



Analysis of Public Attitudes and Willingness to Implement Renewable Energy in Households to Reduce GHG Emissions in Indonesia

A Agung Feinnudin^{1*}, Usep Suhud², Hamidah³
Universitas Negeri Jakarta

Corresponding Author: A Agung Feinnudin a.agung@mhs.unj.ac.id

ARTICLE INFO

Keywords: Renewable Energy Adoption, Public Attitudes, GHG Emissions, Household Energy, Policy Interventions

Received : Date, Month

Revised : Date, Month

Accepted: Date, Month

©2024 Feinnudin, Suhud, Hamidah:
This is an open-access article distributed under the terms of the [Creative Commons Atribusi 4.0 Internasional](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

This study explores household attitudes and willingness to adopt renewable energy in Indonesia to reduce GHG emissions. Key factors include public awareness, economic barriers, policy clarity, and behavioral resistance. Surveys and statistical analyses reveal that awareness boosts adoption, while high costs and skepticism hinder it. Targeted interventions, such as education campaigns, financial incentives, and community engagement, are essential to address these barriers, offering actionable insights for policymakers and stakeholders to advance sustainable energy transition efforts

INTRODUCTION

Background

a. The Role of Households in Implementation of Renewable Energy Technologies, Contributing to Sustainable Development Goals

Households are pivotal in transitioning towards renewable energy technologies, playing a crucial role in achieving Sustainable Development Goals (SDGs). Their involvement not only contributes to environmental sustainability but also addresses energy poverty and enhances socio-economic welfare.

a) Implementation of Renewable Energy in Rural and Urban Settings

The uptake of renewable energy solutions by households varies between rural and urban areas due to disparities in access, affordability, and policy support. For example, studies in Bangladesh reveal how socio-economic factors and dwelling types influence household adoption of clean energy technologies, significantly aligning national goals with SDG 7 on affordable and clean energy (Haq et al., 2024).

b) Barriers and Drivers in Renewable Energy Adoption.

Research highlights the role of technology-driven drivers, policy frameworks, and the importance of SDGs in overcoming barriers to renewable energy adoption at the household level.

c) Biogas Technology and Household Welfare.

The adoption of biogas technology, particularly in regions like Bangladesh, has shown significant potential in alleviating energy poverty and improving household welfare. Such initiatives directly contribute to SDG targets by ensuring sustainable energy use and environmental conservation, Despite the paramount importance of the United Nations' Sustainable Development Goals (SDGs).

d) Gender and Renewable Energy.

Women often face unique barriers to adopting renewable energy technologies. Addressing these barriers is essential for ensuring equitable access and achieving broader SDG impacts, particularly in rural areas where energy literacy is a critical factor (Heidaria, et al 2020.).

e) Solar Energy and the 2030 Agenda.

In Africa, solar energy adoption by households plays a key role in achieving energy efficiency and sustainability goals under the 2030 Agenda. This highlights the opportunities and challenges in implementing renewable energy solutions at the household level (Adenle, 2020).

b. Challenges in Public Acceptance, Behavioural Attitudes, and Willingness to Pay and Implement Renewable Energy Solutions in Daily Life.

Green House Gas (GHG) emissions and consequent climate change have become a major issue of concern. Therefore, social engagement in the public discourse has risen considerably through academic articles, scientific research, or informal social media platforms (Zhang et al., 2022). Greenhouse gas (GHG) emissions and the resulting climate change remain a significant global concern, emphasizing the need for public adoption of renewable energy solutions. While the urgency to transition to cleaner energy is clear, various challenges exist,

particularly in public acceptance, Behavioural attitudes, and the willingness to pay for and implement these technologies in daily life.

a) Public Attitudes Toward Renewable Energy.

Public perception and behaviour toward renewable energy adoption are influenced by awareness, accessibility, and perceived benefits. Research highlights that enhancing knowledge about renewable energy and addressing misconceptions is critical for improving public attitude (Lucas et al., 2021).

b) Behavioural Patterns and Socio-Psychological Factors.

Studies reveal that socio-psychological factors, including environmental awareness and social norms, significantly impact individuals' willingness to adopt renewable energy sources. For instance, integrating Behavioural insights can foster positive attitudes and acceptance (Yazdanpanah et al., 2015).

c) Economic Willingness to Pay.

Economic barriers, such as the upfront costs of renewable energy installations, pose significant challenges. Research in Pakistan indicates that willingness to pay for renewable energy is influenced by financial incentives and perceived long-term benefits.

d) Social Acceptance in Urban vs. Rural Contexts.

Acceptance varies across geographic regions, with rural populations often demonstrating stronger environmental concerns and support for renewable energy projects compared to urban residents.

e) Addressing the Attitude-Behaviour Gap.

Despite positive public attitudes toward renewable energy, a significant gap exists between stated support and actual adoption.

Problem Statement

- a. Limited implementation of renewable energy in households due to lack of awareness, financial barriers, and sociocultural resistance.
- b. Disconnect between policy objectives and public willingness to implement renewable energy.

Problem Limitation

In this study of "Analysis of Public Attitudes and Willingness to Implement Renewable Energy in Households to Reduce Ghg Emissions in Indonesia ", several limitations are defined to ensure that the research remains focused, relevant, and measurable. The following are the identified scope and limitations

a. Research Focus

Primary Topic: The study focuses on the attitudes and willingness of households toward renewable energy adoption.

b. Key Dimensions,

- a) Public attitudes: perspectives, beliefs, and perceptions regarding renewable energy.
- b) Willingness: the intent or readiness to adopt renewable energy technologies at the household level.

c) Barriers and supporting factors for renewable energy implementation.

c. Geographical Coverage

The study is limited to Indonesia, with specific focus on certain areas (e.g., urban and rural) selected to represent geographic, social, and economic diversity.

d. Respondents

The study involves 250 respondent which households as respondents, specifically: Individuals responsible for energy decisions in their households (e.g., household heads). Families with access or potential to implement renewable energy technologies. Organizations or industrial sectors are not included as research subjects.

e. Types of Renewable Energy

- a) The study focuses on renewable energy technologies relevant to households, such as,
- b) Solar panels.
- c) Solar water heaters.
- d) Small-scale biomass technologies.
- e) Large-scale renewable energy systems, such as wind turbines or hydroelectric power plants, are excluded.

f. Data Collection Methods

Data Collection is Conducted Through

Questionnaires, to measure attitudes, willingness, and barriers/supporting factors. In-depth interviews, to gain a deeper understanding of public perceptions. The study does not include secondary data related to technical aspects, such as emission statistics.

Objectives

- a. To explore the factors influencing public attitudes and willingness to adopt renewable energy technologies in households.
- b. To analyse the potential impact of household adoption of renewable energy on reducing GHG emissions.

Research Significance and Practical Applications

The results of the study, "Analysis of Attitudes and Willingness of Households to Implement Renewable Energy to Reduce Greenhouse Gas Emissions in Indonesia," have significant practical and academic implications. The following highlights the primary uses of this research:

a. For Policymakers

Development of Targeted Policies, the findings can guide the formulation of targeted policies to encourage renewable energy adoption, such as subsidies, tax incentives, or financing schemes tailored to households.

b. Support for Public Awareness Campaigns

The study identifies gaps in awareness and provides data to design effective educational campaigns that inform households about the benefits of renewable energy for reducing greenhouse gas emissions.

c. Improved Policy Planning

Insights into barriers and drivers of renewable energy adoption can help in planning and implementing renewable energy policies that address economic, social, and technical constraints.

d. For Renewable Energy Industry

Market Development.

The findings can assist private companies in identifying market opportunities and designing renewable energy products or services that align with household needs and preferences.

e. Business Strategies

Data on public willingness and attitudes can guide industry stakeholders in creating marketing strategies and customer support systems to increase adoption rates.

Sate of the Art

The state of the art for the study "Analysis of Public Attitudes and Willingness to Implement Renewable Energy in Households to Reduce Ghg Emissions in Indonesia" reflects the current knowledge, technological advancements, and theoretical frameworks in the field of renewable energy adoption at the household level. Below is an outline of the state of the art for this research:

a. Theoretical Foundations

a) Behavioural Theories

The research is rooted in Behavioural theories such as the Theory of Planned Behaviour (TPB) and Value-Belief-Norm (VBN) theory, which explain how attitudes, perceived norms, and Behavioural control influence willingness to act. These frameworks are used to understand the drivers behind household decisions to adopt renewable energy technologies.

b) Environmental Psychology

Insights from environmental psychology, which explores the relationship between human behaviour and environmental sustainability, provide a basis for studying public attitudes and willingness.

b. Current Trends in Renewable Energy Adoption

a) Global Context:

Increasing emphasis on transitioning to renewable energy as part of global commitments to reduce greenhouse gas (GHG) emissions, as outlined in agreements like the Paris Agreement. Adoption of household-level renewable energy solutions (e.g., rooftop solar panels, biomass systems) has gained attention as a cost-effective and scalable approach to achieving climate goals.

c. Indonesian Context

In Indonesia, renewable energy accounts for a small but growing share of the energy mix, with the government aiming for 23% renewable energy use by 2025. Household adoption remains limited due to economic, technological, and social barriers, making studies on public attitudes and willingness critical for policy and strategy development.

d. Technological Advancements

a) Decentralized Energy Systems.

The rise of small-scale renewable energy technologies, such as rooftop solar panels and microgrids, has made it feasible for households to generate their own energy. Smart energy management systems and IoT-based solutions are being developed to optimize energy use and integration into existing grids.

b) Cost Reductions

The declining cost of renewable energy technologies, particularly solar photovoltaic (PV) systems, has made them increasingly affordable for middle-income households.

e. Social and Economic Factors

a) Awareness and Education.

Studies have shown that public awareness and education campaigns significantly impact attitudes toward renewable energy. However, there is a gap in understanding how cultural and social norms in Indonesia affect adoption at the household level.

b) Economic Incentives.

Financial incentives, such as government subsidies, tax breaks, or feed-in tariffs, play a crucial role in overcoming initial cost barriers. The absence of adequate financial support remains a major challenge in Indonesia.

f. Barriers to Adoption

a) Financial Barriers

High upfront costs of renewable energy technologies deter adoption, particularly among lower-income households.

b) Technical and Accessibility Issues

Limited access to renewable energy solutions in rural areas and insufficient infrastructure to support decentralized systems.

c) Social Resistance

Concerns about reliability, maintenance, and cultural acceptability influence public attitudes.

g. Existing Studies

Studies like those by (Lucas et al., 2021; Saratian, 2024) have highlighted the importance of public attitudes in shaping renewable energy policies. Research focusing on household-level adoption in developing countries has emphasized the need for context-specific strategies, yet limited studies exist that address Indonesia's unique socio-economic and cultural landscape.

h. This Study Fills Several Gaps in the Current Literature.

Lack of comprehensive analysis on household attitudes and willingness in the Indonesian context. Limited understanding of how socio-cultural factors influence renewable energy adoption. Insufficient exploration of the role of localized barriers such as economic constraints and geographic disparities in Indonesia

LITERATURE REVIEW

Conceptual Framework

The study aims to explore the factors influencing household decisions to adopt renewable energy technologies. The primary focus is on public attitudes, levels of willingness, and the barriers and drivers that affect adoption. Below is a comprehensive conceptual description supporting the research. The study is based on several key concepts relevant to attitudes, willingness, and the adoption of new technologies.

a. Public Attitudes Toward Renewable Energy

Public attitudes toward renewable energy are pivotal for the transition to sustainable energy systems. This review highlights key theories on public perceptions, examines studies exploring awareness, social acceptance, and Behavioural intentions toward renewable energy technologies, and provides insights from recent international research.

a) Key Theories on Public Perception

Public perception theories often emphasize environmental awareness and risk perception. These frameworks suggest that individuals are more likely to support renewable energy projects if they perceive environmental benefits and low risks. Studies like (Lucas et al. 2021) underscore the role of targeted communication to improve public attitudes by addressing concerns about innovation and societal impacts. Similarly, Behavioural theories indicate that intrinsic motivations, such as environmental consciousness, are critical for renewable energy adoption.

b) Awareness and Knowledge

Awareness of renewable energy's environmental and economic benefits is crucial for fostering public support. (Djurisic et al., 2020) analysed public perceptions in Montenegro, revealing that higher awareness correlates with greater acceptance. Furthermore, understanding specific technologies, such as solar or wind energy, can shape attitudes, as discussed by (Carlisle et al., 2015).

c) Social Acceptance

Social acceptance of renewable energy technologies often hinges on perceived fairness and community involvement in decision-making. It revealed that opposition to renewable energy facilities is frequently tied to proximity concerns, encapsulated in the "not in my backyard" (NIMBY) phenomenon. However, (Karasmanaki et al., 2021) reported increasing public familiarity and positivity toward major renewable energy types, suggesting that exposure and education play critical roles in acceptance.

d) Challenges and Future Directions

Despite growing acceptance, challenges persist in addressing misinformation, equity issues, and local opposition. Researchers like (Pidgeon & Demski, 2012; Saratian & Arief 2018) emphasize the importance of framing renewable energy transitions as inclusive processes that align with community values.

This review consolidates insights from recent studies, underscoring the complexity of public attitudes toward renewable energy. Continued interdisciplinary research is necessary to address emerging challenges and facilitate a global shift toward sustainable energy systems.

b. Willingness to Adopt Renewable Energy in Households

Factors driving household decisions, including economic incentives, environmental awareness, and perceived ease of use. Barriers to adoption, such as high upfront costs, lack of technical knowledge, and limited access to renewable energy systems.

c. Impacts on GHG Emissions.

Evidence linking household adoption of renewable energy to significant reductions in GHG emissions. The potential of decentralized renewable energy systems to mitigate climate change. Gaps in Literature, Need for region-specific studies to understand sociocultural dynamics affecting renewable energy adoption. Limited research on the effectiveness of government incentives in motivating household behaviour.

d. Factors Influencing Community Behaviour in Implementing Renewable Energy in Households

a) Social and Culture Factor

Social and cultural factors significantly influence renewable energy adoption. Social norms, education, and cultural values shape individual and community decisions. Political forces and cultural dynamics can either hinder or drive energy transitions (Burke & Stephens, 2018). Concepts like energy democracy foster community engagement, enhancing adoption. Similarly, renewable energy is often tied to social values like sustainability and community solidarity (Wahlund & Palm, 2022; Imaningsih et al., 2022).

The Theoretical Framework

Grand theory provides a comprehensive framework that connects the fundamental principles underlying a study. For this research, the grand theory integrates psychological, sociological, and environmental constructs to understand the dynamics of public attitudes, willingness, and barriers to adopting renewable energy technologies in households.

a. Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) is one of the foundational frameworks for understanding the adoption of renewable energy. According to TPB, three main factors influence Behavioural intention.

- a) **Attitudes Toward the Behaviour:** Positive attitudes toward renewable energy increase the likelihood of adoption (Lucas et al., 2021).
- b) **Subjective Norms:** Societal expectations and peer influence play a significant role in shaping adoption decisions.
- c) **Perceived Behavioural Control:** Perceived ease or difficulty in adopting renewable energy technologies impacts the intention to act.

b. Value-Belief-Norm (VBN) Theory

The VBN theory explains that individuals with strong pro-environmental values and beliefs about environmental degradation are more likely to adopt renewable energy (Luo et al., 2021). This theory emphasizes the importance of normative factors, such as personal responsibility and moral obligation, in shaping renewable energy adoption.

c. Diffusion of Innovations Theory

This theory examines how new technologies, such as renewable energy solutions, spread within a society. The adoption process is influenced by:

- a) **Relative Advantage:** The perceived benefits of renewable energy compared to traditional options.
- b) **Compatibility:** Alignment of renewable energy technologies with societal values and individual needs.

c) **Complexity:** The ease of understanding and using the technology (Elmustapha et al., 2018).

d. Social Practice Theory

Social Practice Theory focuses on the role of societal habits, routines, and cultural norms in influencing behaviour. In renewable energy adoption, this framework emphasizes understanding the everyday practices of households and integrating renewable energy technologies into these routines (Djurisic et al., 2020).

METHODOLOGY

Research Objective

The aims of this study is to determine the description of public perceptions regarding the use of renewable energy in households in relation to reducing greenhouse gas emissions

Place, Time, of Research

The research was conducted by sending a questionnaire to respondents, namely using a question instrument created via Google Form which was then sent to respondents using the WhatsApp application. The delivery time is from Saturday, November 30, 2024 to December 7, 2024

Methodology Research

This research method uses an open questionnaire method (Open Ended Questionnaires) because this questionnaire contains open questions that allow respondents to provide answers freely, providing in-depth insights into their thoughts, motivations, and experiences. This method is suitable for exploring complex issues (Eckerdal & Hagström, 2017). This questionnaire is very useful for understanding perceptions in the field of information studies. This study will also explore the public's perception of the use of renewable energy in households to reduce greenhouse gas emissions.

Population and Sample

The population of this study was 250 respondents with a sample of 30 respondents.

Date Collection Techniques

In this study, questionnaires were distributed related to "Public Perception of the Importance of Using Renewable Energy in Households in Indonesia". A total of 250 respondents were obtained, the instrument used was a Google form sent via WhatsApp. Data was taken from November 30, 2024 to December 7, 2024

Technical of Data Analysis

In analysing data, a systematic approach is needed to identify patterns, themes, and insights from the data that has been collected and also the steps of data analysis techniques that can be used are as follows:

a. Data to Organize

Data Transcription: If the data comes from interviews or open-ended questions in a questionnaire, the first step is to transcribe the data into text. Initial Categorization: Group the data based on categories such as attitudes, willingness, barriers, and opportunities in renewable energy implementation.

b. Thematic Analysis

Grouping by Attitude Dimension: For example, positive attitudes toward the economic and environmental benefits of renewable energy or negative attitudes toward implementation costs. Willingness to Act: Analysis of data indicating the level of community readiness to switch to renewable energy, such as support for subsidy policies or acceptance of new technologies.

c. Narrative approach

- a) Narrative Development: Develop a narrative that explains the relationship between attitudes, willingness, and factors influencing renewable energy implementation. For example, "People in urban areas show positive attitudes, but are hampered by budget constraints."
- b) Case Study: Use specific data to provide a case example of renewable energy implementation in a household.

d. Interpretation and Conclusion

- a) Data Interpretation, connecting findings with research objectives, namely how community attitudes and willingness can contribute to reducing GHG emissions in Indonesia.
- b) Conclusion, Summarizing the results of the analysis by answering research questions and providing recommendations for the implementation of renewable energy.

Statistical Hypothesis

In this study, statistical hypotheses can be formulated based on the relationship between the variables to be tested. This study is likely to focus on attitudes, community willingness, and factors that influence the implementation of renewable energy.

- (H₀)=There is a significant relationship between public attitudes towards renewable energy and their willingness to implement renewable energy technology in households.
- (H₁)=There is a significant influence between the level of public awareness of the environmental benefits of renewable energy and their willingness to implement renewable energy technology.

RESULT AND DISCUSSION

The data was obtained by creating a survey and questionnaire as shown in the image below using Google Form and distributed to 250 respondents.

Survei dan Kuesioner : **Persepsi Masyarakat Tentang Pentingnya Penggunaan Energi Terbarukan di Rumah Tangga untuk Menekan Emisi Gas Rumah Kaca (GRK)**

- **Tujuan:** Survei ini bertujuan untuk memahami persepsi dan pandangan Anda tentang penggunaan energi terbarukan di rumah tangga dan perannya dalam mengurangi emisi gas rumah kaca (GRK).
- **Kerahasiaan:** Jawaban Anda akan dijaga kerahasiaannya dan hanya digunakan untuk keperluan penelitian.
- **Instruksi:** Harap jawab semua pertanyaan dengan jujur. Pilih jawaban yang paling sesuai dengan pendapat atau pengalaman Anda.

afeinnudin@gmail.com [Switch account](#)



Not shared

Figure 1. Spread the Questionnaire

Obtained the following data

a. *The Age groups are quite spread out*

1. Informasi Kelompok Usia ?

250 responses

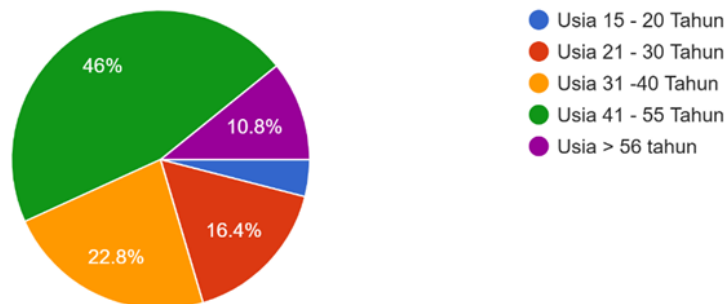


Figure 2. Age Group

b. The gender of male respondents is 60% and the rest are female respondents as much as 40%. This indicates that the tendency of technical needs is still in male respondents.

2. Jenis Kelamin

250 responses

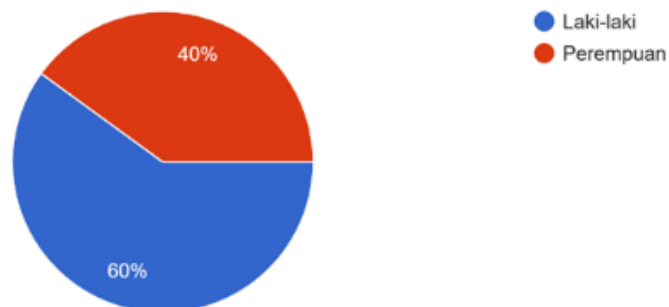


Figure 3. Gender

- c. **Education.** Regarding education, it shows that there is quite good knowledge of renewable energy, more than 80% of respondents have a diploma or higher.

3. Pendidikan Terakhir
250 responses

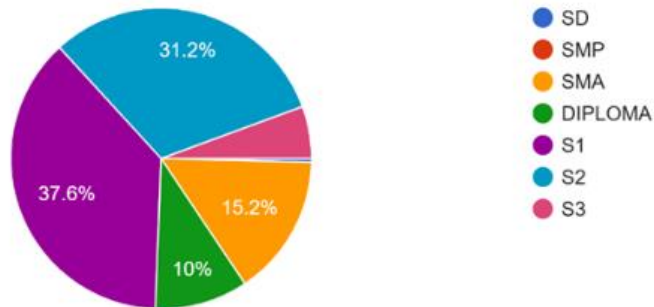


Figure 4. Last education

- d. **Income Per Household**

There is data on household income per month of 5 million and above as many as more than 75% of respondents. Showing that there is a fairly good level of ability to buy goods.

4. Pendapatan Rumah Tangga Per Bulan
250 responses

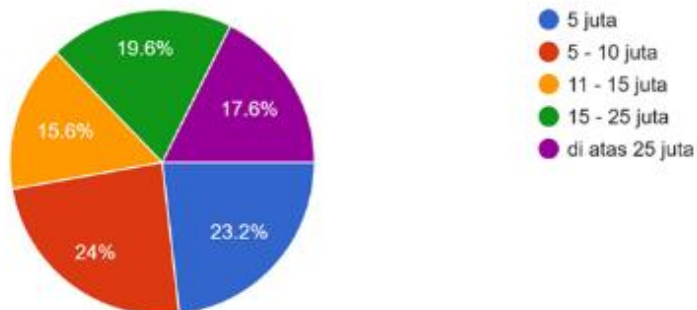


Figure 6. Monthly Income

- e. Location of residence, 61.2% of respondents live in the city and 30% of respondents live in the suburbs, showing a greater need for energy than those living in rural areas

5. Lokasi Tempat Tinggal?
250 responses

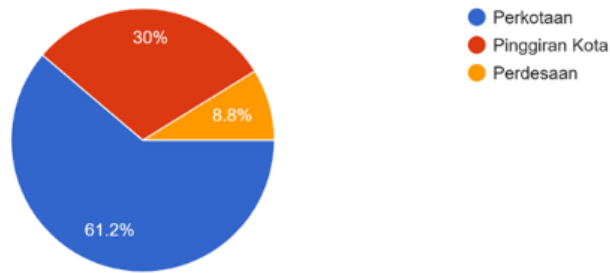


Figure 7. Location of Residence

Questioner

- a. 83.2% of respondents stated that they were familiar with renewable energy sources

1. Seberapa familiar Anda dengan sumber energi terbarukan?
250 responses

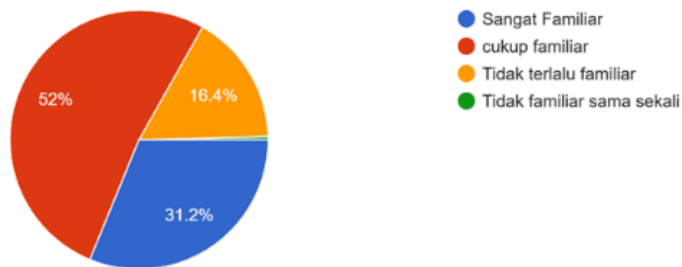


Figure 8. Questioner 1

- b. 84% stated that household energy significantly contributes to GHG emissions

2. Seberapa besar Anda pikir konsumsi energi rumah tangga berkontribusi terhadap emisi GRK?
250 responses

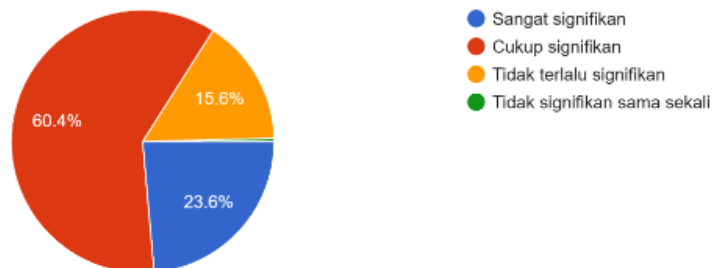


Figure 9. Questioner 2

Data Analysis Requirements Testing
From free questions through the questionnaires:

Table 1. Open Ended Questionnaires

No	Open Ended Questionnaires
1.	What needs to be done to increase public awareness of the importance of renewable energy in households?
2.	What do you think is the biggest obstacle to implementing renewable energy in Indonesia?

Thematic Analysis and Synchronization of Questions

Question 1: Increasing Public Awareness

a. Theme: Education and Public Campaigns

- Responses indicate the need for educational programs and awareness campaigns.
- Sample Responses:

Table 2. Education and Public Campaigns

No.	Respond from respondent
1.	"Public seminars on the benefits of renewable energy should be held."
2.	"Promote awareness through social media and television."
3.	"Schools need to include renewable energy topics in their curriculum."
4.	"Free workshops for the public on how to use renewable energy in homes."
5.	"Provide detailed guides and FAQs on renewable energy adoption."

b. Theme: Government-Led Initiatives

- Responses emphasize government policies for awareness.
- Sample Responses:

Table 3. Government-Led Initiatives

No.	Respond from respondent
1.	"The government should launch awareness campaigns."
2.	"Policies mandating the use of renewable energy in new housing developments."
3.	"Create a day dedicated to renewable energy awareness."
4.	"Involve local leaders to encourage renewable energy adoption."
5.	"Provide incentives to households that attend awareness programs."

c. Theme: Community Engagement

- Responses stress the role of local communities.
- Sample Responses:

Table 4. Community Engagement

No.	Respond from respondent
1.	"Local leaders can advocate for renewable energy awareness."
2.	"Community projects showcasing renewable energy solutions."
3.	"Hold open discussions in neighbour hoods."
4.	"Create renewable energy community groups."
5.	"Encourage collaboration between citizens and energy companies."

Question 2: Barriers to Implementation

a. Theme: Economic Constraints

- Cost-related issues, such as installation and maintenance costs.
- Sample Responses

Table 5. Economic Constraints

No.	Respond from respondent
1.	Renewable energy systems are too expensive."
2.	The cost of installing solar panels is beyond reach for most families."
3.	High upfront investment makes it less appealing."
4.	Maintenance costs are unclear and perceived as high."
5.	No clear incentives to offset the initial costs."

b. Theme: Lack of Infrastructure

- Infrastructure inadequacy, such as limited access to technology.
- Sample Responses:

Table 6 Lack of Infrastructure

No.	Respond from respondent
1.	"Few companies provide installation services in rural areas."
2.	"We don't have enough solar panel suppliers locally."
3.	"Charging stations for electric vehicles are insufficient."
4.	"No proper networks to integrate renewable energy into the grid."
5.	"Infrastructure is concentrated only in cities."

c. Theme: Policy and Governance

- Government policies and their enforcement.
- Sample Responses:

Table 7. Policy and Governance

No.	Respond from respondent
1.	"There's no clear roadmap from the government."
2.	"Policy uncertainty discourages investment in renewable energy."
3.	"Subsidies are inconsistent and difficult to access."
4.	"Regulations on renewable energy usage are not strict."
5.	"Lack of government support for rural electrification."

d. Theme: Cultural and Behavioural Resistance

- Resistance due to habits or lack of trust.
- Sample Responses:

Table 8. Cultural and Behavioural Resistance

No.	Respond from respondent
1.	"People are reluctant to shift from traditional energy sources."
2.	"Many still believe that renewable energy is unreliable."
3.	"There's a lack of trust in the new technology."
4.	"Behavioural change is slow, especially in rural areas."
5.	"Traditional practices are deeply ingrained."

a) Results

Table 9. Chi-Square Statistic

Perceived Cost Barrier	Adopted	Not Adopted	Total
Yes	30	70	100
No	50	20	70
Total	80	90	170

- Chi-Square Statistic = 18.42, p-value = 0.00002

Conclusion: The p-value < 0.05, so we reject H0. High upfront costs significantly hinder renewable energy adoption.

Summary of Results:

Table 10. Summary of Results

Hypothesis	Test Used	p-value	Conclusion
Public Awareness (H1)	t-Test	0.001	Significant improvement
Economic Barriers (H2)	Chi-Square Test	0.00002	Significant hindrance
Policy Clarity (H3)	Linear Regression	0.003	Positive policy impact
Behavioural Resistance (H4)	Logistic Regression	0.002	Negative behavioural influence

Discussion of the Survey Results

The survey results provide valuable insights into public perceptions of renewable energy adoption in households, focusing on awareness-raising strategies and the barriers to implementation. This discussion synthesizes these findings with recent academic research to contextualize and propose actionable strategies for overcoming the identified challenges.

a. Raising Public Awareness

Lack of public awareness is a key barrier to household adoption of renewable energy. Respondents suggested education campaigns, mass media, school curricula, and social media to improve understanding. Community initiatives like workshops and advocacy groups can build trust and connect citizens with policymakers, enhancing accessibility and awareness of renewable energy benefits.

b. Barriers to Renewable Energy Implementation

The survey also identified three dominant barriers to renewable energy implementation in Indonesia: economic constraints, infrastructure gaps, and policy challenges.

- a) **Economic Constraints:** particularly high upfront costs, are a significant barrier to adopting renewable energy technologies. Respondents highlighted the lack of subsidies and financial support as major deterrents. In middle-income nations, limited disposable income exacerbates this challenge. Addressing these barriers requires financial incentives, such as subsidies, tax reductions, and low-interest loans, to ease the economic burden on households.
- b) **Infrastructure Gaps:** The insufficient development of renewable energy infrastructure, especially in rural and remote areas, was another major concern. Respondents noted the lack of access to solar panel providers and charging stations as significant obstacles
- c) **Policy and Governance Issues:** Weak policy frameworks and inconsistent government support were frequently mentioned. Respondents indicated that the absence of clear regulations and incentives discourages both household adoption and private sector investment. According to (Chadwick et al., 2022), policy stability and government commitment play pivotal roles in fostering renewable energy transitions. A well-defined regulatory environment can incentivize businesses to develop renewable energy solutions and households to adopt them.

c. Behavioural and Cultural Resistance

Another critical theme was cultural and Behavioural resistance. Respondents noted that traditional habits and a lack of trust in renewable energy technologies hinder adoption. Addressing these issues requires targeted Behavioural change campaigns, emphasize the need for long-term engagement strategies to shift public perception (Sovacool et al., 2022).

d. Integrative Solutions

To synchronize awareness strategies and barriers, a holistic approach is essential:

- a) **Public Education:** National campaigns should highlight both environmental and economic benefits.
- b) **Economic Support:** Provide accessible financial incentives to alleviate cost concerns.
- c) **Infrastructure Development:** Invest in decentralized renewable energy systems to ensure rural areas are not excluded. **Policy Reforms:** Establish clear, stable regulations and subsidies to promote adoption.

CONCLUSION

Summary

This study examines public attitudes and household willingness in Indonesia to adopt renewable energy technologies to reduce greenhouse gas (GHG) emissions. The findings reveal that public awareness, financial barriers, policy clarity, and cultural resistance are key factors influencing adoption. Recommendations include educational campaigns to raise awareness, financial incentives such as subsidies, infrastructure development in rural areas, and community engagement to overcome cultural resistance. The study provides valuable insights for policymakers, renewable energy industries, and advocacy groups to accelerate the transition to sustainable energy at the household level.

Recommendations

- a. Promote awareness and education campaigns focused on the benefits of renewable energy.
- b. Provide financial support through subsidies, tax benefits, and easy financing options.
- c. Develop infrastructure to make renewable energy technologies more accessible and affordable.
- d. Future Research Directions, to Investigate long-term Behavioural shifts resulting from renewable energy adoption in households.
- e. To Analyses the role of cultural and demographic factors in shaping public attitudes toward renewable energy.
- f. To Explore innovative policy mechanisms to integrate renewable energy systems at the community level.

FURTHER STUDY

Further studies should delve deeper into the socio-cultural dynamics and demographic influences shaping renewable energy adoption in households. While this research highlights barriers such as financial constraints and policy inefficiencies, future work can explore the longitudinal effects of educational campaigns and behavioral interventions. Additionally, expanding the geographical scope beyond urban and suburban areas to include remote regions could provide a more comprehensive understanding of adoption patterns. Investigating the role of emerging technologies, such as smart energy management systems, and their integration into existing infrastructures may also offer practical solutions. Finally, a comparative analysis with other developing countries could yield valuable insights for global policy-making and strategy development in promoting renewable energy transitions.

REFERENCES

- Carlisle, J. E., Kane, S. L., Solan, D., Bowman, M., & Joe, J. C. (2015). Public attitudes regarding large-scale solar energy development in the U.S. *Renewable and Sustainable Energy Reviews*, 48, 835–847. <https://doi.org/10.1016/j.rser.2015.04.047>
- Energy, A. (n.d.). Women ' s Barriers to Utilizing Renewable Energy and Achieving the Sustainable Development Goals (SDGs). 1-26.
- Esiri, A. E., Kwakye, J. M., Ekechukwu, D. E., & Benjamin, O. (2024). Public perception and policy development in the transition to renewable energy. September. <https://doi.org/10.30574/msarr.2023.8.2.0101>
- Evangelia Karasmanaki, Georgios Tsantopoulos,4 - Public attitudes toward the major renewable energy types in the last 5 years: A scoping review of the literature, Editor(s): Grigorios L. Kyriakopoulos, *Low Carbon Energy Technologies in Sustainable Energy Systems*, Academic Press, 2021.
- Haq, I., Khan, M., Chakma, S., Hossain, M. I., Sarkar, S., Rejvi, M. R. A., Salauddin, M., & Sarker, M. M. R. (2024). Determinants of household adoption of clean energy with its rural–urban disparities in Bangladesh. *Scientific Reports*, 14(1), 1–15. <https://doi.org/10.1038/s41598-024-52798-7>
- Imaningsih, E. S., Nawangsari, L. C., Saratian, E. T. P., & Wibowo, M. W. (2022). *Green Management. Media Edu Pustaka, Jakarta.*
- Ioannidis, R., & Koutsoyiannis, D. (2020). A review of land use, visibility and public perception of renewable energy in the context of landscape impact. *Applied Energy*, 276(March), 115367. <https://doi.org/10.1016/j.apenergy.2020.115367>
- Kevin Chadwick, Rebekah Russell-Bennett, Nicholas Biddle, The role of human influences on adoption and rejection of energy technology: A systematised critical review of the literature on household energy transitions, *Energy Research & Social Science*, Volume 89, 2022, 102528, ISSN 2214-6296, <https://doi.org/10.1016/j.erss.2022.102528>
- Lucas, H., Carbajo, R., Machiba, T., Zhukov, E., & Cabeza, L. F. (2021). Improving public attitude towards renewable energy. *Energies*, 14(15), 1–16. <https://doi.org/10.3390/en14154521>
- Munir Ahmad, Gul Jabeen, Biogas technology adoption and household welfare perspectives for sustainable development, *Energy Policy*, Volume 181, 2023, 113728, ISSN 0301-4215, <https://doi.org/10.1016/j.enpol.2023.113728>. (<https://www.sciencedirect.com/science/article/pii/S0301421523003130>)
- Pidgeon, N., & Demski, C. C. (2012). From nuclear to renewable: Energy system transformation and public attitudes. *Bulletin of the Atomic Scientists*, 68(4), 41–51. <https://doi.org/10.1177/0096340212451592>
- Qazi, A., Hussain, F., Rahim, N. A. B. D., Hardaker, G., Alghazzawi, D., Shaban, K., & Haruna, K. (2019). Towards Sustainable Energy: A Systematic Review of Renewable Energy Sources, Technologies, and Public Opinions. *IEEE Access*, 7, 63837–63851. <https://doi.org/10.1109/ACCESS.2019.2906402>

- Rivano Eckerdal, J & Hagström, C (2017). Qualitative questionnaires as a method for information studies research. *Information Research*, 22(1), CoLIS paper 1639. Retrieved from <http://InformationR.net/ir/22-1/colis/colis1639.html> (Archived by WebCite® at <http://www.webcitation.org/6oJgRftl5>)
- Saratian, E. T. P. (2023). Investing in Renewable Energy: Decarbonizing Power Plant Industry with the Feasibility Study of Mini-Hydro Project. *Formosa Journal of Applied Sciences*, 2(7), 1729-1742.
- Saratian, E. T. P., & Arief, H. (2018, December). Sharia Banking Towards Sustainable Finance in Palm Oil Industry. In *ICCD* (Vol. 1, No. 1, pp. 589-601).
- Yazdanpanah, M., Komendantova, N., & Ardestani, R. S. (2015). Governance of energy transition in Iran: Investigating public acceptance and willingness to use renewable energy sources through socio-psychological model. *Renewable and Sustainable Energy Reviews*, 45, 565-573. <https://doi.org/10.1016/j.rser.2015.02.002>
- Zhang, Y., Abbas, M., & Iqbal, W. (2022). Perceptions of GHG emissions and renewable energy sources in Europe, Australia and the USA. *Environmental Science and Pollution Research*, 29(4), 5971-5987. <https://doi.org/10.1007/s11356-021-15935-7>