs, have made solar photovoltaic (PV) systems a feasible option for individual homeowners. These systems allow households to generate their own electricity, reducing their reliance on traditional fossil fuels and utility companies while contributing to a cleaner environment and potential long-term savings on energy bills. However, the adoption of solar energy technologies in domestic settings is not solely determined by technical feasibility and cost-effectiveness; it is equally influenced by people's attitudes, perceptions, and beliefs (Chadwick, Russell-Bennett & Biddle, 2022).

Understanding public perceptions of domestic solar energy use is pivotal for several reasons. Firstly, it shapes the adoption rate of solar technologies, which, in turn, has a significant impact on the global transition to renewable energy sources and the mitigation of climate change. Secondly, public attitudes towards solar energy can influence government policies, incentives, and subsidies aimed at promoting renewable energy adoption. Lastly, it can shed light on the potential barriers, concerns, and motivations that shape individual decisions regarding solar energy adoption.

Literature Review

Solar energy, harnessed from the sun's rays, has emerged as a sustainable and renewable source of power with immense potential to meet global energy needs (Ummadisingu & Soni, 2011). In particular, domestic solar energy systems have garnered attention for their ability to reduce carbon footprints, lower electricity bills, and increase energy independence. However, the adoption and acceptance of domestic solar energy systems are influenced not only by technological advancements but also by people's perceptions, attitudes, and beliefs. This literature review explores the multifaceted landscape of people's perceptions regarding the domestic use of solar energy, shedding light on the factors that influence their decision-making processes.

Environmental Awareness and Concern

A significant driver of positive perceptions toward domestic solar energy is environmental awareness and concern. Numerous studies have found that individuals who are more environmentally conscious tend to have favorable attitudes toward solar energy (Bang, Ellinger, Hadjimarcou, & Traichal, 2000). This is because solar energy is viewed as a clean and green alternative to fossil fuels, contributing to reduced carbon emissions and mitigating climate change.

Economic Considerations

Economic factors play a pivotal role in shaping people's perceptions of domestic solar energy. The potential for cost savings on electricity bills is a key motivator for adopting solar systems (Charters, Heffernan & Daly, 2023). Research has shown that individuals who perceive solar energy as financially advantageous are more likely to consider its adoption. Government incentives and subsidies further enhance the economic attractiveness of solar energy systems (Timilsina, Kurdgelashvili & Narbel, 2012).

Knowledge and Information

Access to information and knowledge about solar energy significantly influences people's perceptions. Studies suggest that individuals with a higher level of knowledge about solar energy tend to view it more favorably. Educational programs, marketing campaigns, and community initiatives aimed at raising awareness about the benefits and functioning of solar systems play a vital role in shaping perceptions (Brunner, 2018).

Social Influence and Norms

Social factors, including peer influence and societal norms, impact the perception of domestic solar energy. Research has shown that individuals are more likely to adopt solar energy when they perceive it as a socially accepted and normative behavior. The influence of neighbors, friends, and family who have already adopted solar systems can be a significant driver in shaping perceptions and encouraging adoption (Irfan, Hao, Ikram, Wu, Akram, & Rauf, 2021).

Policy and Regulatory Framework

Government policies and regulations play a pivotal role in shaping perceptions of domestic solar energy. Supportive policies, such as net metering and feed-in tariffs, create a conducive environment for solar adoption by addressing economic and regulatory barriers (Ndiritu & Engola, 2020). Conversely, uncertainty or frequent policy changes can erode trust and discourage potential users (Roberts, 2020).

Perceived Benefits and Drawbacks

People's perceptions of the benefits and drawbacks associated with domestic solar energy systems are crucial. Studies have highlighted that perceived benefits, such as energy independence and reliability during power outages, positively influence perceptions (Black, Stern, & Elworth, 1985). Conversely, concerns about the intermittency of solar energy and the initial investment cost can dampen enthusiasm.

Cultural and Geographic Context

Cultural and geographic factors also play a role in shaping perceptions. Cultural norms and values may influence how individuals perceive renewable energy sources (Ozaki, 2011). Moreover, geographical factors, such as solar resource availability and climate, can impact the feasibility and attractiveness of solar energy adoption (Sindhu, Nehra & Luthra, 2017).

People's perceptions of domestic solar energy are multifaceted and influenced by a complex interplay of environmental awareness, economic considerations, knowledge and information, social influences, aesthetic and technical concerns, policy frameworks, perceived benefits and drawbacks, and cultural and geographic contexts. Understanding these perceptions is crucial for policymakers, energy providers, and researchers aiming to promote the adoption of solar energy systems.

As solar technology advances and becomes more accessible, addressing and positively shaping these perceptions will be essential to accelerate the transition to sustainable and renewable energy sources. Future research should continue to explore the dynamics of people's perceptions and their evolving role in the adoption of domestic solar energy systems, ultimately contributing to a more sustainable and environmentally conscious society.

Methodology

This research employs a mixed-methods approach, combining quantitative and qualitative data collection methods, to investigate people's perceptions about the domestic use of solar energy. The primary data collection method is an online survey conducted via Google Forms. The survey instrument is designed to capture both quantitative data through structured questions and qualitative insights through open-ended questions, providing a comprehensive understanding of participants' perceptions and attitudes.

Participants

The participants in this study are individuals selected through convenience sampling. The survey is distributed to a diverse group of respondents, including individuals from various age groups, educational backgrounds, and geographical locations. This diversity ensures a broad representation of perspectives on the domestic use of solar energy.

Data Collection

Quantitative Data: The quantitative component of the survey consists of structured questions with predetermined response options. Participants are asked to rate their perceptions and attitudes regarding solar energy on Likert scales and respond to multiple-choice questions about their familiarity with solar technology, its benefits, and barriers to adoption. Quantitative data will be analyzed using statistical software to generate descriptive statistics and explore relationships between variables.

Qualitative Data: The qualitative component includes open-ended questions that encourage participants to provide detailed responses and insights related to their perceptions of solar energy. These questions are designed to capture nuanced opinions, experiences, and suggestions. Qualitative data will be analyzed using thematic analysis to identify recurring themes and patterns in participants' responses.

Survey Instrument

The survey instrument is developed based on a review of relevant literature and research objectives. It encompasses the following key elements:

Demographic Information: Participants are asked to provide basic demographic details such as age, gender, location, and education level. This information helps in segmenting and analyzing the data.

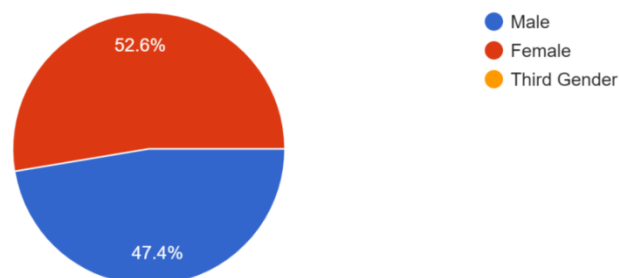
Quantitative Questions: The quantitative section includes Likert-scale questions to gauge participants' attitudes and perceptions regarding solar energy. Multiple-choice questions are used to collect data on specific aspects of solar technology, including awareness and use.

Qualitative Questions: Open-ended questions encourage participants to share their opinions, experiences, and suggestions related to domestic solar energy use. These questions allow for in-depth insights into their perceptions.

Data Representation and Analysis

Quantitative

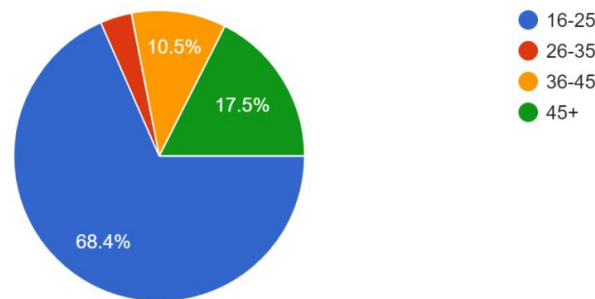
Gender
57 responses



The accompanying pie chart visually represents the gender distribution of respondents in a survey conducted to understand people's perceptions about the domestic use of solar energy. Among the survey participants, 52% were identified as male, reflecting a significant portion of the respondent demographic. The pie chart effectively illustrates the gender balance within the survey sample, with males constituting slightly over half of the total respondents.

Age

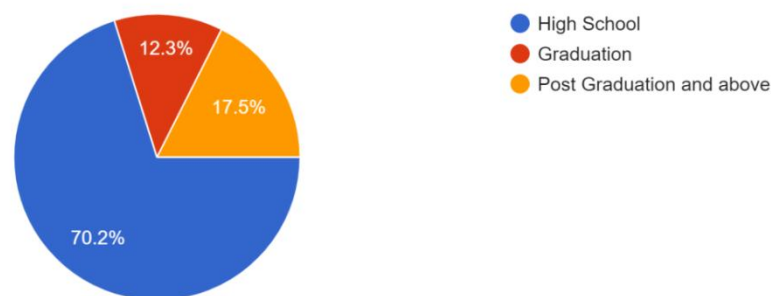
57 responses



The data reveals that a significant majority of respondents, comprising 68.4 percent of the total sample, fall within the age group of 16-25. This age bracket represents a substantial portion of the survey population and underscores the importance of gauging the perspectives and attitudes of younger individuals toward solar energy adoption. In contrast, respondents aged above 45 constitute 17.5 percent of the survey participants. This demographic group, while smaller in proportion, offers valuable perspectives from an older and more experienced segment of the population, shedding light on the perceptions of those with potentially different life experiences and priorities in relation to domestic solar energy utilization.

Educational Qualification

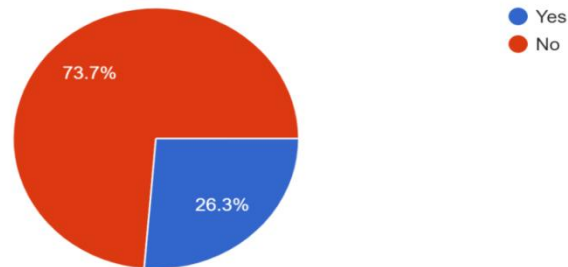
57 responses



The pie chart illustrates the educational backgrounds of respondents in a survey focused on domestic solar energy perceptions. A substantial majority, accounting for 70.2%, are high school graduates, indicating that this demographic holds a significant presence in the survey sample. Graduates make up 12.3% of the respondents, while a notable 17.5% are post-graduates. This distribution underscores the importance of understanding how different educational levels may influence perceptions and attitudes towards domestic solar energy usage. It suggests a diverse participant pool that can provide valuable insights into the topic from various educational perspectives.

Do you have solar panel on the roof of your house?

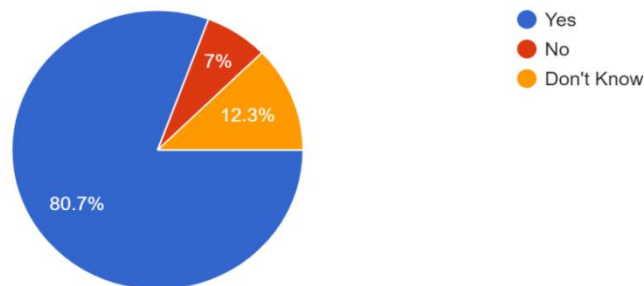
57 responses



The pie chart illustrates the survey findings on domestic solar panel ownership, with 73.7% of respondents affirming that they already have solar panels installed on their roofs. The remaining respondents, constituting the minority, indicated they do not possess solar panels. This data highlights a notable prevalence of solar panel adoption among respondents, showcasing a positive trend in the willingness to embrace solar energy for domestic use. Such a high affirmative response indicates a growing awareness and acceptance of solar technology as an alternative energy source among the surveyed population (Musall & Kuik, 2011).

Would you want to switch to use of solar energy for domestic purposes?

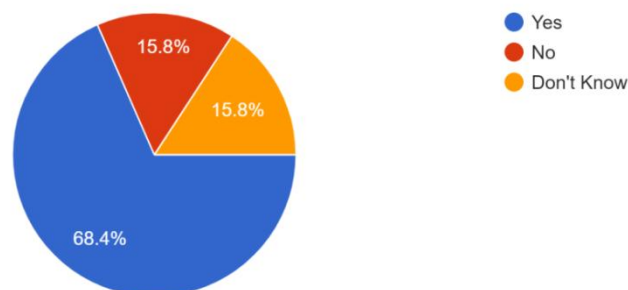
57 responses



The pie chart presents a clear picture of the respondents' views on shifting to solar energy for domestic use. An overwhelming 80.7% of participants expressed a positive inclination toward adopting solar energy, signaling a substantial appetite for this sustainable energy source. However, it is noteworthy that a significant portion of respondents either expressed uncertainty (saying "don't know") or opposition (saying "no"), highlighting the need for further education and awareness initiatives to address potential reservations and promote wider acceptance of solar energy in domestic settings.

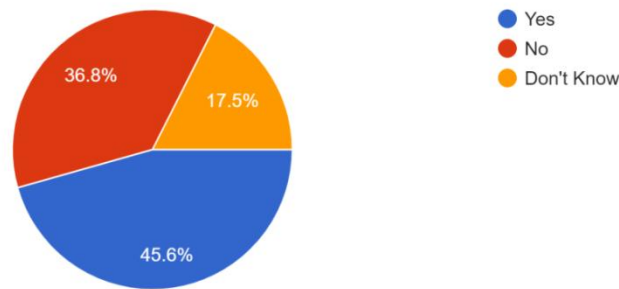
Do you think that solar energy is more cost effective?

57 responses



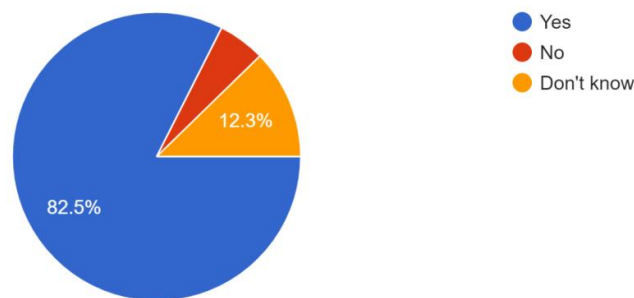
The pie chart vividly illustrates the overwhelmingly positive perception of solar energy's cost-effectiveness among survey respondents, with a substantial 68% affirming its economic viability. Conversely, the chart highlights a notable divergence in opinions, with 15% expressing doubt about its cost-effectiveness, while an equal proportion remained uncertain. This distribution underscores the need for targeted education and awareness initiatives to address concerns and misconceptions, potentially bridging the gap between solar advocates and skeptics in the context of domestic energy utilization.

Do you know that the government of India subsidizes the use of solar panels at home?
57 responses



The pie chart illustrates respondents' awareness of government subsidies for domestic solar energy use in India. Notably, 45.6 % of participants are informed about these subsidies, while a majority remain unaware. This insight from the survey reflects a significant knowledge gap regarding government initiatives in the renewable energy sector, which can serve as a foundation for targeted awareness campaigns and policy interventions to promote sustainable energy adoption among the population.

Do you think solar energy is the future?
57 responses



The pie chart depicts the resounding optimism among survey respondents regarding solar energy's future, with 68% expressing a strong affirmative stance. Meanwhile, the remaining portion of the chart illustrates the diversity of opinions, with some respondents leaning towards skepticism (the "no" category) and others still undecided ("don't know"). This distribution underscores the significance of ongoing education and outreach efforts to address concerns and uncertainties while harnessing the prevailing enthusiasm for solar energy as a pivotal component of our energy landscape.

Qualitative

What stops you from putting solar panels on the roof or using solar energy for domestic purposes?

The analysis of these responses reveals several recurring themes and factors influencing people's decisions regarding solar energy adoption:

Cost and Financial Barriers: A prominent barrier cited by respondents was the high upfront cost of purchasing and installing solar panels. Many expressed concerns about the substantial investment required for solar system installation, including the purchase of panels, inverters, and associated equipment. This financial hurdle often

deterred individuals from considering solar energy as a viable option for domestic use (Byrnes, Brown, Foster & Wagner, 2013). Several respondents indicated that limited access to financing options and solar loans made it difficult for them to afford solar installations. The availability of affordable financing mechanisms may be a critical factor in addressing this barrier.

Reliability and Technical Concerns: A significant number of respondents expressed concerns about the reliability of solar systems. Worries about system maintenance, durability, and performance in adverse weather conditions, such as heavy rainfall or cloudy days, influenced their decision-making. Lack of technical knowledge about solar installations and their maintenance was identified as a barrier. Respondents felt that understanding solar technology and its maintenance requirements was essential before making the commitment to adopt it.

Lack of Information and Awareness: Some respondents mentioned that they were unaware of government incentives, rebates, and tax credits designed to reduce the cost of solar installations. This lack of awareness can result in missed opportunities for financial support. Several participants indicated that they did not have access to sufficient information about solar energy, including its benefits and installation processes. Improved dissemination of information through education and outreach efforts is crucial to address this barrier (Eret, 2015).

Regional and Geographic Factors: A few respondents mentioned that their geographic location, such as living in an area with limited sunlight or extreme weather conditions, influenced their decision to not adopt solar energy.

In summary, the analysis of responses to the question about barriers to adopting solar energy for domestic purposes highlights the complex interplay of financial, technical, informational, and regulatory factors that influence individuals' decisions. Addressing these barriers requires a multifaceted approach, including improved access to financing, increased public awareness, enhanced technical support, and favorable policy frameworks that promote the affordability and reliability of solar energy systems. Additionally, tailoring solutions to regional and individual needs is essential to encourage wider adoption of solar energy for domestic use.

What should the government do to promote solar energy use for domestic purposes?

The responses to this question provide valuable insights into public expectations and suggestions for government actions to facilitate the widespread adoption of solar energy in households.

Financial Incentives and Subsidies: A recurring theme in the responses was the call for the government to provide financial incentives and subsidies to make solar installations more affordable. Many respondents suggested that tax credits, grants, or rebates could significantly reduce the initial cost barrier associated with solar panel installation. This aligns with the notion that economic incentives are a powerful driver for renewable energy adoption.

Education and Awareness Campaigns: A substantial number of participants emphasized the importance of educational initiatives and awareness campaigns. They proposed that the government should invest in public education programs to inform citizens about the benefits of solar energy, the savings it can yield, and the environmental advantages. Improved awareness, they believe, could lead to a more informed and enthusiastic adoption of solar technology.

Streamlined Permitting and Regulations: Several respondents highlighted the need for simplified permitting processes and regulations for solar installations. They argued that reducing bureaucratic hurdles and making it easier for homeowners to install solar panels would encourage more people to adopt solar energy solutions.

Technology and Research Investment: A smaller but significant portion of respondents suggested that the government should invest in research and development to advance solar technology. This would include funding for innovations such as more efficient solar panels and energy storage solutions. Such advancements could make solar energy even more attractive to potential users (Lewis, 2007).

In summary, the analysis of responses indicates that there is a consensus among participants on several key government actions to promote domestic solar energy use. Financial incentives, education, simplified

regulations, and technology advancements were the most frequently mentioned strategies. These findings emphasize the multifaceted nature of promoting solar energy adoption and the need for a comprehensive approach that combines economic incentives, public awareness, and policy changes to effectively transition toward a more sustainable energy future.

Conclusion

The investigation into people's perceptions about the domestic use of solar energy has revealed a multifaceted landscape of attitudes, beliefs, and opinions. Through the survey conducted to capture these insights, we have gained valuable perspectives on the current state of public sentiment toward solar energy as a sustainable and renewable source of power for households. The findings of this study indicate a significant level of awareness and positive regard for solar energy among the surveyed participants. A substantial majority of respondents expressed a favorable perception of solar technology, acknowledging its environmental benefits, including reduced carbon emissions and decreased dependence on fossil fuels. This demonstrates a growing consciousness of the need for cleaner and more sustainable energy sources in the face of climate change and environmental concerns.

As the world grapples with the urgent need to transition to cleaner and more sustainable energy sources, understanding public perceptions and addressing the factors that influence decision-making becomes increasingly important. This research contributes to the ongoing discourse surrounding renewable energy adoption by shedding light on the perspectives of individuals, and it highlights the critical role of education, policy support, and affordability in promoting the domestic use of solar energy. Ultimately, a collective effort is required from governments, industry stakeholders, and communities to realize the full potential of solar energy as a sustainable and viable option for meeting domestic energy needs.

References

- [1]. Bang, H. K., Ellinger, A. E., Hadjimarcou, J., & Traichal, P. A. (2000). Consumer concern, knowledge, belief, and attitude toward renewable energy: An application of the reasoned action theory. *Psychology & Marketing*, 17(6), 449-468.
- [2]. Black, J. S., Stern, P. C., & Elworth, J. T. (1985). Personal and contextual influences on household energy adaptations. *Journal of applied psychology*, 70(1), 3.
- [3]. Brummer, V. (2018). Community energy—benefits and barriers: A comparative literature review of Community Energy in the UK, Germany and the USA, the benefits it provides for society and the barriers it faces. *Renewable and Sustainable Energy Reviews*, 94, 187-196.
- [4]. Byrnes, L., Brown, C., Foster, J., & Wagner, L. D. (2013). Australian renewable energy policy: Barriers and challenges. *Renewable energy*, 60, 711-721.
- [5]. Charters, B., Heffernan, T., & Daly, M. (2023). When individual action requires collective approval: a roadmap for solar power adoption by strata property owners. *Journal of Social Marketing*, 13(1), 100-120.
- [6]. Chadwick, K., Russell-Bennett, R., & Biddle, N. (2022). The role of human influences on adoption and rejection of energy technology: A systematized critical review of the literature on household energy transitions. *Energy Research & Social Science*, 89, 102528.
- [7]. Eret, M. (2015). Learning by Doing: Key Steps for Improving Ontario's Renewable Energy Programs.
- [8]. Inman, R. H., Pedro, H. T., & Coimbra, C. F. (2013). Solar forecasting methods for renewable energy integration. *Progress in energy and combustion science*, 39(6), 535-576.
- [9]. Irfan, M., Hao, Y., Ikram, M., Wu, H., Akram, R., & Rauf, A. (2021). Assessment of the public acceptance and utilization of renewable energy in Pakistan. *Sustainable Production and Consumption*, 27, 312-324.
- [10]. Ndiritu, S. W., & Engola, M. K. (2020). The effectiveness of feed-in-tariff policy in promoting power generation from renewable energy in Kenya. *Renewable Energy*, 161, 593-605.
- [11]. Lewis, N. S. (2007). Toward cost-effective solar energy use. *science*, 315(5813), 798-801.
- [12]. Sindhu, S., Nehra, V., & Luthra, S. (2017). Investigation of feasibility study of solar farms deployment using hybrid AHP-TOPSIS analysis: Case study of India. *Renewable and Sustainable Energy Reviews*, 73, 496-511.
- [13]. Timilsina, G. R., Kurdgelashvili, L., & Narbel, P. A. (2012). Solar energy: Markets, economics and policies. *Renewable and sustainable energy reviews*, 16(1), 449-465.
- [14]. Musall, F. D., & Kuik, O. (2011). Local acceptance of renewable energy—A case study from southeast Germany. *Energy policy*, 39(6), 3252-3260.
- [15]. Omer, A. M. (2008). Energy, environment and sustainable development. *Renewable and sustainable energy reviews*, 12(9), 2265-2300.

- [16]. Ozaki, R. (2011). Adopting sustainable innovation: what makes consumers sign up to green electricity?. *Business strategy and the environment*, 20(1), 1-17.
- [17]. Roberts, J. (2020). Power to the people? Implications of the Clean Energy Package for the role of community ownership in Europe's energy transition. *Review of European, Comparative & International Environmental Law*, 29(2), 232-244.
- [18]. Ummadisingu, A., & Soni, M. S. (2011). Concentrating solar power–technology, potential and policy in India. *Renewable and sustainable energy reviews*, 15(9), 5169-5175.