# EXPLORING SOLAR PV ADOPTION IN INDONESIA: INFLUENCES AND CONSUMER BEHAVIOR

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## ABSTRACT

While most studies on solar energy in Indonesia focus on the broader economic reasons for the limited adoption of solar photovoltaic (PV) systems, this research emphasizes the personal motivations of consumers. It investigates how factors such as green consumption value, price value, social influence, and facilitating conditions influence individuals' willingness to adopt solar PV technology. Data were collected through simple random sampling. The analysis, conducted using partial least squares structural equation modeling, revealed that price value, green consumption value, and facilitating conditions significantly and positively impact the intention to adopt solar panels. However, social influence does not significantly affect the decision-making process. These findings can inform policy development and marketing efforts to encourage the use of renewable energy solutions in Indonesia.

**Keywords:** Facilitating Condition, Green Consumption Value, Price Value, Social Influence, Rooftop Photovoltaic

## INTRODUCTION

As awareness of global warming grows, countries worldwide are shifting from fossil fuels to renewable energy, with solar power seeing significant advancements. In the U.S., solar capacity has surged by over 94% in the past decade, and Europe installed enough solar power in 2022 to supply electricity to 12.4 million homes. Despite its potential due to high solar radiation, Indonesia's adoption of solar photovoltaic (PV) systems remains limited, growing only 6.4% over the last ten years. Compared to similar countries like India and Malaysia, Indonesia's progress in renewable energy is slow, and research on green technology in Indonesia is still emerging.

While existing studies in Indonesia often focus on technical and regulatory aspects or the influence of major stakeholders, there is a lack of research on individual consumer behavior regarding solar PV adoption. This study aims to fill that gap by examining factors that influence households' intentions to adopt solar panels. By focusing on price value, green consumption value (GCV), social influence, and facilitating conditions, the research seeks to understand how these factors shape consumer attitudes and decisions. This approach aligns with Ajzen's theory, which suggests that behavioral intention is influenced by personal values, social expectations, and perceived control.

The study will explore how price and environmental values interact to affect consumer attitudes toward solar technology. It will also examine the roles of social influence and facilitating conditions, drawing on established theories of technology acceptance. The goal is to identify key factors that drive the intention to adopt solar panels, providing insights for both academic literature and practical strategies. By understanding these influences, businesses and policymakers can develop targeted approaches to promote solar PV adoption in Indonesia. The paper will cover theoretical background, research methodology, results, and implications, concluding with limitations and recommendations.

## LITERATURE REVIEW

### Behavioral intention

Behavioral intention refers to the conscious decision-making process that influences whether someone will use a particular technology. In the case of solar photovoltaic (PV) systems, it involves a customer's willingness to adopt solar energy, which can lead to purchasing and installing solar panels at home. This intention is a strong predictor of actual behavior, meaning that if someone plans to use solar panels or recommends them to others, they are more likely to follow through with the purchase and installation.

**Price Value**

Price value is about weighing the benefits of a product against its costs. For solar PV technology, the benefits include savings on electricity bills, while the costs involve the initial investment and ongoing maintenance. Research shows mixed results on how price value affects the intention to adopt new technologies. Some studies find that a favorable price value encourages adoption, while others see no significant effect. This study aims to explore how consumers perceive the price value of solar PV systems and hypothesizes that a positive price value will increase the likelihood of adopting solar technology.

**Green Consumption Value**

Green consumption value (GCV) measures how much individuals value environmental protection in their purchasing decisions. It goes beyond just being concerned about environmental issues; it also considers how willing people are to make environmentally friendly choices, even if it means some inconvenience. GCV is expected to positively influence the intention to adopt solar PV technology, as people who prioritize eco-friendly products are more likely to choose solar panels for their homes.

**Social Influence**

Social influence examines how much consumers are affected by the opinions of family and friends regarding the use of a technology. In some cultures, social influence plays a significant role in encouraging the adoption of solar panels, while in others, it has little impact. This study seeks to understand the role of social influence among Indonesian consumers and hypothesizes that positive social influence will encourage the adoption of solar PV systems.

**Facilitating Condition**

Facilitating conditions refer to the resources and support available to consumers that make adopting a new technology easier. This includes having the necessary knowledge, financial resources, and compatibility with existing systems. While some studies show that facilitating conditions positively impact the intention to adopt solar technology, others find them insignificant. This research will explore how these conditions affect Indonesian consumers' decisions to adopt solar PV technology, hypothesizing that favorable facilitating conditions will increase adoption intentions.

## METHODOLOGY

**Population and Sample**

This study used a cross-sectional design with a quantitative approach, collecting data through online questionnaires distributed via social media platforms like Line, WhatsApp, and Instagram. The target participants were individuals over 20 years old, living in houses, who had completed high school, and earned more than Rp10 million per month. These criteria were chosen to focus on people with the financial means to purchase solar PV systems and suitable housing for installation. Participants received information about average solar panel prices to help them answer questions related to price value. A simple random sampling method was used to select participants for the survey.

**Data Analysis Technique**

The study employed a self-administered questionnaire divided into two main sections: Section A for participant profiling and Section B for assessing the constructs. Section A included filtering questions on age, housing status, education level, and income, as well as introductory questions on gender and electricity bills. The questionnaire items were adapted from validated empirical studies. Initially, the questionnaire was piloted with 10 respondents to refine its quality and effectiveness. After incorporating feedback, the final questionnaire was distributed.

**Data Processing and Analysis**

The research used partial least squares (PLS) structural equation modeling with Smart PLS software Version 4 to test the hypotheses and research model. The analysis included evaluating the measurement model using the PLS algorithm and applying the bootstrapping technique. The data underwent checks for convergent validity, discriminant validity, and reliability, following guidelines from Hair, Hult, and Ringle. The analysis involved three key steps: model specification, outer model evaluation, and inner model evaluation. The structural model examined the

relationships between exogenous constructs (green concern value, price value, social influence, and facilitating conditions) and the endogenous construct (behavioral intention).

## ANALYSIS AND DISCUSSION

### Analysis

The final sample of 210 respondents consisted of 95 female (45% of total sample) and 105 male (50% of total sample). Majority of the sample were between 20-30 years old (n=95, 45%), followed by 31-40 year olds (n=41, 20%), 41-50 years olds (n=38, 18%), and 50 years and older (n=36, 17%). Most of the respondents' last education is a bachelor's degree (n=119, 56%), followed by both high school (*Sekolah Menengah Atas*) (n=31, 15%) and diploma qualification (D3) (n=31, 15%), and a postgraduate degree (n=29, 14%). Furthermore, in terms of monthly income, 108 (51%) respondents earned above Rp10M and below 20M, 46 (22%) respondents above Rp20M and below Rp30M, 21 (10%) respondents above Rp30M and below Rp40M, 11 (5%) respondents above Rp40M and below Rp50M, and 24 (11%) respondents earning above Rp50M. At the time of writing, the average monthly income in big cities in Indonesia (i.e. Jabodetabek, Surabaya, and Bali) were Rp 10.500.000 (Goodstats.id, 2023). In terms of average monthly electricity bill, 46 (22%) respondents had a bill below Rp1M, 88 (42%) had a bill above Rp1M and below Rp2M, 49 (23%) had a bill above Rp2M and below Rp3M, while 27 (13%) had a bill above Rp3M.

Table 2 retained 20 item loadings as they exceeded the 0.707 cutoff value specified by Hair et al. (2017). Additionally, there are one item from facilitating condition, one item from social influence, and three items from price value with factor loadings ranging from 0.523 to 0.682 that were retained as they met the minimum threshold value of 0.500 for the average variance extracted (AVE) (Barclay, Thompson, & Higgins, 1995). There are five other items that were excluded from the final model due to low factor loadings: one from social influence (SI 4), three from price value (PV 3, PV 4, PV 5), and one from facilitating conditions (FC 4). Furthermore, the composite reliability for each construct exceeded the recommended minimum cutoff value of 0.700 by Hair et al. (2017), affirming the measurement model's adequate convergent validity.

Table 2
Convergent Validity

| Construct | Items | Full Sample (N=210) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Outer Loadings | Cronbach's Alpha | AVE | rho A | rho C | VIF |
| Behavioral Intention | BI1 | 0.868 | 0.805 | 0.719 | 0.808 | 0.885 | 1.851 |
| | BI2 | 0.855 | | | | | 1.872 |
| | BI3 | 0.820 | | | | | 1.587 |
| Green Consumption Value | GCV1 | 0.756 | 0.867 | 0.600 | 0.879 | 0.900 | 1.974 |
| | GCV2 | 0.814 | | | | | 2.306 |
| | GCV3 | 0.840 | | | | | 2.375 |
| | GCV4 | 0.757 | | | | | 1.907 |
| | GCV5 | 0.745 | | | | | 1.751 |
| | GCV6 | 0.727 | | | | | 1.514 |
| Price Value | PV1 | 0.806 | 0.771 | 0.518 | 0.803 | 0.841 | 2.176 |
| | PV2 | 0.828 | | | | | 2.265 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | PV6 | 0.682 | | | | | 1.424 |
| | PV7 | 0.606 | | | | | 1.403 |
| | PV8 | 0.651 | | | | | 1.480 |
| Social Influence | SI1 | 0.523 | 0.626 | 0.560 | 0.770 | 0.785 | 1.146 |
| | SI2 | 0.786 | | | | | 1.392 |
| | SI3 | 0.887 | | | | | 1.314 |
| Facilitating Condition | FC1 | 0.661 | 0.898 | 0.623 | 0.905 | 0.920 | 1.565 |
| | FC2 | 0.744 | | | | | 2.341 |
| | FC3 | 0.768 | | | | | 2.482 |
| | FC5 | 0.786 | | | | | 1.987 |
| | FC6 | 0.879 | | | | | 3.927 |
| | FC7 | 0.829 | | | | | 2.755 |
| | FC8 | 0.838 | | | | | 2.887 |

Cross-loadings, Fornell and Larcker criterion, and the Heterotrait-Monotrait (HTMT) criterion were used to assess the discriminant validity of this study. Each item's cross-loadings value was at least 0.100 smaller than its factor loading value. Moreover, this study aligns with Fornell and Larcker (1981) recommendation where the square root of the AVE for each construct should be greater than the correlation values. Table 3 shows that the HTMT for each construct was below the specified threshold of 0.85 (Clark & Watson, 1995; Kline, 2011), confirming discriminant validity.

Table 3
HTMT Criterion Result

| Construct | FC | GCV | BI | PV | SI |
|---|---|---|---|---|---|
| FC | | | | | |
| GCV | 0.569 | | | | |
| BI | 0.890 | 0.646 | | | |
| PV | 0.732 | 0.519 | 0.862 | | |
| SI | 0.546 | 0.530 | 0.621 | 0.545 | |

Based on the structural model of the findings, three variables were found to positively and significantly influence Behavioral Intention, namely: Price Value (beta = 0.321, $p < .01$), Green Concern Value (beta = 0.155, $p < .01$), and Facilitating Condition (beta = 0.436, $p < .01$). However, the direct effects of Social Belief (Beta = 0.77, $p = 0.296$) on Behavioral Intention was not significant. Meanwhile, ANOVA results reveal that the regression factors have an $R^2$ of 0.683 ($R^2$ adjusted = 0.677). Implications of these findings will be explained in the next section.

Table 3
Structural model results

| H | Path | Beta | Std. Error | t-stat | p-value | Results | $f^2$ | $R^2$ | $R^2$ adjusted |
|---|---|---|---|---|---|---|---|---|---|
| H1 | PV -> BI | 0.321 | 0.063 | 5.113 | 0.000 | Supported | 0.175 | 0.683 | 0.677 |
| H2 | GCV -> BI | 0.155 | 0.065 | 2.386 | 0.017 | Supported | 0.052 | | |
| H3 | SI -> BI | 0.077 | 0.060 | 1.294 | 0.196 | Not Supported | 0.014 | | |
| H4 | FC -> BI | 0.436 | 0.078 | 5.573 | 0.000 | Supported | 0.296 | | |

**Discussion**

The study confirmed that price value significantly influences the intention to adopt solar PV technology, aligning with previous research by Lau et al. (2020) and Kilani et al. (2023). Despite many respondents earning above the average income in Indonesia's major cities, they remain sensitive to price. This highlights the importance of effective pricing strategies, such as promotional pricing or installment plans, to enhance the perceived affordability of solar PV systems.

The research also found that green consumption value (GCV) positively impacts the adoption of solar PV, supporting the second hypothesis. This aligns with findings from Risitano et al. (2023) and Chatterjee et al. (2021), indicating that environmentally conscious individuals are more inclined to adopt solar technology. Raising awareness about the limitations of non-renewable energy and the environmental impact of coal could further boost solar PV adoption in Indonesia.

Unexpectedly, social influence did not significantly affect the intention to adopt solar PV, even in a collectivist society like Indonesia. This might be due to limited peer adoption and skepticism about the technology. As the adoption rate has dropped significantly since 2020, social influence may be weakened by the lack of success stories. Future research could explore this further by focusing on those who have already adopted solar PV.
Facilitating conditions were found to positively impact the intention to adopt solar PV, supporting the fourth hypothesis. This finding is consistent with previous studies by Akroush et al. (2019), Lau et al. (2020), and Tanveer et al. (2021). High accessibility to solar PV sellers and robust support services encourage adoption. Solar PV providers should emphasize their after-sales services and guarantees to reassure potential customers.

**CONCLUSION AND RECOMMENDATIONS**

The study successfully explored the factors influencing the intention to adopt solar PV systems in Indonesia. To increase the national adoption rate, stakeholders should consider offering promotional pricing, government incentives, and flexible payment options. Awareness campaigns and educational programs can enhance public understanding of the environmental benefits and functionality of solar PV. Additionally, businesses should focus on providing reliable after-sales support to reduce uncertainties and encourage adoption.
Despite the valuable insights gained, the study has some limitations. The reliance on self-reported data may introduce response bias, particularly regarding green consumption values. The geographic focus on East Java limits the generalizability of the findings. Future research could expand to other regions and increase the sample size for greater robustness. Comparative studies across different demographic groups could also enrich the literature by examining factors such as age, education, and income as moderating variables.

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| Construct | Full Sample (N=210) | | |
|---|---|---|---|
| | AVE | rho A | rho C |
| Behavioral Intention | 0.719 | 0.808 | 0.885 |
| Green Consumption Value | 0.600 | 0.879 | 0.900 |
| Price Value | 0.518 | 0.803 | 0.841 |
| Social Influence | 0.560 | 0.770 | 0.785 |
| Facilitating Condition | 0.623 | 0.905 | 0.920 |