

Green Product, Green Brand Image, Green Advertising on Purchase Decisions Mediated by Price, SERVQUAL

Dewi Puspaningtyas Faeni^{1*}, Herni Pujiati², Dewi Sri Wulandari³

Universitas Dirgantara Marsekal Suryadarma, Jakarta, Indonesia^{1,2,3}

dewi.faeni@unusrya.ac.id^{1*}, hernipujiati@unsurya.ac.id², dewisw0202@gmail.com³



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Abstract

Purpose: This study aims to analyze the effect of green product, green brand image, and green advertising on purchase decisions at Photovoltaic Industry, with price and SERVQUAL as mediating variables. The objective is to understand how green marketing strategies determined purchase decision upon renewable energy sector.

Research Methodology: The research was conducted at Photovoltaic Industry, using a quantitative approach. Collected 109 respondents Slovin's formula. The statistic analysis employed Structural Equation Modeling (SEM) with SmartPLS 4.2 software.

Results: Green product, green brand image, and green advertising have a positive and significant effect on purchase decisions, both partially and simultaneously. Price and SERVQUAL proven as mediators determined green marketing strategies on consumer purchasing behavior.

Conclusions: The study concludes that integrating green marketing strategies with competitive pricing and high service quality can significantly enhance purchase decisions at Photovoltaic Industry. This highlights the importance of combining environmental values with practical business elements.

Limitations: The study is limited to one Photovoltaic company and a relatively small sample size of 109 respondents, which may restrict the generalization of findings to other industries or regions.

Contributions: This research contributes to the field of marketing management and sustainability studies by providing empirical evidence on the role of green marketing in consumer decision-making. It offers practical implications for business practitioners, policymakers, and academics in developing strategies that align environmental responsibility with improved organizational performance based on renewable energy.

Keywords: *Green Advertising, Green Brand Image, Green Product, Purchase Decisions, Service Quality*

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1. Introduction

Global warming is becoming an environmental problem that is for all countries, including Indonesia. In 2021, Indonesia announced a commitment to reduce carbon emissions by expanding the use of the

renewable energy sector by 23%. To support the sustainable energy target, one of the commitment is implement renewable energy sector in electricity for clean, safe and affordable electricity for all Indonesian, state-owned enterprises and private companies to work together and implement solutions needed to improve efficiency on the one hand in a systematic and large system.

1.1 Electricity Generation by Energy Source in Indonesia (2017–2022)

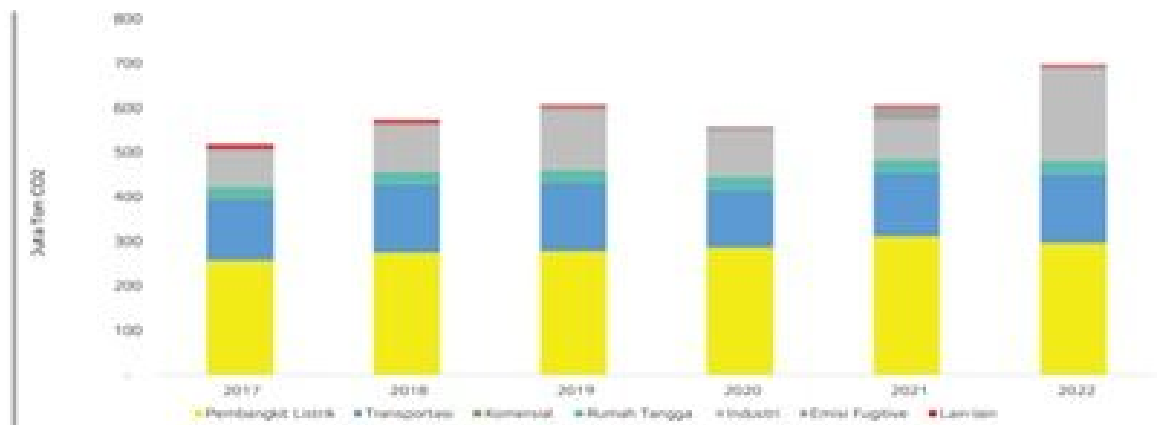


Figure 1. CO2 emissions per sector in 2017-2022

Figure 1 illustrates the trend of electricity generation by energy source in Indonesia over the period 2017–2022. The stacked bar chart categorizes electricity production into six major sources: electricity generated from power plants, transportation, commercial activities, households, industry, emissions from energy production, and other sectors. Overall, the figure demonstrates a gradual increase in total electricity generation during the six-year period, despite a temporary decline in 2020 due to the COVID-19 pandemic.

The 2023 National Energy Balance Analysis Report states that the trend of CO2 emissions from 2017-2022 has grown by 6.1% annually from fuel combustion and fugitive emissions. The highest growth came from the industrial sector at 20.6% per year. This shows that from year to year the air in Indonesia is getting unhealthy. The solution that can be taken by the government to stop these adverse impacts is to use clean energy. It is recorded that Indonesia is the sixth largest carbon emitter country in Asia Pacific which produces more than 704.4 million tons of carbon in 2023. The energy sector is the sector that contributes the most to carbon (CO2) emissions, followed by IPPU (Industry and Product Use), Forestry, Agriculture and Waste.



Figure 2. Carbon emitting countries in the world in 2023

Figure 2 presents the ranking of the world's largest carbon dioxide (CO₂) emitters, illustrating the substantial disparities in emission levels among the ten highest-emitting countries. The data reveal that China is by far the largest contributor to global CO₂ emissions, producing approximately 11,218.4 million tonnes (MtCO₂), which exceeds the emissions of all other countries included in the figure by a considerable margin. China's dominant position reflects its extensive industrial activities, rapid economic development, large population, and continued reliance on coal as the primary energy source for electricity generation and manufacturing.

The United States ranks second, with emissions of approximately 4,639 MtCO₂, accounting for less than half of China's total emissions but remaining substantially higher than those of the other countries. The United States' emissions are primarily associated with transportation, industrial production, electricity generation, and residential energy consumption. India occupies the third position, emitting approximately 2,595 MtCO₂, reflecting its accelerating industrialization, rapid urbanization, population growth, and increasing energy demand. Although India's per capita emissions remain relatively low compared to those of developed economies, its total emissions continue to rise due to expanding economic activities.

The second tier of emitters consists of Russia, with approximately 1,614 MtCO₂, followed by Japan, contributing around 1,013 MtCO₂. Russia's emissions are largely attributable to its fossil fuel extraction, heavy industries, and energy-intensive manufacturing sectors. In contrast, Japan's emissions primarily originate from electricity generation, industrial production, and transportation, particularly following increased dependence on fossil fuels after the Fukushima nuclear accident.

Indonesia ranks sixth among the ten largest CO₂-emitting countries, with total emissions of approximately 704.4 MtCO₂. Indonesia's emissions are largely driven by coal-based electricity generation, industrial expansion, transportation, and land-use changes associated with economic development. The country's position among the world's largest emitters highlights the growing environmental challenges accompanying rapid economic growth and increasing energy consumption. This finding emphasizes the importance of strengthening climate mitigation strategies through renewable energy development, improvements in energy efficiency, sustainable industrial practices, and the implementation of environmentally responsible human resource and corporate management policies.

The remaining countries, Iran (683.6 MtCO₂), Saudi Arabia (620.4 MtCO₂), Germany (571.9 MtCO₂), and South Korea (571.2 MtCO₂), record comparatively lower emission levels but continue to contribute significantly to global greenhouse gas emissions. Their emissions are primarily associated with fossil fuel combustion, industrial production, petrochemical industries, electricity generation, and transportation activities. Although Germany has made substantial progress in renewable energy deployment, it remains among the largest emitters due to its industrial base and energy consumption.

This Figure demonstrates a highly uneven global distribution of carbon dioxide emissions, with a small number of countries accounting for a disproportionately large share of total global emissions. The considerable gap between China and the remaining countries underscores the critical role of major emitting economies in achieving international climate objectives, including the targets established under the Paris Agreement.

The President of Indonesia at the G20 Summit launched a Net Zero region by 2060 where this region uses new and renewable energy and can produce Green Products. The government's efforts to reduce carbon emissions that continue to increase are by launching a renewable energy-based carbon policy (NRE), which is the transition to a green economy. Solar Power Plant (SPP) is a technology that converts sunlight energy into electricity. Solar power is an environmentally friendly renewable energy. one of the most popular and sustainable renewable energy sources in the world today ([Souisa, Johanis, & Universitas, 2022](#)).

To convert sunlight into electrical energy, solar cells are needed. Solar energy is the main source of endless free energy on earth (Timothy et al., 2023). The current condition encountered is that new technologies are being developed to generate the collected solar energy. Solar energy is a primary energy that has non-polluting and inexhaustible properties ([Alhamad, & Sawsan, 2023](#); [Amalia, Lia, & Freddy, 2021](#); [Annisa, & Tenri, 2018](#)). Clean energy is energy that is ready to be used for certain needs. Clean energy generally comes from renewable energies such as geothermal, wind, bioenergy, sunlight, and water flow. In 2021, there are already 12.16% of Indonesians who have started using clean energy ([Majeed, & Edina, 2022](#); [Carri, & Franklin, 2025](#)).

This is also emphasized in the use of solar energy sources is quite easy to do in Indonesia, if managed properly, then energy security in Indonesia can be realized. Sustainable living can be realized through investment in new and renewable energy to gradually reduce the use of fossil energy ([Arif, Muhammad, & Nisrul, 2023](#)).

1.2 Trends in Renewable Energy Production (2018–2022)



Figure 3. Solar energy supply in 2018-2022

Figure 3 illustrates the trend in renewable energy production from 2018 to 2022, measured in Tons of Oil Equivalent (TOE). The data demonstrate a consistent upward trajectory throughout the five-year period, indicating continuous improvements in renewable energy generation and increasing national commitment toward sustainable energy development. Renewable energy production increased from 0.05 TOE in 2018 to 0.14 TOE in 2022, representing an overall increase of approximately 180% over the study period. The annual growth pattern reveals steady progress in renewable energy production. Output increased from 0.05 TOE in 2018 to 0.07 TOE in 2019, corresponding to a growth rate of approximately 40%. A more substantial increase occurred between 2019 and 2020, when production reached 0.10 TOE, suggesting accelerated investment in renewable energy infrastructure and enhanced policy support for clean energy development. Despite the economic disruptions caused by the COVID-19 pandemic, renewable energy production continued to expand, demonstrating the resilience of the sector and the sustained implementation of national energy transition initiatives ([Ashraf, Arif, & Muhammad, 2024](#)).

Growth remained positive during the subsequent years, with renewable energy production rising to 0.11 TOE in 2021 before reaching its highest recorded level of 0.14 TOE in 2022. The increase observed in 2022 represents approximately 27% growth compared with the previous year, indicating a renewed acceleration following the post-pandemic economic recovery ([Cornelisz & Greis, 2024](#)). This upward trend suggests increasing deployment of renewable energy technologies, including solar,

From a business sustainability perspective, investment in rooftop solar installations provides multiple economic and environmental benefits. Self-generated renewable electricity reduces long-term electricity expenditure, enhances energy security by decreasing dependence on fluctuating fossil fuel prices, and strengthens corporate resilience against future energy supply uncertainties. Furthermore, organizations adopting renewable energy technologies are better positioned to meet increasingly stringent environmental regulations and stakeholder expectations regarding Environmental, Social, and Governance (ESG) performance.([Dewi & Universitas, 2024](#)).

The implementation of rooftop solar photovoltaic systems also complements organizational sustainability strategies such as Green Human Resource Management (GHRM) and Corporate Social Responsibility (CSR). GHRM practices can support renewable energy initiatives by fostering employees' environmental awareness, encouraging energy-efficient workplace behaviors, and developing organizational competencies related to sustainable operations. Figure X demonstrates substantial progress in the deployment of rooftop solar photovoltaic systems across industrial and commercial facilities ([Dewi, Puspita, & Debora, 2025](#)). The increasing scale and diversity of these installations indicate that distributed solar generation has become an important strategy for improving energy sustainability, reducing greenhouse gas emissions, and supporting the transition toward a low-carbon economy. Continued investment in photovoltaic technology, supportive government policies, technological innovation, and stronger collaboration among industry stakeholders will be essential to accelerate renewable energy adoption and achieve long-term sustainable development objectives. Efforts to switch to solar energy through Photovoltaic Industries, everyone contributes to reducing carbon emissions and maintaining environmental sustainability([Faeni & Riki, 2024](#)). This initiative is in line with the national agenda towards Net Zero Emission 2060 and supports a green lifestyle that is now increasingly relevant in the midst of climate change challenges. Photovoltaic Industries focuses on providing renewable energy solutions and energy efficiency as a contribution to realizing a greener and cleaner Indonesia.

1.4 Installed Rooftop Solar Photovoltaic Capacity by Customer Sector

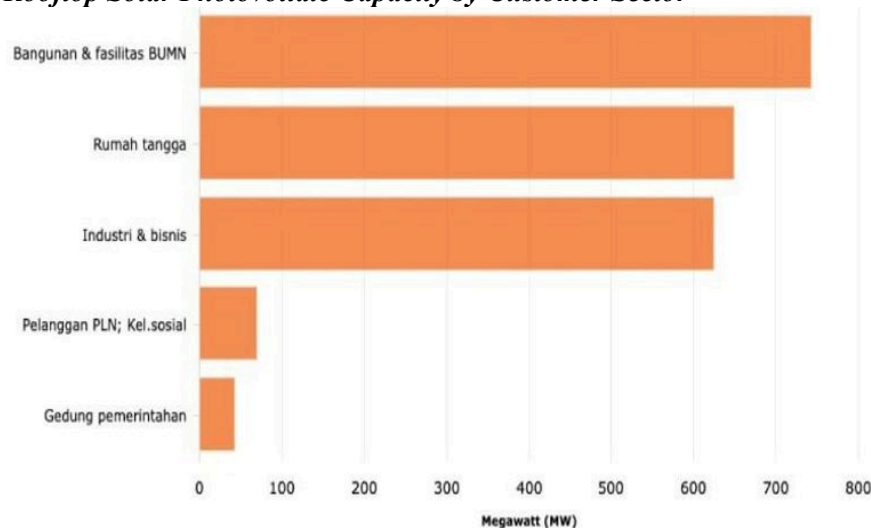


Figure 5. Targeted consumer segmentation

Figure 5 presents the distribution of installed rooftop solar Photo Voltaic (PV) capacity across various customer sectors, measured in Mega Watts (MW). The figure indicates that the adoption of rooftop solar energy is concentrated primarily in State-Owned Enterprise (SOE) buildings and, followed by the residential and industrial and business sectors. In contrast, installations among State Owned Electricity Company customers and government buildings remain comparatively limited, suggesting unequal adoption rates across different categories of electricity consumers .

The residential sector ranks second, with an installed capacity of approximately 640 MW. The substantial contribution of households demonstrates increasing public awareness of renewable energy and growing participation in decentralized electricity generation. Rising residential adoption may be attributed to increasing electricity prices, supportive government policies, technological advancements that have reduced photovoltaic installation costs, and greater public concern regarding environmental sustainability ([Nurdjaman, Djadja, & Ratlan, 2024](#)). Household rooftop solar systems also contribute to improving energy security by enabling consumers to generate electricity for self-consumption while reducing pressure on the national electricity grid ([Febriatmoko, Bogy, & Universitas, 2024](#)).

The industrial and business sector follows closely, with an installed capacity of approximately 620 MW. The relatively high level of adoption within this sector indicates that industries increasingly recognize renewable energy as a strategic investment capable of lowering operational costs, improving energy efficiency, and strengthening corporate environmental performance ([Kurniawan, Febrianto, & Hui, 2024](#)). For many businesses, rooftop photovoltaic systems represent an effective approach to reducing electricity expenditures while simultaneously meeting Environmental, Social, and Governance (ESG) expectations from investors, customers, and regulatory authorities ([Hartanto, Prasetyo, & Puspo, 2023](#)).

By comparison, State Owned Electricity customers and government buildings contribute only a small proportion of total installed photovoltaic capacity, with capacities remaining below 100 MW. These comparatively low levels of adoption may reflect budgetary constraints, limited investment incentives, administrative challenges, or slower implementation of renewable energy programs within the public sector. The findings suggest considerable untapped potential for expanding rooftop photovoltaic deployment in government facilities, educational institutions, healthcare centers, and other public infrastructure ([Iryadana & Ade, 2024](#)).

From an organizational perspective, the increasing adoption of rooftop photovoltaic systems provides strong support for the implementation of GHRM and CSR initiatives, investing in renewable energy can strengthen employee engagement in environmental sustainability through green training, environmentally responsible workplace practices, and energy conservation programs ([Mahayasa & Ni, 2024](#)). At the same time, rooftop solar deployment represents a tangible CSR initiative that demonstrates corporate commitment to carbon emission reduction and sustainable development. Integrating renewable energy investment with GHRM and CSR strategies enables organizations to achieve both environmental and organizational performance objectives while contributing to national climate commitments and the Sustainable Development Goals (SDGs) ([Masjhur, Ahmad, & Rifdah, 2024](#)).

The data in the table above shows the segmentation of consumers who are the target sales of Solar Power Plant / PLTS services. SOE buildings and facilities are ranked at the top as targets in using Solar Power Plant / PLTS services. The problem faced in the implementation of Solar Power Plant / PLTS services is the high initial investment cost (Price) ([Hasanah, Uswatun, & Tri, 2025](#); [Hazmi, Prastu, & Yuke, 2023](#); [Yosepha & Luqman, 2024](#)). Although in the long term, Solar Power Plants / Solar Power Plants can reduce household electricity costs, the prices of solar panels, inverters, energy storage batteries, and installation costs are still relatively expensive for most people ([Rizkynugraheny & Elia, 2025](#)).

1.5 Monthly Electricity Generation from Solar Photovoltaic Systems

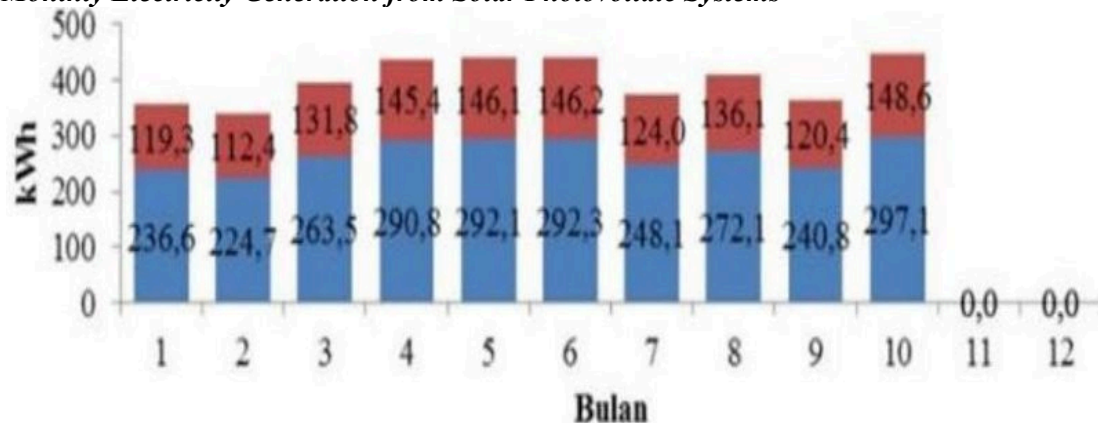


Figure 6. Office building electricity consumption

Figure 6 illustrates the monthly electricity generation of a solar PV system throughout one calendar year, measured in kilowatt-hours (kWh). The stacked bar chart illustrates two components of electricity production for each month, demonstrating the seasonal variation in solar energy output.

This figure demonstrates that rooftop solar photovoltaic systems are capable of producing substantial amounts of renewable electricity throughout most of the year while exhibiting expected seasonal variability. These findings reinforce the important role of solar photovoltaic systems in reducing dependence on fossil-fuel-based electricity, lowering greenhouse gas emissions, and enhancing energy sustainability ([Anggraeni & Hariyadi, 2024](#)). From a sustainability perspective, increasing photovoltaic electricity generation contributes directly to national decarbonization strategies by replacing conventional electricity generated from fossil fuels with clean renewable energy also aligns with GHRM and CSR initiatives, enabling organizations to reduce their environmental footprint while fostering employee engagement in sustainable energy practices. Furthermore, expanding photovoltaic deployment supports several SDGs ([Anggraeni & Hariyadi, 2024](#)). In conclusion, Figure 6. indicates that solar photovoltaic systems provide a reliable source of renewable electricity across most months of the year, despite seasonal fluctuations in energy output. Continued investment in photovoltaic technology, effective system maintenance, and supportive renewable energy policies will be essential to maximize electricity generation, improve energy efficiency, and accelerate the transition toward a low-carbon and sustainable energy system([Arisanti, Desi, & Firmansyah, 2023](#)).

2. Literature Review and Hypotheses Development

Green product refers to goods and services designed to minimize negative environmental impacts throughout their lifecycle. Prior studies highlight that consumers increasingly prefer eco-friendly products as part of their sustainable consumption behavior ([Chen, Yu-shan, & Ying-rong, 2020](#)). In the context of renewable energy, solar panels and photovoltaic rooftop systems represent green products that reduce carbon emissions and promote energy independence. Thus, green product attributes are expected to positively influence consumer purchase decisions ([Uma & Ika, 2024](#)).

Brand image plays a critical role in shaping consumer perceptions and loyalty ([Yustiana, Dhita, & Honor, 2022](#)). A strong green brand image signals a company's commitment to sustainability and environmental responsibility ([Mensah, 2021](#)). Companies that successfully project a green identity are more likely to gain consumer trust and encourage adoption of eco-friendly solutions. Therefore, green brand image is hypothesized to have a significant effect on purchase decisions.

Advertising is a powerful tool for communicating product benefits and values. Green advertising emphasizes environmental responsibility and appeals to consumers' ecological concerns ([Pijoh, 2024](#)). Effective green advertising not only raises awareness but also motivates consumers to act in favor of

sustainable products. Consequently, green advertising is expected to positively influence purchase decisions.

Price remains a decisive factor in consumer decision-making, even in the context of green products. While consumers may value sustainability, affordability often determines actual purchase behavior ([Li, Ying, & Amer, 2024](#)). Previous studies suggest that competitive pricing can strengthen the relationship between green marketing strategies and purchase decisions. Hence, price is hypothesized to mediate the effect of green product, brand image, and advertising on purchase decisions.

Service quality is another critical determinant of consumer satisfaction and loyalty. In the renewable energy sector, installation, maintenance, and customer support are essential components of service delivery ([Permana, Dudi, & Rosalendo, 2025](#)). High service quality enhances consumer confidence and reinforces the perceived value of green products. Thus, service quality is hypothesized to mediate the relationship between green marketing strategies and purchase decisions.

The integration of green product, green brand image, and green advertising creates a holistic marketing strategy that appeals to both rational and emotional aspects of consumer behavior. When supported by competitive pricing and superior service quality, these strategies are more likely to result in positive purchase decisions. This aligns with the theory of planned behavior, which emphasizes the role of attitudes, subjective norms, and perceived control in shaping consumer intentions ([Brand, Green, & Green, 2023](#)).

Based on the literature, the following hypotheses are proposed:

- H₁*: Green product has a positive and significant effect on purchase decisions
- H₂*: Green brand image has a positive and significant effect on purchase decisions
- H₃*: Green advertising has a positive and significant effect on purchase decisions
- H₄*: Price mediates the relationship between green product, green brand image, and green advertising toward purchase decisions
- H₅*: Service quality mediates the relationship between green product, green brand image, and green advertising toward purchase decisions
- H₆*: Green product affects price
- H₇*: Green brand image has an effect on price
- H₈*: Green product and green advertising
- H₉*: Service quality affects price
- H₁₀*: Price affects the green brand image
- H₁₁*: Service quality and green brand image affect purchase decision
- H₁₂*: Service quality affects green brand image
- H₁₃*: Price and service quality affect purchase decisions
- H₁₄*: Service quality, price has a positive and significant effect on purchase decisions

3. Research Methodology

This study adopts a quantitative survey-based approach to investigate the effect of green product, green brand image, and green advertising on purchase decisions at Photovoltaic Industries, with price and service quality as mediating variables. The research design is explanatory, aiming to test hypotheses and measure causal relationships among variables using Structural Equation Modeling (SEM) ([Beatrice, Jesslyn, & Helena, 2025](#)).

3.1 Population and Sample

The population of this study consists of all staff members of Photovoltaic Industries, a engaged in renewable energy solutions. Using Slovin formula, a sample size of 109 respondents was determined. Respondents were selected through simple random sampling to ensure equal representation and minimize bias.

3.2 Data Collection Instruments

Data were collected using a structured questionnaire based on a Likert scale (1–5), ranging from “strongly disagree” to “strongly agree.” The questionnaire was divided into sections measuring: Green Product (X_1), Green Brand Image (X_2), Green Advertising (X_3), Price (Z_1), Service Quality (Z_2) and Purchase Decision (Y). Each construct was operationalized using indicators adapted from prior validated studies in marketing and sustainability research.

3.3 Survey Procedure

The survey was conducted in Jakarta at Photovoltaic Industry office environment. Respondents completed the questionnaire under standardized conditions, ensuring confidentiality and voluntary participation. No external incentives were provided to avoid bias in responses.

3.4 Data Analysis Tools

The collected data were processed using SmartPLS 4.0 software, which is widely applied in SEM analysis for testing complex models with latent variables. The analysis included: Validity and reliability testing (Cronbach Alpha, Composite Reliability, AVE), Multicollinearity testing (VIF), Path coefficient analysis, R-square and Q-square testing for predictive relevance and Bootstrapping for hypothesis testing and significance levels

3.5 Research Assumptions and Theories

This study is grounded in green marketing theory and the Theory of Planned Behavior, which explains how attitudes, subjective norms, and perceived behavioral control influence consumer decisions ([Febriandari, 2025](#)). Assumptions include: Respondents provide honest and unbiased answers, the sample size is sufficient to represent the population and SEM assumptions regarding linearity, reliability, and validity are met ([Faeni & Hasan, 2025](#)).

4. Results and Discussions

The initial stage of analysis begins with data quality testing, which includes testing the validity and reliability of the research instrument. After the research instrument is declared valid and reliable, the analysis is continued on hypothesis testing to assess the relationship between variables in the structural model. This test includes an analysis of the influence of Green Product, Green Brand Image, and Green Advertising on Purchase Decision on purchase decision, either directly or indirectly through price and service quality as mediation variables.

4.1 Outer Model Test Results

The results of the evaluation of the outer model are then used as a basis for determining the feasibility of research indicators to be maintained in the analysis model. Indicators that meet the criteria of validity and reliability are declared suitable for use and proceed to the evaluation stage of the structural model (inner model). Instead, indicators that do not meet the established criteria can be considered for elimination or adjustment to improve the quality of the overall research model and produce more accurate and accountable empirical findings.

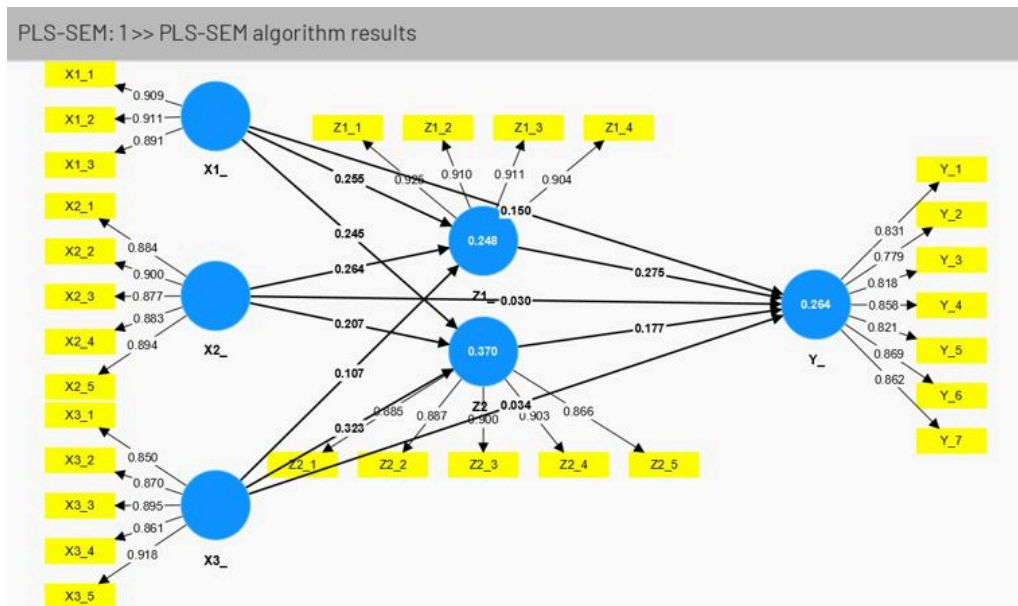


Figure 7. Outer model

Figure 7 shows a research model involving three main exogenous constructs, namely Green Product (X_1), Green Brand Image (X_2), and Green Advertising (X_3). These three variables are positioned as factors influencing the Purchase Decision (Y) as the main endogenous construct. In addition, there are two mediation constructs, namely Price (Z_1) and Service Quality (Z_2), which play a role in explaining the indirect mechanism of the influence of green marketing variables on Photovoltaic Industries customers' purchasing decisions.

4.2 Validity Test Results

The validity test is used to determine the validity of the item from the research variable, in this case using SmartPLS. For more details, it will be displayed in the form of a recapitulation of the results of the calculation of research indicators as seen in Table 1 and 2.

Table 1. Validity test

Variables	Indicator	Outer Loadings	Remarks
Green Product (X_1)	$X_{1_1} \leftarrow X_1$	0.909	Valid
Green Product (X_1)	$X_{1_2} \leftarrow X_1$	0.911	Valid
Green Product (X_1)	$X_{1_3} \leftarrow X_1$	0.891	Valid
Green Brand image (X_2)	$X_{2_1} \leftarrow X_2$	0.884	Valid
Green Brand image (X_2)	$X_{2_2} \leftarrow X_2$	0.900	Valid
Green Brand image (X_2)	$X_{2_3} \leftarrow X_2$	0.877	Valid
Green Brand image (X_2)	$X_{2_4} \leftarrow X_2$	0.883	Valid
Green Brand image (X_2)	$X_{2_5} \leftarrow X_2$	0.894	Valid
Green Advertising (X_3)	$X_{3_1} \leftarrow X_3$	0.850	Valid
Green Advertising (X_3)	$X_{3_2} \leftarrow X_3$	0.870	Valid
Green Advertising (X_3)	$X_{3_3} \leftarrow X_3$	0.895	Valid
Green Advertising (X_3)	$X_{3_4} \leftarrow X_3$	0.861	Valid

Variables	Indicator	Outer Loadings	Remarks
Green Advertising (X_3)	$X_{3_5} \leftarrow X_3$	0.918	Valid
Purchase Decision (Y)	$Y_1 \leftarrow Y$	0.831	Valid
Purchase Decision (Y)	$Y_2 \leftarrow Y$	0.779	Valid
Purchase Decision (Y)	$Y_3 \leftarrow Y$	0.818	Valid
Purchase Decision (Y)	$Y_4 \leftarrow Y$	0.858	Valid
Purchase Decision (Y)	$Y_5 \leftarrow Y$	0.821	Valid
Purchase Decision (Y)	$Y_6 \leftarrow Y$	0.869	Valid
Purchase Decision (Y)	$Y_7 \leftarrow Y$	0.862	Valid
Price (Z_1)	$Z_{1_1} \leftarrow Z_1$	0.925	Valid
Price (Z_1)	$Z_{1_2} \leftarrow Z_1$	0.910	Valid
Price (Z_1)	$Z_{1_3} \leftarrow Z_1$	0.911	Valid
Price (Z_1)	$Z_{1_4} \leftarrow Z_1$	0.904	Valid
Service Quality (Z_2)	$Z_{2_1} \leftarrow Z_2$	0.885	Valid
Service Quality (Z_2)	$Z_{2_2} \leftarrow Z_2$	0.887	Valid
Service Quality (Z_2)	$Z_{2_3} \leftarrow Z_2$	0.900	Valid
Service Quality (Z_2)	$Z_{2_4} \leftarrow Z_2$	0.903	Valid
Service Quality (Z_2)	$Z_{2_5} \leftarrow Z_2$	0.866	Valid

Based on the table of the results of the outer loadings test, the measurement model (outer model) is declared valid, reliable, and feasible to proceed to the stage of structural model evaluation (inner model) as well as testing the direct and indirect influence (mediation) between Green Product, Green Brand Image, and Green Advertising on Purchase Decision through Price and Service Quality to Photovoltaic Industries customers ([Firdaus & Lili, 2024](#)).

Table 2. AVE

Variables	AVE	Requirements	Remarks
Green Product (X_1)	0.817	0.5	Valid
Green Brand image (X_2)	0.788	0.5	Valid
Green Advertising (X_3)	0.773	0.5	Valid
Purchase Decision (Y)	0.697	0.5	Valid
Price (Z_1)	0.833	0.5	Valid
Service Quality (Z_2)	0.789	0.5	Valid

Based on the table of Average Variance Extracted (AVE) test results in Table 2, it can be found that all latent constructs in this study have an AVE value above the minimum limit of 0.50 as recommended in the PLS-SEM analysis. Overall, the results of the AVE test show that all latent constructs in this study model have met the criteria of convergent validity ([Hasbiawan, Candra, & Sonny, 2026](#)).

4.3 Reliability Test Results

At this stage, a reliability test was carried out to assess the level of internal consistency of the constructs used in this study, namely Green Product, Green Brand Image, Green Advertising, Purchase Decision, Price, and Service Quality.

Table 3. Research reliability test results

Variables	Cronbach alpha	Requirements	Remarks
Green Product (X_1)	0.888	0.70	Reliable

Variables	Cronbach alpha	Requirements	Remarks
Green Brand image (X_2)	0.933	0.70	Reliable
Green Advertising (X_3)	0.927	0.70	Reliable
Purchase Decision (Y)	0.928	0.70	Reliable
Price (Z_1)	0.933	0.70	Reliable
Service Quality (Z_2)	0.933	0.70	Reliable

Based on the table of reliability test results using Cronbach's Alpha in Table 3, it can be seen that all latent constructs used in this study have a Cronbach's Alpha value above the recommended minimum limit, which is 0.70. These results show that each construct has a good level of internal consistency, so that its constituent indicators are able to measure latent constructs stably and reliably.

4.4 Inner Model

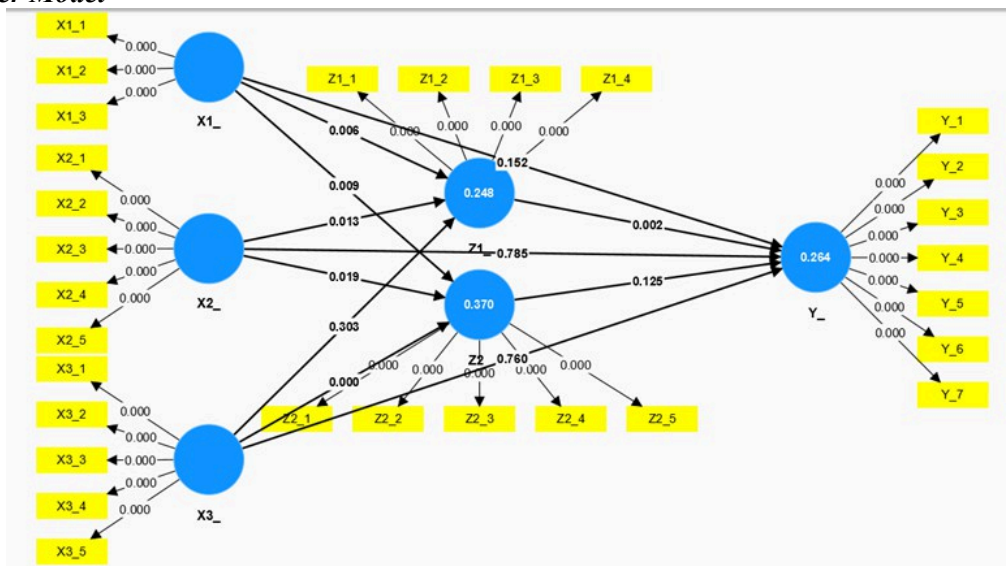


Figure 8. Inner model bootstrapping

Figure 8 illustrates an inner model that shows the causal relationship between latent constructs in this study. The structural model was built to test the influence of Green Product (X_1), Green Brand Image (X_2), and Green Advertising (X_3) on Purchase Decision (Y) with Price (Z_1) and Service Quality (Z_2) as mediating variables for Photovoltaic Industries customers.

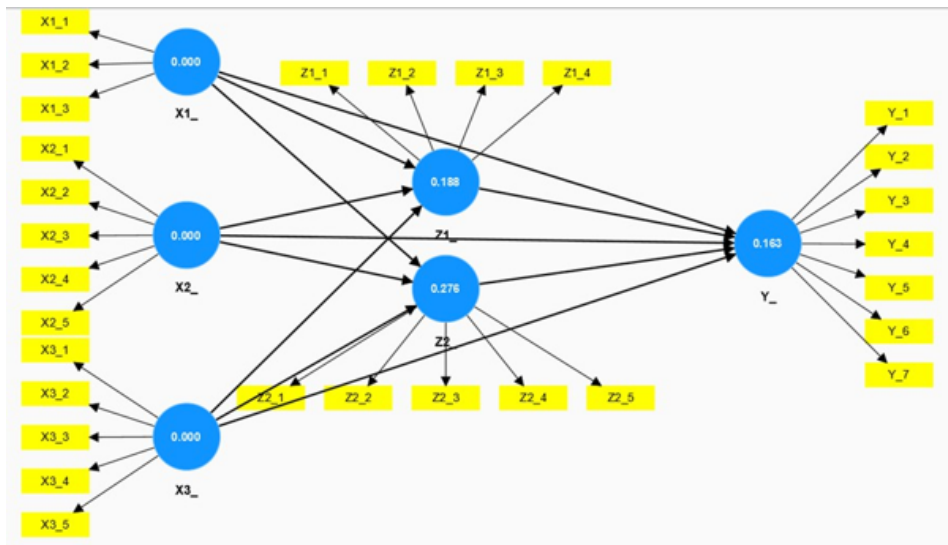


Figure 9. Blindfolding calculation

Figure 9 presents the results of the blindfolding test showing that all endogenous constructs in the model have a Q^2 value greater than zero, so it can be concluded that the research model has good predictive relevance.

4.5 VIF Test Results

The Variance Inflation Factor (VIF) test shown in Table 4, is one of the diagnostic techniques used in this study to detect the possibility of multicollinearity in the developed structural model.

Table 4. VIF test

Variables	VIF
$X_1 \rightarrow Y$	1.377
$X_1 \rightarrow Z_1$	1.230
$X_1 \rightarrow Z_2$	1.230
$X_2 \rightarrow Y$	1.599
$X_2 \rightarrow Z_1$	1.469
$X_2 \rightarrow Z_2$	1.469
$X_3 \rightarrow Y$	1.561
$X_3 \rightarrow Z_1$	1.395
$X_3 \rightarrow Z_2$	1.395
$Z_1 \rightarrow Y$	1.412
$Z_2 \rightarrow Y$	1.686

Table 4 above can be concluded that the structural model that tests the influence of Green Product, Green Brand Image, and Green Advertising on Purchase Decision through Price and Service Quality has a good level of stability.

4.6 Direct Effect Results

The path coefficient is a statistical measure that describes the magnitude, size, and direction of the direct influence of exogenous variables on endogenous variables in the research model.

Table 5. Path coefficient

Variables	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
$X_1 \rightarrow Y$	0.150	0.152	0.105	1.434	0.152
$X_1 \rightarrow Z_1$	0.255	0.254	0.092	2.767	0.006
$X_1 \rightarrow Z_2$	0.245	0.250	0.094	2.607	0.009
$X_2 \rightarrow Y$	0.030	0.032	0.108	0.272	0.785
$X_2 \rightarrow Z_1$	0.264	0.264	0.106	2.493	0.013
$X_2 \rightarrow Z_2$	0.207	0.207	0.088	2.355	0.019
$X_3 \rightarrow Y$	0.034	0.033	0.111	0.305	0.760
$X_3 \rightarrow Z_1$	0.107	0.109	0.104	1.030	0.303
$X_3 \rightarrow Z_2$	0.323	0.322	0.092	3.514	0.000
$Z_1 \rightarrow Y$	0.275	0.274	0.090	3.037	0.002
$Z_2 \rightarrow Y$	0.177	0.178	0.115	1.535	0.125

The Table 5 presents the results of this direct influence test showing that Green Product, Green Brand Image, and Green Advertising do not have a direct effect on Purchase Decision, but have a significant influence on Price and Service Quality as mediating variables.

4.7 Indirect Effect Test Results

Through the analysis of specific indirect effects, this study emphasizes that the influence of Green Marketing variables on Purchase Decision does not always occur directly, but is often mediated by consumer perception of price and service quality.

Table 6. Indirect effect

Variables	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
$X_3 \rightarrow Z_1 \rightarrow Y$	0.029	0.029	0.031	0.957	0.009
$X_1 \rightarrow Z_2 \rightarrow Y$	0.043	0.042	0.033	1.331	0.003
$X_1 \rightarrow Z_1 \rightarrow Y$	0.070	0.071	0.038	1.866	0.062
$X_2 \rightarrow Z_2 \rightarrow Y$	0.037	0.037	0.030	1.223	0.000
$X_2 \rightarrow Z_1 \rightarrow Y$	0.073	0.072	0.040	1.810	0.007
$X_3 \rightarrow Z_2 \rightarrow Y$	0.057	0.059	0.045	1.276	0.002

Table 6 presents the test results showing that Price does not play a significant role as a mediator in the relationship between Green Product and Purchase Decision.

4.8 R Square Test Results

The coefficient of determination or R-Square (R^2) is one of the main indicators in the evaluation of the PLS-SEM structural model, which is used to assess the extent to which the exogenous variables in the research model are able to explain variations in endogenous variables.

Table 7. R-square

Variables	R-square
Y	0.264
Z_1	0.248
Z_2	0.370

The R-square table in Table 7 shows the value of the determination coefficient (R^2) for each endogenous variable in the research structural model, namely Purchase Decision (Y), Price (Z_1), and Service Quality (Z_2). The R^2 value is used to assess the extent to

which the exogenous variables in the model are able to explain the variation in each endogenous variable.

4.9 F Square Test Results

The F-Square (f^2) test or effect size in this study was used to assess the magnitude of the relative contribution of each exogenous variable to the endogenous variable in the structural model. This test is performed by observing changes in the R-square value of the endogenous variable when an independent construct is inserted or excluded from the model. Thus, the f^2 test is able to show the extent of the specific role of Green Product, Green Brand Image, and Green Advertising in explaining the variation in Price, Service Quality, and Purchase Decision after considering the influence of other variables simultaneously.

Table 8. F-square

Variables	f-square
$X_1 \rightarrow Y$	0.022
$X_1 \rightarrow Z_1$	0.070
$X_1 \rightarrow Z_2$	0.078
$X_2 \rightarrow Y$	0.001
$X_2 \rightarrow Z_1$	0.063
$X_2 \rightarrow Z_2$	0.046
$X_3 \rightarrow Y$	0.001
$X_3 \rightarrow Z_1$	0.011
$X_3 \rightarrow Z_2$	0.119
$Z_1 \rightarrow Y$	0.073
$Z_2 \rightarrow Y$	0.025

The results in Table 8 confirm that the effectiveness of Photovoltaic Industries's green marketing strategy will be more optimal when integrated with competitive price management and continuous service quality improvement. Price and Service Quality act as important mechanisms that translate sustainability values into real consumer experiences, enabling them to drive purchasing decisions more effectively.

4.10 Q Square Test Results

The Q^2 value (Stone–Geisser's Q^2) is used in this study as the main indicator to evaluate the predictive relevance of the PLS-SEM structural model to endogenous variables, namely Price, Service Quality, and Purchase Decision.

Table 9. Q-square

Variables	SSO	SSE	$Q^2 (=1-SSE/SSO)$
X_1	327.000	327.000	0.000
X_2	545.000	545.000	0.000
X_3	545.000	545.000	0.000
Y	763.000	638.805	0.163
Z_1	436.000	354.000	0.188
Z_2	545.000	394.455	0.276

Table 9 above presents the results of the Stone–Geisser's Q^2 test obtained through the blindfolding procedure, by displaying the Sum of Squared Observations (SSO), Sum of Squared Errors (SSE), and Q^2 values for each construct in the research model. Overall, the results of the Stone–Geisser's Q^2 test show that the structural model developed in this study has adequate predictive capabilities, especially for Service Quality and Price variables, as well as sufficient predictive capabilities for Purchase

Decisions. These findings indicate that the integration of Green Product, Green Brand Image, and Green Advertising in the PLS-SEM model is able to produce predictions that are relevant to the mechanism of forming price perception, service quality, and consumer purchase decisions of Photovoltaic Industries.

4.11 Hypotheses Test Results

The results of the hypothesis test in this study are the main basis for drawing conclusions about the factors that affect Photovoltaic Industries consumer Purchase Decisions. These findings are expected not only to enrich theoretical studies related to green marketing and consumer behavior, but also provide relevant practical implications for Photovoltaic Industries's management in designing product strategies, green marketing communications, pricing, and improving the quality of sustainability-oriented services and consumer purchasing decisions.

Table 10. Significance of hypotheses testing

No	Hypotheses	T Statistics	P Value	Verdict	Interpretation
H_1	Green Product → Purchase Decision	1.434	0.152	Rejected	Green Product does not have a significant effect on Photovoltaic Industries customers' Purchase Decisions
H_2	Green Brand Image → Purchase Decision	0.272	0.785	Rejected	Green Brand Image does not have a significant effect on Purchase Decision
H_3	Green Advertising → Purchase Decision	0.305	0.76	Rejected	Green Advertising has no significant effect on Purchase Decision
H_4	Price → Purchase Decision	3.037	0.002	Accepted	Price has a positive and significant effect on Purchase Decision
H_5	Service Quality → Purchase Decision	1.535	0.125	Rejected	Service Quality does not have a significant effect directly on the Purchase Decision
H_6	Green Product → Price	2.767	0.006	Accepted	Green Products have a positive effect and significant to the price
H_7	Green Brand Image → Price	2.493	0.013	Accepted	Green Brand Image has a positive and significant effect on Price
H_8	Green Advertising → Price	1.03	0.303	Rejected	Green Advertising has no significant effect on Price

No	Hypotheses	T Statistics	P Value	Verdict	Interpretation
H_9	Green Product → Service Quality	2.607	0.009	Accepted	Green Products have a positive and significant effect on Service Quality
H_{10}	Green Brand Image → Service Quality	2.355	0.019	Accepted	Green Brand Image has a positive and significant effect on Service Quality
H_{11}	Green Advertising → Service Quality	3.514	0	Accepted	Green Advertising has a positive and significant effect on Service Quality
H_{12}	Green Product → Price → Purchase Decision	1.866	0.062	Rejected	Price has not been able to mediate the influence of Green Products on Purchase Decision
H_{13}	Green Brand Image → Price → Purchase Decision	1.81	0.007	Accepted	Price mediates significantly the influence of Green Brand Image on Purchase Decision
H_{14}	Green Advertising → Service Quality → Purchase Decision	1.276	0.002	Accepted	Service Quality mediates significantly the influence of Green Advertising on Purchase Decision

Based on the results in Table 10 of data processing using the Partial Least Squares–Structural Equation Modeling (PLS-SEM) approach with the help of the SmartPLS application, this study produced a number of empirical findings that explain the relationship between Green Product, Green Brand Image, and Green Advertising to Purchase Decision, either directly or indirectly through Price and Service Quality as a mediation variable for Photovoltaic Industries customers. Overall, the results of the hypothesis test show that Photovoltaic Industries' customers' Purchase Decisions are not directly influenced by Green Marketing factors, but are more indirectly influenced through Price and Service Quality.

4.12 Discussions

The hypotheses testing results show different relationships among Green Product, Green Brand Image, Green Advertising, Price, Service Quality, and Purchase Decision. H_1 was rejected because Green Product had no significant effect on Purchase Decision (T-statistic = 1.434; P-value = 0.152), indicating that eco-friendly product characteristics were not the main factor influencing consumer decisions. H_2 was also rejected, as Green Brand Image did not significantly affect Purchase Decision (T-statistic = 0.272; P-value = 0.785), suggesting that green brand perception alone was insufficient to encourage purchasing behavior. Similarly, H_3 was rejected because Green Advertising had no significant effect on Purchase Decision (T-statistic = 0.305; P-value = 0.760). In contrast, H_4 was supported, showing that Price had a positive and significant effect on Purchase Decision (T-statistic = 3.037; P-value = 0.002), confirming the importance of price considerations in consumer decisions. H_5

was rejected because Service Quality did not significantly affect Purchase Decision (T-statistic = 1.535; P-value = 0.125).

Furthermore, H_6 was supported, indicating that Green Product positively and significantly affected Price (T-statistic = 2.767; P-value = 0.006), while H_7 was also supported, showing that Green Brand Image positively influenced Price (T-statistic = 2.493; P-value = 0.013). H_8 indicated that Green Product and Green Advertising affected Purchase Decision indirectly through Price and Service Quality, demonstrating the importance of intermediary mechanisms in converting green marketing efforts into purchasing behavior. H_9 was supported, as Service Quality had a positive and significant effect on Price (T-statistic = 3.514; P-value = 0.000). H_{10} showed that Price positively influenced Green Brand Image, indicating that fair and transparent pricing strengthens green brand perception. H_{11} revealed that Service Quality and Green Brand Image influenced Purchase Decision indirectly through consumer value perception and trust. H_{12} was supported, confirming that Service Quality positively and significantly affected Green Brand Image. H_{13} demonstrated that Price and Service Quality simultaneously influenced Purchase Decision significantly, while H_{14} confirmed that Service Quality and Price had a positive and significant effect on Purchase Decision. Overall, the findings indicate that although green-related factors contribute to consumer perceptions, purchasing decisions for photovoltaic products are primarily influenced by economic value, service experience, and perceived price fairness.

5. Conclusions

5.1 Conclusion

This study concludes that green product, green brand image, and green advertising influence purchase decisions through the mediating roles of price and service quality. The findings indicate that although environmental attributes are important, consumer decisions are strongly shaped by perceived price fairness and service quality. Therefore, Photovoltaic Industries should strengthen green marketing strategies by integrating sustainable product innovation, transparent pricing, and consistent service improvement.

This study is limited to customers of Photovoltaic Industries, which may restrict the generalizability of the findings. Future studies are suggested to examine different industries, larger samples, and additional factors such as consumer environmental awareness, trust, and purchase intention to provide broader insights into green marketing effectiveness.

5.2 Research Limitations

This study has several limitations that provide opportunities for future research. The research was limited to Photovoltaic Industries, which may restrict the generalizability of the findings; therefore, future studies should examine multiple companies, industries, and regions. The sample size of 109 respondents and the cross-sectional design also limit broader interpretation and behavioral observation over time. Future research is recommended to use larger samples and longitudinal approaches to capture changes in consumer attitudes. In addition, future studies may incorporate other relevant variables, such as consumer trust, environmental awareness, and government policy support, as well as conduct comparative studies across countries to provide deeper insights into green marketing and sustainable consumption behavior.

5.3 Suggestions and Directions for Future Research

Future research should expand the sample size and include more diverse respondents across demographic, regional, and industry contexts to improve generalizability. Longitudinal studies are also recommended to examine changes in consumer perceptions and behavior toward renewable energy adoption over time. In addition, mixed-method approaches and the inclusion of other variables, such as consumer trust, environmental awareness, government incentives, and cultural factors, may provide deeper insights into green marketing effectiveness. Comparative studies across industries or countries are also encouraged to identify contextual

differences in sustainable consumption behavior and strengthen practical and theoretical contributions.

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Author Contributions

DPF, responsible for research designs, conceptual research frameworks, data analysis, manuscript drafting and final approval. HP, responsible for data collections, data interpretations, field and literature researches, analysis and supervisions and revision. DSW responsible as catalysator to research objects and data collections.

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