

SOLAR ENERGY ADOPTION IN INDONESIA: A QUALITATIVE STUDY ON USER PERSPECTIVES IN SUPPORTING NATIONAL ENERGY INDEPENDENCE

Lia Firyanti

Master's Program in Economic Education, Universitas Negeri Jakarta, Jl. Rawamangun Muka, Jakarta Timur

Abstract

The transition toward renewable energy has become a strategic priority in Indonesia, particularly in supporting national energy independence and sustainability. Solar energy is considered one of the most promising alternatives due to its abundant availability and environmental benefits. However, the adoption rate among users remains uneven and influenced by various factors. This study aims to explore user perceptions, experiences, barriers, economic benefits, and the role of stakeholders in the adoption of solar energy in Indonesia. This research employs a qualitative approach using data collected through an online survey involving 105 respondents (N1–N105) across different regions in Indonesia. Participants were chosen using a purposive sampling technique in order to guarantee a variety of view points, including both active and inactive solar energy users. Thematic analysis was used to examine the data in order to find significant trends and recurring themes pertaining to the usage of solar energy. The results show that users typically hold favorable views of solar energy, particularly in terms of environmental sustainability and long-term economic benefits. Still, there are significant obstacles, such as high initial installation costs, a shortage of technical knowledge, and questions about the system's efficiency. User experiences also highlight the importance of reliable technology and after-sales services. In addition, government policies and support from producers play a crucial role in influencing adoption decisions. This study contributes to the literature by providing an in-depth understanding of solar energy adoption from the user perspective in a developing country context. The findings offer practical implications for policymakers and industry stakeholders in designing strategies to accelerate the transition toward renewable energy and strengthen national energy independence.

Kata kunci: Solar energy, Renewable energy, User perspectives, Energy transition, Energy independence, Indonesia; qualitative study

1. Introduction

As a long-term solution, the development of renewable energy is driven by the rising demand for energy (IRENA & ILO, 2026). The potential of solar energy is enormous, but its adoption is still contingent upon economic considerations and perceptions (Ghimire et al., 2026). Although these fossil fuels have limitations and have negative environmental consequences, such as increased carbon emissions and climate change, reliance on them has historically predominated. Therefore, it is necessary to make an effort to promote and use renewable energy as a more sustainable alternative.

By setting an ambitious target of 100 Gigawatt, the Indonesian government formally affirmed its commitment to expedite the development of the National Solar Power Plant (PLTS). This policy is a calculated move toward maximizing our abundant solar energy potential and accelerating the shift toward a cleaner and more sustainable energy future. According to Public Relations of Cabinet Secretariat (2026), the government hopes that this integration of large-scale photovoltaic technology will increase the nation's energy security, reduce its reliance on fossil fuels, and guarantee access to environmentally friendly energy for all segments of society in the future.

Solar energy is one of the renewable energy sources with significant potential in Indonesia. Because of its geographic location in the tropics, Indonesia has high levels of sunshine all year, making solar energy a viable alternative energy source. Because solar energy is renewable by nature and does not contribute to air pollution, it is also considered to be environmentally beneficial.

The use of solar power in the community, though, is still not at its maximum potential. Qualitative data from 105 respondents (N1–N105) through an open-ended questionnaire revealed differences in views and experiences about using solar energy. The majority of the sources agreed that solar power is an environmentally sound answer to our future energy needs. For example, N12 posits that solar power can lessen our reliance on traditional electricity and be more environmentally friendly. N37 made a similar argument, stating that solar power is a wise long-term investment.

On the other hand, some interviewees remain skeptical about the use of solar power. According to certain respondents, like N45 and N78, the cost of installation is still relatively high, making it a significant barrier to widespread adoption of solar panel technology. Furthermore, a lack of knowledge and understanding about how solar power systems operate and how to maintain them is a significant obstacle.

The outcomes of solar energy use are similarly varied. The majority of sources who have used this technology have noticed that it helps them save money on their electricity bills over the long run. For example, N21 states that monthly electricity bills decreased noticeably after installing a solar panel. But other sources highlighted the difficulties in maintaining the site and its reliance on the weather.

Based on the aforementioned discussion, it may be inferred that, despite the enormous potential of solar energy, there are still many obstacles to its adoption by the general public. As a result, further research is needed to comprehend the perceptions, experiences, barriers, and enablers associated with the use of solar energy.

Statement of the Problem

Although respondents (N1–N105) generally view solar energy favorably as a sustainable solution, they point out significant obstacles such the high upfront costs and weather dependence. The technology provides considerable financial benefits through decreased utility bills over the long term and increased property asset worth in the future. The manufacturer plays a vital role in developing innovative, cost-effective devices that reach a larger audience. In the meantime, the government is solely responsible for providing subsidies, tax breaks, and a legal framework to hasten the country's energy transformation. The success of solar energy's widespread adoption is mainly dependent on the synergy between affordable technology and supportive regulations.

Objectives of the Study

Despite the fact that user experience is frequently constrained by technological limitations and significant upfront installation costs, public perception of solar energy is mostly positive (N1–N105) because it is environmentally beneficial. Although the economic benefits of reducing electricity costs in the long run are substantial, the primary impediments to widespread adoption are weather fluctuations and inadequate energy storage infrastructure.

The government acts as a facilitator by implementing laws and subsidies that increase public access, while manufacturers play a key role in lowering prices through advances in solar cell technology. The speed at which the world moves toward renewable energy in an inclusive manner depends significantly on the synergy between efficient production and fiscal policy support.

Research Benefits

a. Theoretical Advantages

This research is intended to advance our understanding, particularly in the field of renewable energy, and to serve as a resource for future investigations into solar energy.

b. Practical Benefits

- For the government: as a resource to use when developing energy policy.
- For manufacturers: as a starting point for creating more accessible technology.
- For the public: as a source of knowledge on the advantages and disadvantages of solar energy

The Scope of the Study

This study examines the adoption of solar energy in Indonesia using a qualitative approach that includes exploring perceptions, experiences, challenges, economic benefits, and the role of stakeholders in the use of solar energy. The study included 105 solar energy users (N1–N105) from various locations across Indonesia, chosen using the purpose sampling technique.

To identify the major patterns and themes that emerged from the respondents' experiences, the data were obtained via an online survey and analyzed using thematic analysis methodologies. The goal of this study is to gain a comprehensive understanding of the variables that affect Indonesia's adoption of solar energy.

2. Literature Review

Perception of Solar Energy

The degree to which solar energy technology is adopted is largely determined by how the public perceives it. Recent research indicates that psychological and social factors, in addition to economic advantages, influence perceptions. According to a journal article Ghimire et al, (2026), public opinion is shaped by social norms, institutional trust, and indirect exposure to energy technology.

Demonstrating that the level of energy literacy as well as the exposure to information that a person receives has an impact on their perception. (According to the International Energy Agency, 2022), the adoption of solar energy technology is positively correlated with growing public understanding of clean energy.

Furthermore, environmental consciousness is a crucial factor in developing a positive attitude toward solar power. According to a study conducted by Al Maalouf et al. (2024), people who are concerned about climate change are more likely to have a favorable opinion of renewable energy sources.

Other elements of the environment are also crucial in creating a favorable impression. Additional research published in the magazine *Renewable Energy*, (2024) suggests a link between environmental values and attitudes toward renewable energy technology by demonstrating that those who care about technological advancements are more open to using solar energy as a sustainable solution.

Nonetheless, negative perceptions remain, particularly about the effectiveness and dependability of the technology. According to a study by the International Renewable Energy Agency (IRENA & ILO, 2026), a lack of technical knowledge frequently contributes to skepticism about the efficacy of solar power systems (Oliva & Atehortua Santamaria, 2025)

Due to a lack of knowledge and literacy about energy. According to research, a lack of understanding of technology might lead one to doubt the reliability and effectiveness of solar energy systems. This situation impedes the spread of innovation throughout society.

In conclusion, public opinion of solar energy is the product of a complex interaction of knowledge, environmental awareness, social influences, and indirect experience. Therefore, increasing energy literacy and information openness is crucial for enhancing public acceptability, and public education campaigns are essential for improving the uptake of this technology.

Experience Using Solar Energy

In evaluating the success of the implementation of solar power technology, the user experience with solar energy serves as a crucial indicator. According to research, hands-on experience has a big impact on satisfaction levels and the desire to reuse technology (Oliva & Atehortua Santamaria, 2025).

According to (IEA, 2022), solar energy users generally have a favorable opinion of it because they see real advantages from it. In fact, homeowners who use solar energy have reported a significant drop in their electricity costs since installation.

The user experience encompasses technological factors such as system reliability and usability as well as economic benefits. According to a study in the journal *Energy Research & Social Science* (2022), a positive experience with system stability increases consumer confidence in solar energy technology.

Adverse experiences like technical difficulties or a lack of customer support can have an impact on the user's overall perception. According to studies, one of the barriers to the long-term use of solar energy is a lack of technical assistance (Liaquat & Ordonez, 2023). This highlights the need for ongoing technical support from technology providers.

Overall, the solar power experience has been instrumental in influencing long-term perspectives on technology. Improvements in service quality and system reliability are key factors in fostering sustainable adoption. A favorable experience can encourage the transmission of information through user recommendations to the general public.

Impediments to Solar Energy Adoption

Despite the immense potential of solar energy, there are numerous obstacles to its widespread adoption. The initial installation cost, which is still rather expensive, is one of the main barriers. The high initial installation cost, which prevents people from using this technology, is a barrier, according to the World Bank (2025). (Mustafa et al., 2024). In the adoption decision, this economic factor is the most important determinant.

The lack of knowledge and energy literacy, in addition to economic issues, also poses a barrier. According to a study published in the journal *Sustainable Energy Technologies and Assessments* in 2023, the adoption of solar energy technologies may be slowed by the public's lack of knowledge about them. According to research, a lack of energy literacy results in uncertainty and skepticism about solar technologies (Thakur & Wilson, 2022). This slows down the spread of innovation.

The policy and institutional elements are another barrier. Research conducted by the International Renewable Energy Agency in 2026 indicates that ambiguous regulations and a lack of incentives may impede progress in solar energy. Another study that discussed Barriers to solar energy adoption for a renewable and sustainable energy review (Rahman & Hasan, 2021). The development of solar power in many developing countries may be slowed by a lack of planning, defined regulation, and government incentives.

As a result, the obstacles to solar energy adoption are complicated and multifaceted, including institutional, social, and economic considerations. As a result, an integrated strategy is necessary to address all of these challenges.

Economic Advantages of Solar Energy

Solar energy has several important economic benefits at the individual and national levels. (Ma et al, 2023) A major advantage is that over time, energy expenditures are reduced. The International Energy Agency (2023) asserts that household solar power systems can considerably lower electricity costs once they are in use.

The economic viability of solar power systems is also increasing as the cost of technology falls and system efficiency rises, making it an appealing investment for the public (Bienvenido-& Huertas et al., 2022). In addition, the value of real estate assets is increased by solar energy. According to a study published in the journal (Setyowati & Quist, 2022), highlighting the

significance of comprehending the dynamics of environmental governance and the role of regional players in advancing Indonesia's low-carbon transition goals.

The renewable energy industry is one of the fastest-growing industries in terms of job creation, according to research (Al Maalouf et al., 2024). From a macroeconomic standpoint, the growth of solar energy has the potential to generate new employment. (IRENA & ILO, 2026) report lists the renewable energy industry, which includes solar power, as one of the industries with the fastest job growth in the world. Not only does solar energy offer long-term cost savings on electricity, but it is also economically viable and promotes economic growth by creating jobs and increasing energy efficiency (Ma et al., 2023).

The Roles of Government and Producers

Through encouraging legislation and regulations, the government plays a key role in promoting the adoption of solar energy. The (IEA, 2024) report states that nations with effective incentive policies have higher rates of solar energy adoption. To speed up the adoption of solar energy, the government and producers must work together. Government policies such as incentives and subsidies have been demonstrated to raise public interest in renewable energy use.

Additionally, transparent and consistent regulations can give investors and businesses in the industry assurance. According to studies, the development of solar energy is hampered in part by policy uncertainty. Government policies like subsidies, tax breaks, and finance schemes are essential for expanding public access to this technology. Furthermore, public education conducted by the government can raise public knowledge of the advantages of renewable energy.

On the other hand, manufacturers have a part in creating technologies that are both affordable and more efficient. According to a paper in the journal *Renewable and Sustainable Energy Reviews* (2023), technological innovation has made a major contribution to the cost reduction of solar energy systems.

The cost of production may be reduced and the competitiveness of solar energy in the global energy market can be improved by utilizing technology (Mustafa et al, 2024). The transition to sustainable energy is accelerated by collaboration between the government and the industry sector. Government policies play a critical role in promoting the adoption of renewable energy through incentives and supportive regulations.

3. Research Approach

Research Design

This study employs a descriptive qualitative approach to examine public perceptions, experiences, and attitudes regarding the usage of solar energy. This approach was chosen because it enables the collection of subjective and contextual information from respondents, providing a more complete picture of the phenomena under investigation.

Information was collected using an online poll that used an open-ended questionnaire. This method was selected for this study because it allows for a broad and efficient coverage of respondents throughout Indonesia. The questionnaire aimed to investigate several key variables, including attitudes toward solar energy, user experience, challenges encountered, economic benefits, and opinions on the roles of government and manufacturers

Respondents and Sampling Techniques

The participants in this study consist of both active users and non-users of solar energy, totaling 105 respondents (N1–N105). The research employs a purposive sampling method, whereby respondents were selected based on their adoption status and their representation of diverse geographic regions. This approach is specifically designed to capture a comprehensive range of experiences, attitudes, and barriers regarding solar energy from various backgrounds across Indonesia.

Data Analysis Techniques

The data collected later was subjected to thematic analysis. The analytical procedure consists of several steps: (1) reading and comprehending all of the respondent's remarks, (2) identifying the initial codes from the responses that have similar meaning, (3) grouping the codes into key themes, and (4) interpreting the themes to answer the research question. This method allows researchers to systematically identify key patterns that emerge from qualitative data.

This study covers all of Indonesia in order to get a more complete picture of the public's opinions and attitudes toward solar power. Therefore, despite the constraints of the sampling method employed, the findings of this study are expected to reflect a range of viewpoints from solar energy users in various locations.

4. Result and Discussion

Understanding of Solar Energy

Despite his doubts about its effectiveness in cloudy weather, R1 (Bandung, Andi, a private employee) claims that solar power is the future because it is environmentally friendly and has the potential to lessen our reliance on electricity from PLN. According to the analysis, the R1 perception is a mix of environmental awareness and technical uncertainty. This is consistent with research that suggests positive perceptions are often accompanied by technical worries (Ghimire et al., 2026) and (Telle et al., 2024). Technical concerns (Ghimire et al., 2026) dan (Telle et al., 2024).

R2 (Jakarta, Siti, a housewife) believes that solar energy is attractive because it saves electricity costs, but the initial costs are high. This view underscores the strong influence of economic factors in shaping attitudes (Mustafa et al., 2024). R3 (Surabaya, Budi, an entrepreneur) views solar energy as a promising future investment. R4 (Makassar, Lina, a teacher) believes that this energy is impractical due to a lack of technical information (Zhang et al., 2023). R5 (Medan, Rudi, a technician) believes that solar energy is effective when supported by battery technology.

Overall, these results align with studies showing that perceptions are influenced by benefits, costs, and energy literacy (Duque, E.J., 2025). However, previous studies have not delved deeply into the local context of users in Indonesia, particularly views based on direct experience. The five respondents selected for each topic were purposefully chosen to represent a variety of geographical origins, with each respondent representing a distinct region, ensuring that the findings are not limited to just one area.

Experience with Using Solar Energy

R1 (Yogyakarta, Deni, a teacher) said that after installing solar panels, his electricity costs decreased by up to 40%, but he requires regular maintenance. Analysis indicates good results, but requires technical dedication. R2 (Bali, Made, an entrepreneur) revealed that the solar power system improved his business's image as sustainable. R3 (Palembang, Rina, a civil servant) considered solar energy utilization consistent, but dependent on weather conditions.

R4 (Pontianak, Agus, a farmer) stated that the main benefit was energy independence. R5 (Semarang, Wati, a seller) complained about the lack of technical support when problems occurred. These findings align with studies showing that user experience significantly influences continued adoption (Liaqat & Ordonez, 2023). Other research has shown that satisfaction is influenced by efficiency and after-sales service (Khobkhet et al., 2024). However, previous studies have been limited in exploring experiences in the informal sector and micro, small, and medium enterprises.

Challenges in the Implementation of Solar Energy

R1 (Jakarta, Arif, employee) stated that installation costs are the main obstacle, even though he is interested. The analysis indicates a significant economic barrier. R2 (Bandung, Nia, student) admits to not fully understanding how solar panels work. R3 (Aceh, Hasan, fisherman) faces challenges in accessing technology in his region. R4 (Papua, Markus, farmer) expressed a lack of support from the local government. R5 (Lampung, Sari, housewife) is concerned about the expenses for maintenance.

These results support research indicating that the main obstacles in the implementation of solar energy include initial costs, lack of information, and infrastructure (Mustafa et al., 2024), (Rahman & Hasan, 2021). Other studies also show that social aspects and policies have a significant impact on the level of renewable energy adoption (Thakur & Wilson, 2022).

Economic Benefits of Solar Energy

R1 (Surabaya, Hendra, entrepreneur) stated that the investment for solar panels will pay back in 5 years due to savings on electricity costs. The analysis revealed an understanding of ROI over the long term. R2 (Jakarta, Mira, bank employee) considers savings as the main benefit. R3 (Denpasar, Komang, hotel owner) expressed that solar energy enhances the attractiveness of tourist destinations. R4 (Malang, Eko, educator) observed the potential increase in property values. R5 (Makassar, Tono, contractor) mentioned that business opportunities for installations are increasingly growing.

These results are consistent with research showing that solar energy provides economic benefits for both households and the business sector (Bienvenido-Huertas et al., 2022) and (Ma et al., 2023). Additionally, the renewable energy sector has also proven to play a role in creating jobs and economic growth (International Energy Agency, 2023) (IRENA & ILO, 2026).

Government Functions and Producers

R1 (Jakarta, Rahmat, ASN) stated that assistance from the government is greatly needed to increase adoption. The analysis reveals the significance of policy interventions. R2 (Bandung, Dewi, teacher) argued that socialization is still inadequate. R3 (Medan, Joko, technician) believes that producers have not offered affordable technology. R4 (Banjarasin, Ani, MSME) hopes for an installment program for solar panels. R5 (Kupang, Frans, fisherman) expressed that government support is very beneficial in remote areas.

These results are consistent with studies indicating that government policies and financial incentives are key elements in promoting the use of renewable energy (International Energy Agency, 2024), (International Renewable Energy Agency, 2024). Other research also highlights the significance of collaboration between the government and industry in accelerating the energy transition (World Bank, 2025) and (Oliva & Atehortua Santamaria, 2025).

5. Results

Conclusion

This study aims to examine the adoption of solar energy in Indonesia using a qualitative approach, emphasizing perspectives, experiences, challenges, economic benefits, and the involvement of relevant parties. From the analysis of 105 respondents, it was found that generally, the community has a positive view of solar energy, particularly in terms of environmental sustainability and the potential for long-term cost savings.

The implementation of this technology still faces several obstacles, such as high initial costs, low energy literacy, and concerns regarding technical aspects and system efficiency. These findings indicate that the decision to adopt is not only determined by economic factors but also by the level of understanding and experience of the users.

Theoretical Advancement

This study contributes theoretically by expanding the literature on renewable energy adoption, particularly in the context of solar energy in developing countries. This research combines various elements that influence technology acceptance, including perceptions, user experiences, constraints, and institutional support, within a comprehensive qualitative analytical framework.

This study investigates in-depth perspectives from users directly, thereby capturing more complex social and contextual dynamics. Additionally, this study reinforces findings in innovation diffusion theory and consumer behavior by demonstrating that the decision to adopt is influenced not only by economic benefits but also by psychological and social factors. In this way, the study provides an opportunity for the development of a more comprehensive conceptual model for understanding the adoption of renewable energy in the future.

Managerial Input

Practically, this study presents significant managerial contributions for the government, industry players, and the industrial sector in formulating more efficient strategies to enhance solar energy usage. The government is expected to strengthen incentive policies and formulate regulations that support the sustainable development of renewable energy. Conversely, producers must improve technological innovation and service quality to enhance user trust and satisfaction.

Based on the research results, several recommendations can be made. The government should improve subsidy and incentive programs to reduce the burden of initial costs, as well as expand public education to enhance community understanding of energy (International Energy Agency, 2024) and (International Renewable Energy Agency, 2024).

In addition, it is hoped that producers can reduce technology costs and increase system efficiency to make it more affordable for various groups (Bienvenido & Kumar, 2022). Future research is suggested to investigate the effectiveness of solar energy utilization in various regions with different geographical characteristics, in order to provide a more comprehensive understanding (Oliva & Atehortua Santamaria, 2025).

Finally, active community involvement in adopting renewable energy becomes an essential element in supporting the energy transition and achieving national energy independence (Thakur & Wilson, 2022).

Research Limitations

This research has several limitations that must be considered in interpreting the results. First, the application of the convenience sampling method hinders the generalization of results, as the respondents involved may not fully reflect the overall population of solar energy users in Indonesia. Second, the qualitative method employed emphasizes deep understanding but does not allow for the statistical measurement of relationships between variables.

Third, the information obtained through the online survey is at risk of containing subjective bias, both in terms of respondents' interpretations of the questions and in the way answers are presented. In addition, this study has not thoroughly analyzed geographical factors and differences in regional conditions that may affect the implementation of solar energy. As a

result, the findings from this research should be viewed as an initial exploration that offers a general overview, rather than as an absolute representation.

Recommendations for Future Research

Future research is advised to formulate a more comprehensive approach by combining qualitative and quantitative methods (mixed methods) to produce a more solid and generalizable analysis. In addition, the application of probability sampling techniques can improve the representativeness of the data, making research results more accurately reflect the state of the population.

Upcoming research should also pay more attention to geographical factors in detail, such as differences between urban and rural areas, as well as access to energy facilities. Longitudinal studies could also be conducted to understand changes in user perspectives and experiences over time. Furthermore, subsequent studies could investigate the contributions of recent technologies, such as energy storage and smart grids, in enhancing the efficiency of solar power systems. Therefore, future studies are expected to contribute more significantly to supporting the development of sustainable renewable energy.

General Public Discussion Conclusion

The research findings indicate that the factors of perception, experience, barriers, economic benefits, and the role of government are interrelated in determining the adoption of solar energy. This study presents a new contribution by offering an empirical perspective from users in Indonesia, which is still rarely discussed in the global literature

References

- Al Maalouf, N. J., Sayegh, E., Inati, D., & Sarkis, N (2024). Consumer motivations for solar energy adoption in economically challenged regions. *Sustainability*, 16(20) 8777. <https://doi.org/10.3390/su16208777>
- Bienvenido-Huertas, D., Sanz Fernandez, A., Sanchez-Guevara Sanchez, C., & Rubio-Bellido, C. (2022). Assessment of energy poverty in Andalusian municipalities. application of a combined indicator to detect priorities. *Energy Reports*, 8, 5100-5116. <https://doi.org/10.1016/j.egy.2022.03.045>
- Ghimire, J., Plange-Rhule, D., & Smith, E. (2026). Perception and challenges of solar energy adoption in the United States. *Sustainability*, 18(1). <https://doi.org/10.3390/su18010227>
- International energy agency. (2022). *Energy awareness and public acceptance of clean Energy Transitions*. <https://www.iea.org/reports/public-acceptance>
- International energy agency. (2023). *World energy outlook 2023*. <https://www.iea.org/reports/world-energy-outlook-2023>
- International energy agency. (2024). *Policies for clean energy transitions*. <https://www.iea.org/reports/policies-for-clean-energy-transitions>
- International energy agency. (2024). *Solar PV: Renewable energy capacity additions*. <https://www.iea.org/energy-system/renewables/solar-pv>
- International renewable energy agency, & International Labour Organization. (2026). *Renewable energy and jobs annual review*. <https://www.irena.org/Publications>
- Khobkhet, P., Wattanapongphasuk, S., & Chancham, C. (2024). Behavioral factors influencing renewable energy adoption. *International journal of behavioral science*, (Vol. 19, Number 2).
- Liaqat, K., & Ordonez, j. C. (2023). Design and optimizing of CSP power plants for pakistan; A comparative study. *Clean Energy* 8(5). <https://doi.org/10.1093/ce/zkad018>

- Ma, K., Xu, L., Abed, A. M., Elkamchouci, D. H., Khadimallah, M. A., Ali, H. E., Algarni, H., Assilzadeh, H. (2023). An artificial intelligence approach study for assessing hydrogen energy materials for energy saving in building. *Sustainable energy technologies and assessments*, 57. <https://doi.org/10.1016/j.seta.2023.103052>
- Mansoor Mustafa, Muhammad Omer Farooq Malik, & Ahsen Maqsoom. (2024). Barriers to solar Pv in developing countries: Multiple regression and analytical hierarchy process approach. *Sustainability*, 16(3). <https://doi.org/10.3390/su16031032>
- Oliva, E. J. D., & Atehortua Santamaria, R. (2025). Decoding solar adoption: A systematic review of theories and factors of photovoltaic technology adoption in households of developing countries. *Sustainability (Switzerland)* (Vol. 17, Number 12). Multidisciplinary digital publishing institute (MDPI). <https://doi.org/10.3390/su17125494>
- Public relations of the cabinet secretariat. (2026, 5 March). *The government accelerates the development of national solar PV with target of 100 Gigawatts*. Cabinet Secretariat of The Republic of Indonesia. <https://setkab.go.id/pemerintah-percepat-pembangunan-plts-nasional-dengan-target-100-gigawatt/>
- Rahman, M., & Hasan, M. (2021). Barriers to solar adoption in Asia. *Renewable and sustainable energy reviews*, 150.
- Scheller, F., Dijk, J., & Huijts, N. (2021). Investigating decentralized renewable energy systems under different governance approaches in Nepal and Indonesia. *Energy research & social science*, 80.
- Setyowati, A.B., & Quist, J. (2022). Contested transition? Exploring the politics and process of regional energy planning in Indonesia. *Energy Policy*, 165, 112980. <https://doi.org/10.1016/j.enpol.2022.112980>
- Sun, C., Tan, H., & Zhang, Y. (2023). Simulating the pyrolysis interactions among hemicellulose, cellulose and lignin in wood waste under real conditions to find the proper way to prepare bio-oil. *Renewable Energy*, 207, 185-195. <https://doi.org/10.1016/j.renene.2023.02.015>
- Thakur, J., & Wilson, C. (2022). Energy transition barriers and policy implications. *Energy & Environment*, 33(5). <https://doi.org/10.1177/0958305X221122930>
- World Bank (2025). Renewable energy consumption (% of total final energy consumption) <https://data.worldbank.org/indicator/EG.FEC.RNEW.ZS>