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From Intention to Action: Exploring the Determinants of Sustainable Household Energy Consumption Among Mapúa University - Intramuros SHS Students

Von Steven Bolivar[1], Ernest Manuel Clarin[2], Elmari Stanley Gemzon[3], Matt Cyrus Buenafe[4], Aziel Ury Cruzada[5], Ryo Jerome Tuzon[6]

[1,2,3,4,5]Student, TEM, Mapua University – Intramuros
[6]Adviser, Senior Highschool Department, Mapua University - Intramuros

Abstract
This study examined the psychological and social factors influencing sustainable energy practices among 179 senior high school students at Mapúa University – Intramuros. Key variables included attitudes, perceived behavioral control, subjective norms, perceived benefits, product quality, and understanding of energy policies. Participants were selected using Slovin's formula and convenience sampling, with data collected via structured online surveys distributed through Google Forms. The survey featured multiple-choice items and four-point Likert scale questions to measure students' perceptions and behaviors. Descriptive statistics in SPSS were used to summarize demographic data and response trends, while Spearman's rho correlation analysis assessed the relationship between energy-saving intentions and actual behaviors. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to analyze complex relationships among variables and identify mediating effects. Findings revealed that students demonstrated strong energy-saving attitudes, perceptions, and a clear intent to sustain such behaviors. A strong positive correlation was established between energy-saving intention and behavior, suggesting that as students' motivation to conserve energy increases, so do their sustainable actions. PLS-SEM analysis further indicated that enhancing awareness of energy-saving benefits and reinforcing social influence can significantly strengthen energy conservation efforts. These insights highlight the potential for targeted educational and behavioral interventions to support sustainability.

Keywords: Sustainable energy, Senior High School Students, Climate Change, Intention, Behavior

INTRODUCTION

Background of the Study

The escalating global environmental crisis has underscored the urgent need for concerted efforts to reduce carbon emissions, a primary driver of climate change. While large-scale industrial activities and transportation systems often dominate discussions on carbon reduction, household energy consumption remains a significant contributor that requires closer examination. Thøgersen (2021) emphasized that emissions from human production and consumption activities, particularly those related to CO2 and other

climate gases, threaten the stability of the global climate. According to Jia et al. (2024), global energy use, heavily influenced by home appliances, contributes to environmental issues such as climate change, global warming, and air pollution. Residential energy use accounts for a substantial portion of global energy consumption and greenhouse gas emissions, making it a critical area for intervention. Gaspari (2021) highlights that people's awareness, willingness to change, and the provision of feedback are essential factors influencing energy consumption behaviors, contributing positively to the ongoing efforts to reduce household energy use. Behavioral interventions have demonstrated long-term effectiveness in reducing energy consumption by providing personalized feedback and social comparisons, which influence energy-saving intentions and behaviors (Allcott & Rogers, 2014). By exploring these dynamics, we can gain valuable insights into how to promote energy conservation and foster a more sustainable lifestyle.

Households contribute significantly to global greenhouse gas emissions, accounting for 72% through their consumption behaviors (Dubois et al., 2019). However, despite this substantial impact, research specifically focusing on the energy consumption habits and environmental effects within the younger demographic remains limited. Jaradat et al. (2024) emphasizes the significant role of youth in shaping future energy use, as they are crucial in the transition to more sustainable energy behaviors. Recent research underscores that while general studies on household energy use typically focus on broader populations, they often neglect the unique psychological and social factors influencing young people's energy-saving behaviors, which are shaped by their awareness of climate change and environmental concerns (Si et al., 2022). Furthermore, there is a noticeable gap between awareness and action in energy conservation. Despite growing awareness of climate change, many individuals, including students, fail to adopt consistent energy-saving practices, which may be due to gaps in climate change education and the disconnect between environmental knowledge and action (Feldbacher et al., 2021). Therefore, to promote sustainability effectively, it is essential to investigate the drivers behind young people's energy consumption behaviors. Attitudes, subjective norms, and perceived behavioral control are key predictors of intentions to reduce energy consumption (Harorli & Erciş, 2023; Conradie et al., 2023). Moreover, There is a growing recognition of the need for localized studies that explore energy consumption patterns in specific cultural and contextual settings. Such studies are essential to understanding how local customs, socio-economic factors, and environmental contexts influence energy behaviors, helping to design more effective and relevant energy-saving interventions (Ghofrani et al., 2021). By addressing these gaps, more targeted and impactful strategies can be developed to encourage sustainable behaviors.

This research is crucial because it investigates the behaviors of a key demographic group – young people – who will play a critical role in shaping future energy consumption trends. By understanding their intentions, we can develop targeted interventions and educational strategies to promote energy conservation and foster a culture of sustainability. The findings of this study could have implications for educational institutions, policymakers, and students themselves. Educational institutions can utilize the insights to design effective energy conservation programs and integrate sustainability into their curricula. Policymakers can leverage the findings to develop policies that encourage energy efficiency and reduce carbon emissions at the household level. Ultimately, this study aims to contribute to the growing body of knowledge on household energy consumption and carbon footprint reduction, empowering students to make informed choices that benefit both themselves and the environment. By raising awareness and encouraging responsible energy use among young people, we can contribute to a more sustainable future for all.

Review of Related Literature

Factors Influencing Energy-Saving Intentions

This exploration of the interplay between intentions in the realm of household energy consumption highlights the crucial role of psychological factors in shaping sustainable practices. Research indicates that individuals' conscious decisions to conserve energy can significantly impact their carbon footprint. Households are responsible for over 70% of carbon emissions, highlighting the importance of behavioral changes in climate mitigation efforts (Niamir, 2019). By understanding the psychological drivers behind energy-saving intentions, we can gain valuable insights into how to promote and encourage more environmentally responsible behaviors. Chen and Chen (2021) stated that perceived behavioral control has the strongest direct impact on behavior, followed by energy-saving attitudes and subjective norms. Furthermore, to promote energy conservation, interventions should focus on psychological attributes and financial consciousness, and media campaigns should emphasize adopting energy-saving technologies (Ahmad et al., 2020).

While the Theory of Planned Behavior provides a valuable framework for understanding the formation of energy-saving intentions, it's crucial to acknowledge the influence of other factors that can significantly impact both intentions and behaviors related to energy conservation. Perceived benefits, for instance, is a type of emotional perception that positively influences an individual's behavior (Tsujikawa et al., 2016). Studies related to energy-saving behavioral intention topics have shown that perceived benefits have a positive effect on household energy-saving intentions (Nguyen & Hoang, 2022). Similarly, the quality of energy-related products, including appliances and building materials, can significantly influence energy consumption patterns. Recent studies have demonstrated the influence of energy-saving product quality on household energy saving behavioral intentions (Nguyen & Hoang, 2022; Ali et al., 2019). The purchase and use of quality energy-saving appliances help reduce household energy consumption (Olatunde et al., 2024). Furthermore, energy policies at the local, regional, and national levels can create a supportive environment for energy conservation. Research shows that various policy instruments, including standards and labeling, government investment, strategic planning, fiscal measures, and grants, are effective in reducing energy intensity (Azhgaliyeva et al., 2020).

To understand energy-saving intentions and behaviors effectively, we must consider various factors beyond just providing information. According to Liao et al. (2019), perceived economic benefits and environmental benefits have a positive influence on the behavioral intention to save energy. Studies have also found that appliance quality is a critical determinant of consumers' intention to purchase energy-efficient appliances (Harun et al., 2022). Furthermore, energy policy is an important tool to reduce the intensity of energy use contributing to improving energy efficiency (Mushafiq et al., 2023). By addressing these multifaceted factors, we can empower individuals to translate their intentions into actions, leading to a reduction in household energy consumption and a positive environmental impact.

Energy-Saving Intentions and its Effect on Sustainable Energy Consumption Behaviors

Research has consistently demonstrated a strong link between individuals' intentions to save energy and their actual energy consumption behaviors. Attari et al. (2023) emphasize that individuals with a strong commitment to energy conservation are more likely to adopt energy-saving practices, as their motivation facilitates overcoming barriers to implementing sustainable behaviors. This can manifest in various ways, such as making conscious decisions about appliance usage. Individuals with strong energy-saving intentions often prioritize actions like purchasing energy-efficient appliances, reducing their usage frequency, or adjusting settings to minimize energy consumption (Carrus et al., 2021). Furthermore, these

individuals may be more inclined to make investments that promote energy efficiency in their homes. Green alternatives like biomass boilers, heat pumps, and solar systems offer promising solutions that can lead to substantial energy savings (Farghali et al., 2023).

A key focus of this theme is understanding the "intention-behavior gap" – the discrepancy between individuals' desires to save energy and their actual energy consumption practices. Despite growing awareness of environmental issues and the importance of sustainability, various factors can hinder the translation of intentions into action. These factors include a lack of knowledge about effective energy-saving strategies, perceived barriers such as inconvenience or high costs, social influences that may not support sustainable practices, and the persistence of ingrained habits that are resistant to change (Horhota et al., 2014). Bridging this intention-behavior gap requires a deeper understanding of these barriers and the development of targeted interventions to overcome them.

When individuals possess a genuine desire to conserve energy, they are more likely to make conscious decisions and adopt practices that align with their intentions (Macovei, 2015). This can manifest in various ways, such as prioritizing the purchase of energy-efficient appliances, using appliances less frequently or more efficiently, and actively seeking ways to reduce energy waste in their daily routines. For instance, individuals with strong energy-saving intentions may be more inclined to adjust thermostat settings to optimize heating and cooling, turn off lights when leaving a room, unplug devices when not in use, and take shorter showers to conserve water and the energy used to heat it (Piao & Managi, 2023). By understanding which specific behaviors are most influenced by intentions, we can design more effective interventions and educational campaigns that target these actions and empower individuals to translate their intentions into tangible energy savings.

Promoting Sustainable Energy Consumption Among Young People

This theme focuses on the specific opportunities in promoting sustainable energy consumption among young people, a demographic that will play a crucial role in shaping future energy consumption patterns. It examines the unique characteristics and needs of this population, exploring effective strategies for engaging them in energy conservation efforts and empowering them to become agents of change in their homes, schools, and communities. This involves designing interventions that address the multifaceted nature of energy consumption, considering both individual motivations and external influences.

Young people are often more receptive to messages that resonate with their values and aspirations, so framing energy conservation in terms of its positive impact on the environment, social responsibility, and future generations can be particularly effective (Si et al., 2022). Furthermore, providing them with opportunities to actively participate in energy-saving initiatives and empowering them to become advocates for sustainability can foster a sense of ownership and responsibility (Pargeter, 2024). This can be achieved through interactive workshops, educational programs, and community engagement initiatives that provide hands-on experiences and encourage young people to take the lead in promoting energy conservation.

Another important aspect is exploring the various interventions and strategies that can be employed to promote sustainable energy consumption among young people. Creating a supportive environment within schools and communities, where energy conservation is encouraged and rewarded, can reinforce positive behaviors and foster a culture of sustainability (Pargeter, 2024). This might involve implementing energy-saving initiatives in schools, providing incentives for adopting energy-efficient practices, and recognizing and celebrating students' efforts in promoting sustainability (Malcolm, n.d.). By understanding the unique needs and motivations of young people and utilizing a diverse range of interventions, we can effectively

promote sustainable energy consumption behaviors and empower them to contribute to a more environmentally responsible future.

Synthesis

This review of related literature has explored the multifaceted nature of household energy consumption, examining the interplay of individual intentions, behaviors, and external factors in shaping sustainable energy practices. The first theme highlighted the crucial role of energy-saving intentions in driving energy conservation behaviors. Research consistently demonstrates that individuals with strong intentions to save energy are more likely to engage in practices that reduce their energy use, such as using energy-efficient appliances and adopting energy-saving habits (Attari et al., 2023; Carrus et al., 2021; Farghali et al., 2023). Furthermore, the literature emphasizes the importance of psychological and social factors, including attitudes, norms, perceived benefits, product quality, and energy policies, in shaping these intentions (Chen & Chen, 2021; Ahmad et al., 2020; Nguyen & Hoang, 2022).

The second theme delved into the relationship between energy-saving intentions and actual energy consumption behaviors. This includes recognizing the potential for an "intention-behavior gap" where various factors, such as lack of knowledge, perceived barriers, social influences, and ingrained habits, can hinder the translation of intentions into action (Horhota et al., 2014). However, studies also highlight that individuals with genuine desires to conserve energy are more likely to make conscious decisions that align with their intentions, such as prioritizing energy-efficient appliances, using appliances more consciously, and actively reducing energy waste in their daily routines (Macovei, 2015; Piao & Managi, 2023).

Finally, the third theme explored the importance of promoting sustainable energy consumption among young people, emphasizing their crucial role in shaping future energy consumption patterns. This involves understanding their unique characteristics and needs, and designing interventions that resonate with their values and aspirations (Si et al., 2022). Creating supportive environments within schools and communities that encourage and reward energy conservation can reinforce positive behaviors and foster a culture of sustainability (Pargeter, 2024; Malcolm, n.d.). By understanding the multifaceted nature of energy consumption and utilizing a diverse range of interventions, we can effectively promote sustainable energy consumption behaviors and empower young people to contribute to a more environmentally responsible future.

Research Gap

Despite the growing body of research on household energy consumption and sustainable behaviors, critical gaps remain, particularly regarding senior high school students in the Philippines. Existing studies often examine broader populations, overlooking the unique characteristics and behaviors of this age group, which is pivotal in shaping future energy consumption trends. Furthermore, while energy-saving intentions are recognized as important, further investigation is needed to understand how these intentions translate into action among young people, including the barriers that may hinder this process.

This necessitates more localized research that considers the specific contextual factors, such as local policies, infrastructure, and social norms, influencing energy behaviors in the Philippines. Finally, there is limited research evaluating the effectiveness of various interventions in promoting sustainable energy consumption specifically among senior high school students. This study aimed to address these gaps by focusing on this demographic at Mapúa Intramuros University, investigating the relationship between

intentions and behaviors, considering the unique context of the Philippines, and providing insights for developing effective interventions to promote sustainable energy use among young people.

Research Objectives

This research investigated the relationship between energy-saving intentions and sustainable energy consumption behaviors among senior high school students at Mapúa Intramuros University. It seeks to understand how students' intentions to conserve energy translate into actual practices within their households, considering the unique context of the Philippines and the potential barriers that may hinder the adoption of sustainable energy use. Specifically, this research aimed to:

1. Examine the factors that influence energy-saving intentions among Mapúa Intramuros SHS students, including their:
   1.1 attitudes;
   1.2 perceived behavioral control
   1.3 subjective norms
   1.4 perceived benefits
   1.5 perceived quality of products; and
   1.6 their understanding of energy policies.

- To analyze the correlation between energy-saving intentions and specific household energy consumption behaviors among Mapúa Intramuros SHS students, identifying which intentions are most strongly associated with energy-efficient practices.
- To develop a structural model using Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the relationships between energy-saving intentions, influencing factors, and sustainable energy consumption behaviors among Mapúa Intramuros SHS students.

Hypotheses

H1. Perceived quality of energy-saving products will have a significant positive effect on household intention to save energy.

H2. Understanding of energy policies will have a significant positive effect on household intention to save energy.

H3. Perceived benefits of energy conservation will have a significant positive effect on household intention to save energy.

H4. Attitude towards energy conservation will have a significant positive effect on household intention to save energy.

H5. Subjective norms will have a significant positive effect on household intention to save energy.

H6a. Perceived behavioral control will have a significant positive effect on household intention to save energy.

H6b. Perceived behavioral control will have a significant positive effect on household energy-saving behaviors.

H7. Household intention to save energy will have a significant positive effect on household energy-saving behaviors.

H8. Household intention to save energy will positively mediate the relationship between TPB factors (attitude, subjective norms, and perceived behavioral control) and energy-saving behavior.

Significance of the Study

This study aimed to identify how students' energy consumption behaviors at home correlate with their energy-saving intentions. The findings will provide insights into how such behaviors contribute to sustainable practices, promoting an environmentally conscious mindset and encouraging actions to improve household energy use. The study seeks to create awareness and foster sustainable energy consumption habits, helping to mitigate climate change and influence broader societal change. Key beneficiaries of this study include:

Senior High School Students. By understanding the factors that influence their energy-saving intentions and behaviors, students will become more mindful of their energy usage and can make informed decisions to adopt more sustainable practices. This awareness can lead to more energy-efficient habits, contributing to global environmental efforts.

E*ducational Institutions.* The insights gained can be used to educate students, faculty, and staff about sustainable energy consumption behaviors, positioning schools as champions of sustainability through energy conservation initiatives and curriculum integration.

Local Communities. Insights from the study can inspire communities to engage in energy-saving practices and foster collective efforts to reduce their overall environmental impact, contributing to sustainability goals.

Businesses. The research will provide recommendations for businesses to encourage energy-efficient consumer behaviors through product innovations and marketing strategies, promoting environmentally sustainable consumption patterns.

Environmental Advocates. This research will enrich the global discourse on energy conservation, showing how individual and household-level actions, such as reducing energy consumption and adopting sustainable practices, can contribute to climate change mitigation.

Policymakers. Understanding the link between household energy consumption and sustainable practices will help policymakers develop strategies and regulations that encourage households to adopt more energy-efficient behaviors, contributing to climate action at the local and national levels.

Future Researchers. The study will serve as a reference for future research in energy consumption behavior, energy-saving intentions, and environmental sustainability, advancing discussions in fields like environmental science, behavioral studies, and educational research.

Scope and Delimitations

This research investigated the link between energy-saving intentions and actual energy consumption behaviors among senior high school students at Mapúa Intramuros University in the Philippines. It explored the factors influencing these intentions, including attitudes, perceived control, social norms, perceived benefits of energy conservation, views on product quality, and understanding of energy policies. The study analyzed how these intentions translate into real-world actions like using energy-efficient appliances and adopting energy-saving habits. By conducting this research within the unique Filipino context, the study aimed to provide localized insights into the energy consumption patterns of this specific group and contribute to the development of effective strategies for promoting sustainable energy use among young people.

The research was conducted in 2025 with a sample of 179 students, utilizing both online and physical data collection methods. It will be delimited to this specific group of students and their household energy consumption behaviors. While acknowledging the influence of external factors, the study primarily

focused on individual and household-level factors within the students' control. The research was conducted within a defined timeframe and included only students who provide full consent for data collection and sharing.

Conceptual Framework

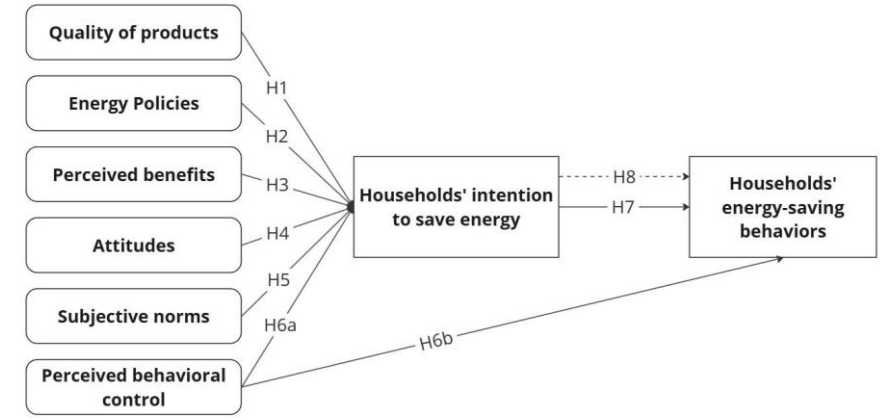

Figure 1. Conceptual Framework

This conceptual framework employs Structural Equation Modeling (SEM) to analyze the complex interplay of factors influencing household energy-saving behaviors. SEM is a powerful statistical technique used to examine the relationships between multiple variables, allowing for the assessment of both direct and indirect effects within a network of constructs. In this framework, SEM was used to understand how various factors contribute to the formation of energy-saving intentions and how those intentions, in turn, affect actual behaviors.

The foundation of this framework lies in the Theory of Planned Behavior (TPB), a widely recognized model in social psychology that explains human behavior (Jokonya, 2017). TPB posits that intentions are the most immediate predictor of behavior, and these intentions are shaped by three primary factors: attitudes, subjective norms, and perceived behavioral control (La Barbera & Ajzen, 2020). This framework builds upon TPB by incorporating additional factors specifically relevant to energy conservation, enriching the model's explanatory power in this context. Extending beyond the core TPB constructs, this framework includes perceived benefits of energy conservation, perceived quality of energy-saving products, and understanding of energy policies as key influencers of intention. Incorporating additional variables can enhance the predictive power of TPB-based models for energy conservation behavior (Macovei, 2015). By integrating these factors, the model provides a more nuanced understanding of the motivations driving individuals to adopt energy-saving practices. It recognizes that intentions are not formed in isolation but are shaped by a combination of individual beliefs, social influences, and contextual factors.

Through SEM analysis, this framework provided a comprehensive picture of the pathways through which these factors contribute to energy-saving intentions and behaviors. It examined the direct effects of each

factor on intention, as well as any indirect effects that may occur through mediating variables. Additionally, the model acknowledges the potential for an "intention-behavior gap," recognizing that various barriers may hinder the translation of intentions into actions. By employing SEM to analyze this comprehensive framework, the research aims to uncover the complex dynamics involved in promoting sustainable energy consumption and provide valuable insights for developing effective interventions.

METHODS

Research Design

This study employed a descriptive correlational research design to investigate the relationship between energy-saving intentions and sustainable energy consumption behaviors among Mapúa Intramuros SHS students. As Cataldo et al. (2019) explain, descriptive correlational studies are observational research designs that examine relationships between variables without manipulation or intervention. This approach aligned with the study's aim to explore naturally occurring associations between students' intentions to save energy and their actual energy consumption practices. Furthermore, as noted by Omair (2015), descriptive correlational studies are valuable for generating hypotheses and describing sample characteristics in various fields.

Specifically, this correlational approach was used to assess whether students with stronger intentions to save energy actually engaged in more sustainable behaviors at home. This included examining their use of energy-efficient appliances, their adoption of energy-saving habits, and their overall awareness of energy consumption. Numerous studies have incorporated correlational design into their study. For example, researchers have employed descriptive correlational designs to investigate the factors influencing intentions and behaviors related to a variety of pro-environmental actions, such as renewable energy use (Fazal et al., 2023), energy-saving at work (Akhound et al., 2021), and ethical consumer behavior (Tomșa et al., 2021). By utilizing this design, the study aimed to provide valuable insights for developing effective strategies to promote sustainable energy consumption among students and contribute to a more environmentally conscious society.

Setting

This study was conducted with senior high school students at Mapúa Intramuros University. This specific setting was chosen for its accessibility, facilitating efficient data collection through online surveys and potential in-class distribution. Focusing on students within this defined educational institution allowed for a focused analysis of energy-saving intentions and behaviors within a particular age group and social context, which was crucial for understanding the unique characteristics and influences that shape the behaviors of young people (Martins et al., 2020). Intramuros, a historic walled city within Manila, offered a distinct urban setting with a mix of residential, commercial, and historical structures, potentially influencing energy consumption patterns (Purio et al., 2022).

Conducting the study within a single university setting minimized extraneous variables that could have been introduced by including students from other institutions with varying socioeconomic backgrounds, access to technology, and household characteristics (Jaggars et al., 2021). By focusing on this specific setting, the study aimed to gain a deeper understanding of the factors that influence energy-saving intentions and behaviors among a particular group of students in a unique urban environment (Zhao et al., 2019). This localized approach provided valuable insights for developing targeted interventions and promoting sustainable energy practices within the university and potentially beyond.

Respondents and Sampling Technique

In this quantitative study, the sample included 179 senior high school students, from a population of 1,089 grade 11 and 12 students studying at Mapúa University - Intramuros. This number was calculated using Slovin's Formula $n = \frac{1089}{(1+1089(0.07)^2)}$, which allowed researchers to calculate a minimum sample size required to estimate a population within a specified margin of error (Bobbitt, 2023). This ensured that sufficient data was collected to produce reliable results. The study's sample (n) size is still within the range of acceptable margin of error values which are usually around 0.04 - 0.08 (Voxco, 2021). The 0.07 margin of error allowed the study to be feasible and ensured that the study remains statistically robust while being practical and resource-efficient as lower values require higher sample size to be more accurate (Webster, 2024).

The researchers used convenience sampling, a form of non-probability sampling, where participants were selected based on their availability and willingness to participate. This method allowed the researchers to gather data quickly and efficiently from readily accessible students, ensuring the target sample size was met within time and resource constraints (Nikolopoulou, 2022). Google Forms was used to invite the respondents to complete a structured survey. The survey was accompanied by a detailed explanation of the purpose of the study to ensure informed participation. Using a four-point Likert scale and multiple-choice questions, the researchers systematically collected data on the determinants of household energy consumption behaviors among Mapúa University - Intramuros SHS students.

Data Gathering Tools

This study employed a quantitative approach using a survey, in the form of a structured close-ended questionnaire, to gather data on household energy consumption patterns and energy-saving intentions of senior high school students at Mapúa University - Intramuros. Google Forms, chosen for its affordability, ease of use, and practicality in gathering and evaluating responses, was employed by the researchers (Mondal et al., 2019). Additionally, the research utilized a combination of self-made and adopted questions, with the adopted questions sourced from validated instruments used in previous research by Qalati et al. (2022) and Nguyen and Hoang (2022). This approach ensured the inclusion of well-established measures while allowing for customization to the specific context of this study.

The questionnaire consisted of approximately 30 questions, encompassing multiple-choice questions and four-point Likert scale questions. A four-point Likert scale and multiple-choice questions were utilized as these methods removed neutrality and allowed for systematic data collection and analysis of the relationship between variables (Fleetwood, 2024). Four-point Likert scale questions were used to measure students' attitudes, perceived behavioral control, subjective norms, perceived benefits of energy conservation, perceptions of the quality of energy-efficient products and technologies, and understanding of energy policies related to energy conservation. The Likert scale is a widely used psychometric tool in survey research, particularly for measuring attitudes and opinions (Joshi et al., 2015). To enhance accuracy, participants were asked to provide details from their utility bills or report their monthly energy expenditures.

To ensure the content validity of the questionnaire, a panel of experts was assembled. Content validation by expert panels is a widely used method to ensure questionnaire validity (Nava et al., 2023). This panel consisted of 2 experts with demonstrated knowledge and experience in the field of environmental science. Specifically, the panel comprised Mapúa SHS instructors with expertise in sustainable energy. These instructors critically evaluated each item in the questionnaire to ensure it accurately measured the intended

constructs, such as attitudes, subjective norms, and perceived behavioral control, aligned with the research objectives, and was appropriate for the target population of senior high school students. This step was crucial to ensure that the questions accurately measured the intended constructs, such as attitudes, subjective norms, and perceived behavioral control.

Second, and equally important, a pilot test was conducted with 15 students. This sample size aligned with recommendations by Whitehead et al. (2015) for pilot studies aiming to estimate medium effect sizes, which was appropriate for this study exploring the relationship between energy-saving intentions and behaviors. Pilot testing offered valuable insights, including evaluating questionnaire reliability and validity, estimating time requirements, and providing opportunities for reflection and analysis (Brooks et al., 2016). This pilot test served two primary purposes. Firstly, it assessed the reliability and internal consistency of the scales using Cronbach's alpha coefficient, a widely accepted measure of reliability. Cronbach's alpha is a widely used statistic for measuring the internal reliability of psychometric tests and scales (Robertson & Evans, 2020). Secondly, the pilot test helped identify any potential issues with the clarity or comprehension of the questionnaire items. Therefore, by combining expert validation with a pilot test and utilizing Cronbach's alpha coefficient, this rigorous process aimed to ensure that the data collected was both valid and reliable, ultimately contributing to the robustness and trustworthiness of the study's findings.

Research Procedures

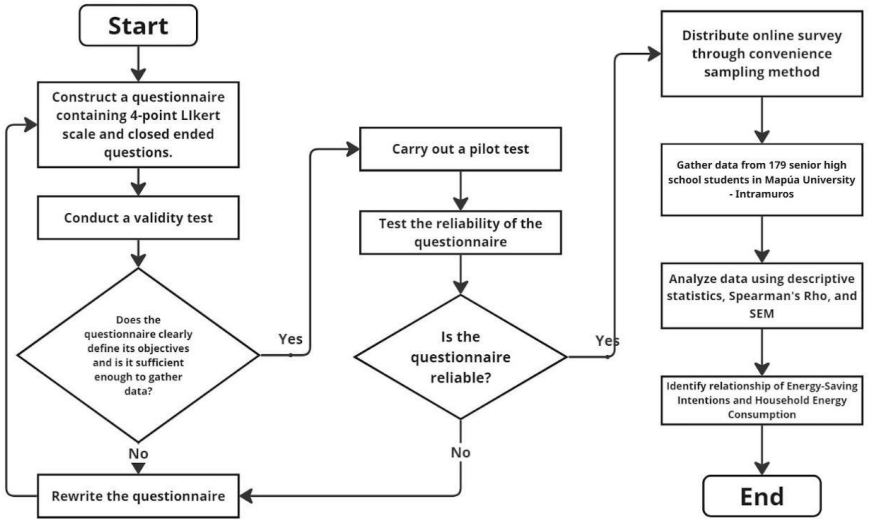

Figure 2. Research Procedures Flowchart

The research process began with the development of a questionnaire designed to gather data on energy-saving intentions and household energy consumption behaviors. This questionnaire included both 4-point Likert scale and closed-ended questions to capture a range of responses. To ensure the quality of the instrument, it underwent a validity test by a panel of experts, followed by a pilot test to assess its reliability

using Cronbach's alpha. Once deemed valid and reliable, ethical approval was sought from the Mapúa University Research Ethics committee. With ethical approval in place, the online survey was distributed to 179 senior high school students at Mapúa University - Intramuros using a convenience sampling method. This method allowed for efficient data collection from readily available participants. The collected data was then analyzed using descriptive statistics to understand the characteristics of the sample and identify any initial correlations between energy-saving intentions and household energy consumption. To further examine the complex relationships between the variables, Structural Equation Modeling (SEM) was employed. SEM allowed for the assessment of both direct and indirect effects, providing a comprehensive analysis of the factors influencing energy-saving intentions and behaviors. Specifically, SEM was used to test the hypothesized relationships between the six predictor variables (perceived quality of products, energy policies, perceived benefits, attitudes, subjective norms, and perceived behavioral control), household intention to save energy (the mediating variable), and household energy consumption behaviors. This analysis provided valuable insights into the pathways through which these factors influenced sustainable energy practices. Finally, the research concluded by interpreting the statistical results from both the descriptive analysis and the SEM. Conclusions were drawn about the relationship between energy-saving intentions and household energy consumption, contributing to a deeper understanding of the factors that influenced sustainable energy behaviors among the student population. This understanding informed the development of targeted interventions to promote energy conservation within the university and beyond. If, at any point, the questionnaire failed the validity test, was found unreliable, or ethical approval was not granted, the researchers addressed these issues before proceeding with the study.

Data Analysis

This study employed a comprehensive data analysis strategy to thoroughly examine the intricate relationships between energy-saving intentions and sustainable energy consumption behaviors among Mapúa Intramuros SHS students. The analysis involved a combination of descriptive statistics and Structural Equation Modeling (SEM), to provide a robust and nuanced understanding of the factors that influenced energy conservation practices.

To begin, descriptive statistics were utilized to provide a preliminary overview of the data and to characterize the study sample (Simplilearn, 2021). This involved calculating frequencies and percentages to describe the distribution of responses for demographic variables, such as age, gender, grade level, and socioeconomic background, as well as categorical variables related to energy consumption behaviors. Additionally, means and standard deviations were calculated to summarize the responses to Likert-scale items measuring energy-saving intentions, attitudes, perceived behavioral control, subjective norms, perceived benefits, product quality, and understanding of energy policies. These descriptive analyses were conducted using SPSS. SPSS (Statistical Package for the Social Sciences) is a versatile and widely used software for statistical analysis in various fields, including social sciences, education, and healthcare (Alili & Krstev, 2019).

Following descriptive analysis, this study utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.1.0.9 to analyze the complex relationships between variables (Hair et al., 2019). This technique was well-suited for the study's complex model with multiple relationships, formative and reflective indicators, and the mediating role of household intention to save energy (Qalati et al., 2021). PLS-SEM is particularly effective in prediction and explaining variance, aligning with the

goal of understanding factors contributing to sustainable energy behaviors (Tang et al., 2019). This method is widely accepted in social science research, including pro-environmental behavior studies (Hair et al., 2019; Qalati et al., 2021), and involved specifying the model, estimating parameters, evaluating model fit, and testing hypothesized relationships using path coefficients and significance levels.

Furthermore, correlation analysis, specifically Spearman's rho ($\rho = 1 - \frac{6\sum d^2}{n(n^2-1)}$), was used to examine the strength and direction of the association between energy-saving intentions and specific energy consumption behaviors. Spearman's rho is a non-parametric correlation coefficient suitable for ordinal data, such as Likert scale responses, and does not assume a linear relationship between variables (Schober et al., 2018). This analysis helped identify which intentions were most strongly associated with energy-efficient practices, providing insights into the specific behaviors that were most influenced by intentions. Values between 0.0 to 0.19 indicated a very weak relationship, 0.2 to 0.4 suggested a weak one, values from 0.4-0.59 implied moderate correlation, 0.60-0.79 indicated strong correlation and 0.8-0.99 suggested very strong correlation (Weir, 2018).

Ethical Considerations

This study was committed to upholding the highest ethical standards in research, prioritizing the rights and well-being of all participants. The study adhered to the principles of the Data Privacy Act of 2012 (Republic Act No. 10173), which mandates the protection of personal information collected from individuals, ensuring their privacy and security. This commitment to ethical research ensured that the study was conducted in a responsible and respectful manner, safeguarding the rights of all involved.

To ensure ethical conduct, this study implemented various measures. All participants were provided with a comprehensive informed consent form detailing the study's purpose, procedures, potential risks and benefits, and their rights, including the right to withdraw at any time. This was to guarantee voluntary participation based on a clear understanding of the research (Thourani, 2022). Data was collected anonymously and confidentially, stored securely, and accessed only by authorized researchers. As the study involved minors, extra care was taken to ensure their understanding and obtain consent from both students and their parents/guardians. Participants were treated with respect and dignity throughout the process. The potential benefits of the research, which aimed to contribute to the understanding of energy-saving intentions and behaviors, outweighed any potential risks to the participants. The selection of participants was fair and equitable.

By adhering to these ethical considerations and the Data Privacy Act of 2012, this study aimed to conduct research that was both rigorous and responsible. This approach ensured the protection of participants' rights while contributing to the advancement of knowledge in a socially and ethically sound manner. The study demonstrated a commitment to ethical research practices, recognizing the importance of balancing the pursuit of knowledge with the respect for individual rights and well-being.

RESULTS and DISCUSSION

OBJECTIVE 1

Table 1 presents data from 179 Grade 11 and 12 students at Mapúa University - Intramuros, reflecting their attitudes, behaviors, and perceptions toward energy conservation. Descriptive statistics and normality tests were conducted using JASP, a statistical software that enables accurate analysis. The constructs examined include Attitude (ATT), Perceived Behavioral Control (PBC), Subjective Norms (SN),

Perceived Benefits (PB), Perceived Product Quality (PQ), Energy Policies (EP), Energy-Saving Intention (ESI), and Energy-Saving Behavior (ESB). For each indicator, the median was used to determine central tendency, while standard deviation measured variability in responses. The findings reveal which constructs students strongly agreed with and where opinions were more diverse.

Table 1. Median and Standard Deviation of Key Study Indicators

Code	Questions	Median	Std. Dev.
Attitude (ATT)	ATT1: Saving home electricity is necessary.	4.000	0.434
	ATT2: Saving home electricity is important to improve the air environment.	4.000	0.648
	ATT3: Saving home electricity is important to reduce CO2 emissions.	4.000	0.608
	ATT4: Saving home electricity maintains a high quality of family life.	4.000	0.693
Perceived behavior control (PBC)	PBC1: I know what I should do to save electricity effectively	4.000	0.602
	PBC2: I know what I should do to reduce electricity usage.	4.000	0.621
	PBC3: I know what I should do to use electricity efficiently	4.000	0.648
	PBC4: I know what I should do to save electricity without difficulty	3.000	0.743
Subjective Norms (SN)	SN1: I save electricity because my neighbors encourage me to do the same.	2.000	0.939
	SN2: I save electricity because my family members encourage me.	4.000	0.825
	SN3: I save electricity because my friends encourage me.	2.000	0.932
	SN4: I save electricity because it is a matter of social concern.	3.000	0.929
Perceived benefits (PB)	PB1: Saving electricity helps reduce costs for the household.	4.000	0.369
	PB2: Saving electricity is beneficial for the household.	4.000	0.490
	PB3: Saving electricity makes family life better.	3.000	0.748
	PB4: Saving electricity helps protect the ecological environment.	4.000	0.610
Perceived Quality (PQ)	PQ1: I prioritize buying products with energy-saving labels.	3.000	0.879
	PQ2: I prioritize buying products that apply	3.000	0.813

	technological advances to save energy.		
	PQ3: I prioritize customer feedback on energy-saving features as an important factor in purchasing decisions.	3.000	0.831
Energy Policies (EP)	EP1: Policies play an essential role in motivating me to save electricity.	3.000	0.859
	EP2: I am aware of specific policies related to electricity saving in my area (e.g., Renewable Energy Act of 2008, Energy Efficiency and Conservation Act).	3.000	1.026
	EP3: I actively seek information about energy-saving policies.	3.000	0.997
	EP4: I have received guidance on how to use electricity efficiently (from government or other sources).	3.000	0.921
Energy saving intention (ESI)	ESI1: I am committed to saving electricity in my home in the future.	4.000	0.582
	ESI2: I will make a conscious effort to reduce my household's energy consumption.	4.000	0.563
	ESI3: I plan to adopt specific energy-saving practices in my daily life (e.g., taking shorter showers, using energy-efficient lighting).	3.000	0.713
	ESI4: I will use energy-efficient appliances to save electricity in the future.	4.000	0.639
Energy saving behavior (ESB)	ESB1: I actively participate in household energy-saving activities (e.g., unplugging appliances when not in use, recycling).	4.000	0.656
	ESB2: I turn off lights when they are not needed (e.g., during the daytime or when rooms are unoccupied at night).	4.000	0.575
	ESB3 I recommend others to save energy.	4.000	0.646

Students demonstrated strong and consistent agreement under the Attitude (ATT) construct, with all four items scoring a median of 4.000 and standard deviations ranging from 0.434 to 0.693. Similarly, three items under Perceived Behavioral Control (PBC) also had medians of 4.000, indicating a sense of knowledge and control over energy-saving practices; however, one item scored lower with a median of 3.000, suggesting that not all students found such actions easy to perform. The standard deviations for PBC ranged from 0.602 to 0.743, reflecting moderate variability. Subjective Norms (SN) showed more dispersed responses—family and friend influence received medians of 4.000, but neighbors and broader social pressure scored lower, with medians of 2.000 and 3.000, respectively. The variation in this construct was more pronounced, with standard deviations between 0.825 and 0.939, indicating uneven social influence.

The Perceived Benefits (PB) construct revealed consistently high scores across all items, each with a median of 4.000. This construct also had the lowest standard deviations, ranging from 0.369 to 0.610, which signifies strong agreement and low variability in recognizing the advantages of saving electricity. In contrast, Perceived Product Quality (PQ) displayed more varied perceptions. While energy-efficiency labeling was highly valued (median = 4.000), other indicators like brand reputation and peer or government endorsements scored slightly lower at 3.000. The standard deviations in this construct ranged from 0.748 to 0.879, pointing to moderate variability in students' product assessment criteria.

Energy Policies (EP) scored a median of 3.000 across all items, reflecting moderate levels of awareness about institutional and governmental energy-saving regulations. However, the standard deviations were the highest among all constructs, ranging from 0.859 to 1.026. This suggests that while some students may be informed about relevant laws and policies, others have little to no awareness. Regarding Energy-Saving Intention (ESI), three items received medians of 4.000, indicating strong intent to conserve energy, while one item—focused on concrete energy-saving actions—had a median of 3.000. The standard deviations (0.563–0.713) indicate moderate variability in the strength and clarity of students' intentions.

Lastly, Energy-Saving Behavior (ESB) demonstrated strong and consistent practice of conservation habits. All items in this construct scored a median of 4.000, reflecting frequent behaviors like turning off unused appliances and unplugging devices. The associated standard deviations, ranging from 0.446 to 0.656, were relatively low, suggesting widespread and consistent application of energy-saving practices among students. These results collectively provide a snapshot of where student consensus lies and where perceptions are more fragmented.

With the descriptive results establishing a strong positive orientation toward energy-saving behaviors, further interpretation highlights the significance of these findings in the context of existing literature and behavioral frameworks. The data reveal a strong and consistent recognition among students regarding the value of conserving electricity, as shown by high median scores and low variability in the Attitude construct. This suggests that the idea of energy conservation is well-ingrained in their beliefs, potentially due to environmental education, media influence, or school-based initiatives (Barata et al., 2017). Such positive attitudes are essential, as previous studies have found that attitude significantly predicts pro-environmental intentions and behavior (Ilham et al., 2022; Lee & Tanusia, 2016). The consistency of student responses implies a shared understanding that saving electricity contributes to both environmental sustainability and personal or familial well-being. These findings reinforce the notion that when students perceive environmental action as meaningful and beneficial, they are more likely to support it (Ilham et al., 2022; Lee & Tanusia, 2016). The low standard deviation supports the idea that few students deviate from this belief, making attitude a strong and unified motivator within this population.

Building on this positive foundation, it is also important to consider how students perceive their ability to act on these attitudes. While students generally reported a high sense of control over their ability to save electricity, one item scored notably lower, indicating that some do not find energy-saving practices easy to implement. This suggests a discrepancy between knowing what should be done and having the practical means or habits to do so. The gap highlights the role of perceived difficulty in shaping actual behaviors, as outlined in the Theory of Planned Behavior (Ajzen, 1991). Students might face constraints such as shared living environments, lack of decision-making power, or limited access to energy-efficient technologies. These findings align with prior research stating that self-efficacy alone is insufficient unless paired with enabling conditions (Jonitz et al., 2024; Mavroudi & Divitini, 2017). Addressing barriers

through supportive systems, school campaigns, or family engagement may bridge the gap between control and action (Garbacz et al., 2017).

Aside from perceived control, students' energy-saving behaviors are also shaped by the people and social circles around them. The Subjective Norms construct showed a divide: students felt motivated by the expectations of family and peers but were less influenced by broader community or societal norms (Heib et al., 2024). This suggests that energy-related social pressure is more effective when it comes from intimate relationships rather than from institutions or public campaigns (Lin & Jia, 2023). It reflects how social influence operates more powerfully within trusted circles, consistent with findings that personal normative beliefs are more influential than generalized social norms in youth behavior (Hargreaves & Middlemiss, 2020). The relatively high standard deviations show that this influence is uneven, possibly depending on students' household environments or peer groups. The implication is clear: efforts to promote energy-saving behavior should consider leveraging peer and family influence rather than relying solely on mass messaging (Hargreaves & Middlemiss, 2020).

Beyond social motivations, students also appear to be driven by their understanding of the practical advantages of conserving electricity. Among all constructs, Perceived Benefits yielded the most uniform responses, indicating strong consensus that conserving energy leads to lower costs, environmental protection, and other practical advantages. This supports the idea that when tangible benefits are perceived, motivation to engage in behavior increases (Xing et al., 2022). The low variability suggests this belief cuts across student demographics, making it a strong point of leverage in promoting energy-efficient practices. These findings are in line with economic behavior theories, which propose that perceived value or personal gain enhances behavioral intention (Lu & Wang, 2020; Kumar et al., 2022). The consistency also hints at the success of energy-saving messages in emphasizing cost-efficiency and environmental responsibility (Schwartz et al., 2015). If reinforced in both policy and pedagogy, this construct could further strengthen long-term energy-saving habits.

However, when it comes to evaluating products that support energy conservation, students' responses show more complexity. Responses regarding Product Quality showed greater variation, with students placing more importance on energy-saving labels than on brand reputation, peer feedback, or government endorsement. This suggests that while labeling is a recognizable and trusted indicator, other quality cues are subject to personal or cultural interpretation. The findings reflect how consumer trust may be developing, but not yet fully aligned with a critical evaluation of product quality beyond visible labels. Prior studies suggest that visual indicators, such as energy efficiency labels, often have a stronger influence on purchasing decisions among young consumers than abstract endorsements (Andor et al., 2016; Kabaja et al., 2023). The inconsistency may also stem from a lack of exposure to or understanding of how product quality is verified. Educating students on evaluating product quality—especially in terms of energy efficiency—could lead to more informed consumer behavior (Iordache Platis & Romanowicz, 2020).

Meanwhile, students' awareness of larger systemic supports for energy conservation reveals another area for improvement. Energy Policies (EP) had the lowest consistency among constructs, with wide variation in how informed students felt. Despite policies such as the Renewable Energy Act of 2008 and school-level sustainability efforts, the results suggest that many students remain unaware or unsure of the existing legal and institutional frameworks (Ilham et al., 2022; Lamia et al., 2024). This reflects findings in sustainability education literature which highlight that policy awareness among youth is often low unless explicitly integrated into formal curricula (Msengi et al., 2019). The limited awareness may weaken students' ability to contextualize their individual efforts within larger systems of change. Enhancing energy

policy education—through curriculum revisions, awareness drives, or interactive learning activities—could empower students to become more engaged and critical participants in sustainability efforts (Hoque et al., 2022). The large spread in responses highlights an urgent gap in knowledge dissemination.

Despite these gaps, students show promising levels of commitment when it comes to their personal intentions (Sheeran & Webb, 2016). Energy-Saving Intention (ESI) received generally high scores, but one item related to concrete action planning had a slightly lower median. This suggests that while students are motivated and willing to conserve electricity, not all have clear strategies for how to do so. According to behavioral science research, intention alone is not enough—specific, actionable goals are crucial to translating motivation into behavior (Yue et al., 2019; Lee & Tunisia, 2016). The moderate variability supports the idea that while most students express willingness, some may not have the tools, routines, or support systems to carry out their plans. Incorporating behavioral nudges or action-based learning in classrooms might help translate intent into daily practice (Weijers et al., 2023). By encouraging goal-setting and providing real-life applications, schools can bridge the intention-action gap.

Finally, despite occasional challenges in planning, many students are already engaging in meaningful conservation practices (Wang & Lin, 2024; Nadeem et al., 2023). Energy-Saving Behavior (ESB) construct revealed that many students are already turning off unused appliances, unplugging devices, and avoiding excessive electricity use. The combination of high medians and low standard deviations indicates that these behaviors are widespread and consistently practiced. This suggests that for many students, energy-saving is not only a value or intention but an actual habit (Loureiro & Lima, 2019; Zerinou et al., 2020; Du & Pan, 2021). It reinforces the importance of positive reinforcement, modeling behavior at home and school, and the availability of structural support. These findings demonstrate that students are not passive actors; many are already contributing to sustainability in tangible ways (Mohamad et al., 2021). Continued encouragement and recognition of these actions may further normalize and sustain energy-conscious behavior among youth.

To complement the item-level analysis, the overall descriptive statistics for each major construct are summarized in Table 2. This table presents a comprehensive overview of the key variables assessed in the study, namely Attitude (ATT), Perceived Behavioral Control (PBC), Subjective Norms (SN), Perceived Benefits (PB), Perceived Product Quality (PQ), Energy Policies (EP), Energy-Saving Intention (ESI), and Energy-Saving Behavior (ESB). For each construct, the number of valid responses, medians, standard deviations, minimum and maximum scores, and results of the Shapiro-Wilk test for normality are provided. Reporting these summary statistics offers a clearer understanding of the central tendency, variability, and distributional characteristics of the data, which are essential for interpreting the overall trends and informing subsequent analyses. Additionally, examining the normality of each variable through the Shapiro-Wilk test helps determine the appropriate statistical techniques for further hypothesis testing. Together, these descriptive statistics provide valuable context for evaluating students' perceptions, intentions, and behaviors regarding energy conservation.

Table 2.

Descriptive Statistics of Key Study Variables

	ATT Median	PBC Median	SN Median	PB Median	PQ Median	EP Median	ESI Median	ESB Median
Valid	179	179	179	179	179	179	179	179
Median	4.000	4.000	3.000	4.000	3.000	3.000	3.500	4.000
Std. Deviation	0.489	0.582	0.785	0.422	0.802	0.866	0.524	0.589
Shapiro-Wilk	0.727	0.770	0.942	0.647	0.827	0.919	0.772	0.625
P-value of Shapiro-Wilk	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Minimum	1.000	1.000	1.000	2.500	1.000	1.000	2.000	1.000
Maximum	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000

Table 2 presents the descriptive statistics for the key study variables. All variables had 179 valid responses. The median scores indicate generally favorable attitudes (ATT = 4.000), perceived behavioral control (PBC = 4.000), perceived benefits (PB = 4.000), and energy-saving behaviors (ESB = 4.000). Subjective norms (SN), perceived product quality (PQ), and energy policy awareness (EP) had lower median scores of 3.000, while energy-saving intention (ESI) had a slightly lower median of 3.500. Standard deviations ranged from 0.422 (PB) to 0.866 (EP), showing varying levels of response consistency. The Shapiro-Wilk tests indicated non-normal distributions for all variables ($p < 0.001$). The minimum and maximum scores reveal that while some students rated variables as low as 1.000, the highest ratings reached the maximum possible value of 4.000 across all constructs.

OBJECTIVE 2

After analyzing the data, researchers proceeded to separate it into intention constructs (ATT, PBC, SN, PB, PQ, EP) and behavior constructs (ESI, ESB). This separation was performed to address the second

objective, which aimed to correlate students' intentions with their behaviors. The average for each variable from each respondent (as presented in Table 3) was calculated using Google Sheets. These averages were then transferred to SPSS, where Spearman's rho was used to determine the correlation between intentions and behaviors. The analysis revealed a Spearman's rho of 0.631, indicating a substantial positive correlation between the two.

Table 3.

Spearman' Rho Correlation Analysis

				Intentions	**Behaviours**
Spearman's rho		Intentions	Correlation Coefficient	1.000	0.631*
			Sig. (2-Tailed) p-value		<0.001
		Behaviours	Correlation Coefficient	0.631*	1.000
			Sig. (2-Tailed) p-value	<0.001	

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To further illustrate the strength and direction of relationships observed in Table 3, Figure 3 presents a visual representation of the correlations through a scatter plot matrix. This figure allows for a clearer understanding of how the variables interact with one another by showcasing the patterns and clustering of data points. While the correlation coefficients provide numerical insight, the scatter plot adds a more intuitive dimension by revealing potential linear trends, outliers, or inconsistencies within the dataset. By combining both numerical and visual tools, the study offers a more comprehensive examination of the interrelationships among the core constructs.

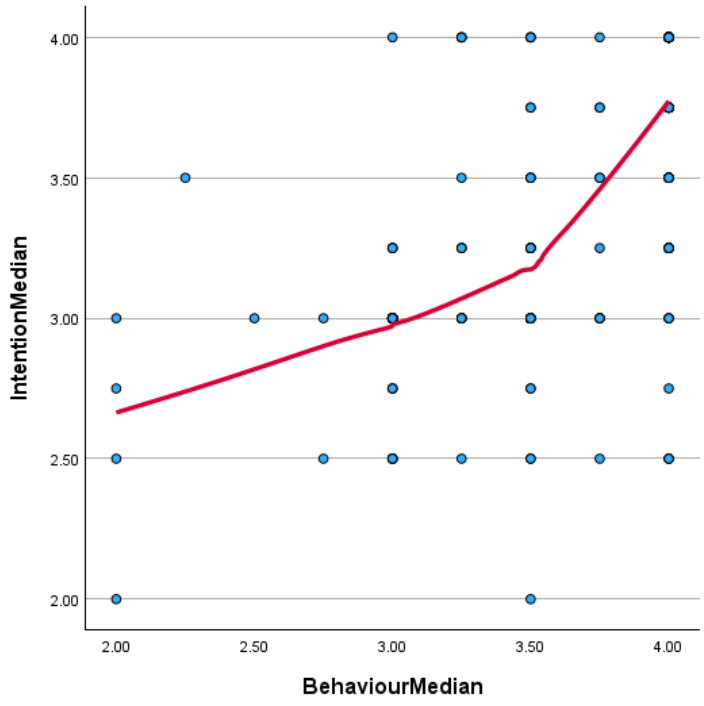

Figure 3. Correlation Between Energy-Saving Intention and Energy-Saving Behavior

The scatter plot specifically illustrates the correlation between Household Energy Intention and Household Energy Behavior, with each data point representing individual observations. The red trend line shows a

positive relationship between the two variables, indicating that as household energy intention increases, household energy behavior also tends to rise. This suggests that individuals with stronger intentions to adopt energy-efficient practices are more likely to translate these intentions into actual behaviour (Lee & Tanusia, 2016; Yue et al., 2019). Since the data does not follow a normal distribution, Spearman's rho correlation analysis was used to assess the relationship. The upward curvature of the trend line may indicate that the strength of this association increases at higher levels of intention, reinforcing the idea that strong commitments to energy-saving behaviors result in more consistent household energy conservation efforts. This finding supports behavioral theories linking intention to action in sustainability-related decisions (Frommeyer et al., 2022).

OBJECTIVE 3

Building on the observed relationship between household energy intention and actual energy-saving behavior, the study proceeded to examine the structural relationships among all key variables using Partial Least Squares Structural Equation Modeling (PLS-SEM). While descriptive and correlational analyses provided foundational insights into the general trends and associations within the data, a more robust analytical approach was required to test the hypothesized causal paths among constructs. The SEM approach enables a simultaneous evaluation of multiple direct and indirect effects, offering a clearer picture of how factors such as attitude, perceived behavioral control, subjective norms, perceived benefits, product quality, and energy policies influence both intention and behavior. This step was essential to determine the strength and significance of pathways theorized in the conceptual framework, thereby validating the proposed model of energy-saving behavior among SHS students at Mapúa University –

Intramuros.

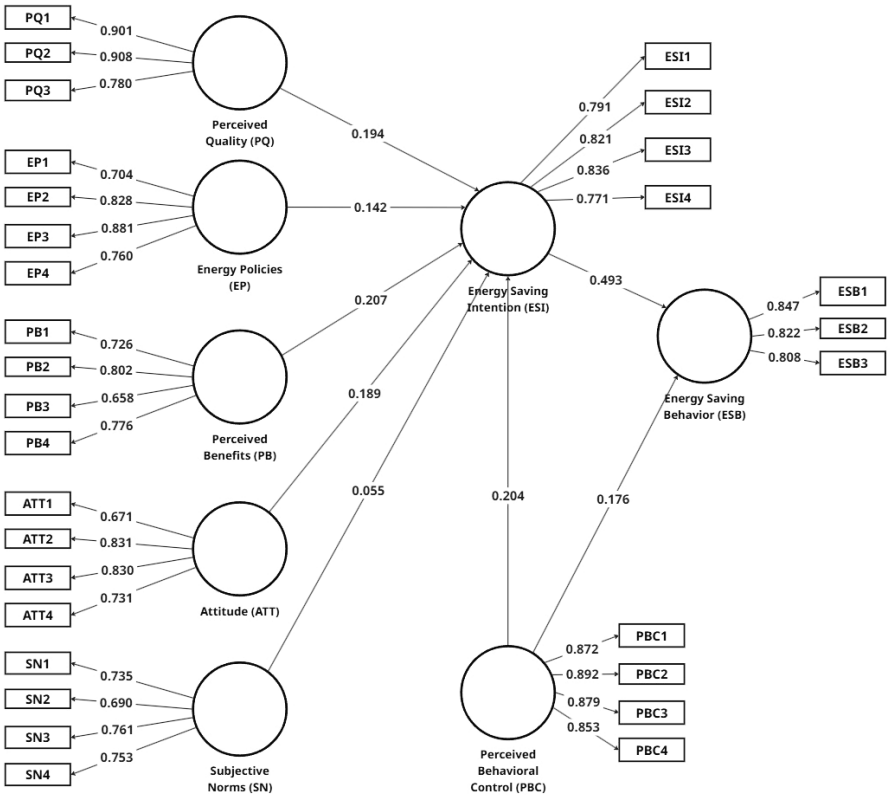

Figure 4. PLS-SEM Analysis of Factors Influencing Energy-Saving Intentions and Behaviors

The PLS-SEM analysis revealed significant relationships between the six predictor constructs—attitude (ATT), perceived behavioral control (PBC), subjective norms (SN), perceived benefits (PB), perceived product quality (PQ), and understanding of energy policies (EP)—and energy-saving intention (ESI). Hypothesis testing confirmed support for H1 (ATT → ESI), H2 (SN → ESI), H3 (PB → ESI), H4 (PQ → ESI), H5 (EP → ESI), H6b (PBC → ESB), H7 (ESI → ESB), and H8 (EP → ESB). Only H6a (PBC → ESI) was not supported, indicating that perceived behavioral control did not significantly influence students' intention to save energy.

Among the predictors, perceived benefits (PB) emerged as the strongest factor influencing ESI ($\beta = 0.207$), followed closely by subjective norms (SN) ($\beta = 0.204$) and understanding of energy policies (EP) ($\beta = 0.194$). Attitude (ATT) also had a significant positive effect on ESI ($\beta = 0.189$), as did perceived product quality (PQ) ($\beta = 0.142$), supporting H1 and H4, respectively. PBC did not significantly predict ESI ($\beta = 0.055$), leading to the rejection of H6a, but it showed a significant direct effect on energy-saving behavior (ESB) ($\beta = 0.189$), confirming H6b. Energy-saving intention (ESI) had the strongest influence on ESB (β

= 0.493), validating H7, while understanding of energy policies (EP) also directly impacted ESB (β = 0.118), supporting H8. The model explained 46.4% of the variance in ESI (R^2 = 0.464) and 33.2% of the variance in ESB (R^2 = 0.332), indicating a moderate to substantial explanatory power. The measurement model assessment further confirmed the reliability and validity of the constructs. Indicator loadings ranged from 0.658 to 0.901, exceeding acceptable thresholds.

The results confirmed that attitude (H1) had a significant positive effect on energy-saving intention (ESI) among Mapúa SHS students. Students who view energy conservation as favorable and beneficial were more inclined to form intentions to save energy (Ilham et al., 2022; Lee & Tanusia, 2016). This aligns with the Theory of Planned Behavior (TPB), which emphasizes attitude as a critical predictor of intention (Ajzen, 1991). The relatively strong beta value (β = 0.189) indicates that promoting positive perceptions about energy-saving could strengthen students' motivation. Efforts to improve students' views on energy conservation, possibly through awareness campaigns or curriculum integration, may thus foster higher intentions (Barata et al., 2017).

Subjective norms (H2) also significantly influenced energy-saving intention, highlighting the role of social influence. Students were more likely to intend to conserve energy when they perceived support or expectations from peers, family members, or authority figures such as teachers (β = 0.204). This finding reflects TPB's argument that normative pressure can shape personal intentions (Heib et al., 2024). It suggests that energy-saving campaigns targeting youth should also engage their social circles, emphasizing collective responsibility (Hargreaves & Middlemiss, 2020).. Promoting social approval for energy-efficient behaviors could strengthen this effect even further.

Perceived benefits (H3) emerged as the strongest predictor of energy-saving intention. Students who recognized tangible advantages—such as cost savings, environmental protection, or personal well-being—were more likely to form intentions (β = 0.207). This finding emphasizes the need to communicate the practical rewards of energy conservation more clearly to students (Lu & Wang, 2020; Kumar et al., 2022). Highlighting immediate and relatable benefits, rather than abstract or long-term gains, may be particularly effective in fostering energy-saving intentions (Xing et al., 2022).. Such a focus would be consistent with findings from benefit-driven behavior change models.

Perceived product quality (H4) also had a significant positive effect on intention, though it was comparatively weaker (β = 0.142). Students who trust the reliability and effectiveness of energy-efficient products were more likely to intend to use them (Andor et al., 2016; Kabaja et al., 2023).. This supports the notion that technological trust can facilitate sustainable behaviors, even among younger consumers. If students doubt product performance, their intentions to save energy may weaken, regardless of their awareness or attitude. Therefore, promoting certified, high-quality products and providing demonstrations could enhance trust and drive stronger energy-saving intentions (Iordache Platis & Romanowicz, 2020).

Understanding of energy policies (H5) significantly influenced students' intentions to conserve energy (β = 0.194). Awareness of national or institutional efforts to promote energy efficiency helped students perceive energy-saving as both necessary and achievable. This suggests that policy knowledge can bridge the gap between abstract environmental concerns and personal responsibility (Ilham et al., 2022; Lamia et al., 2024). Including discussions on energy policies within the educational system could help institutionalize energy-saving intentions among youth. Moreover, increased policy transparency and visibility could make students feel that their actions are part of a larger, supported movement (Hoque et al., 2022).

Perceived behavioral control (H6a) did not significantly affect energy-saving intention (β = 0.055), contradicting the original expectation. This suggests that students may recognize the importance of saving energy but feel limited by external constraints, such as family rules, access to technology, or living conditions (Jonitz et al., 2024; Mavroudi & Divitini, 2017). It highlights a gap between perceived ease and actual empowerment to act, which could hinder intention formation. These results indicate that interventions must not only inform students but also equip them with real opportunities to practice conservation. Programs focusing on skill-building and empowerment may strengthen the PBC-intention link in future efforts (Poggiolini, 2019).

However, perceived behavioral control (H6b) had a significant direct effect on actual energy-saving behavior (β = 0.189). Students who felt capable of taking action were more likely to engage in conservation, even without a strong prior intention (Jonitz et al., 2024; Mavroudi & Divitini, 2017). This reinforces the idea that a sense of control is crucial for behavior execution. Providing students with hands-on experiences and reinforcing their capability to save energy could thus lead to immediate behavioral changes (Garbacz et al., 2017). This finding suggests that interventions promoting behavioral efficacy may have a direct impact, even bypassing the traditional intention pathway.

Finally, Energy-saving intention (H7) was the strongest predictor of actual behavior (β = 0.493), consistent with the TPB's central argument. Students who intended to conserve energy were significantly more likely to perform energy-saving actions (Yue et al., 2019; Lee & Tunisia, 2016).. This highlights the importance of building strong, clear intentions to drive real-world behavior among young individuals. Strengthening intention through targeted messaging, positive reinforcement, and environmental education could thus have substantial impacts (Weijers et al., 2023).. It also suggests that intention formation should remain a central goal of any energy conservation campaign targeted at youth.

To ensure the reliability and validity of the latent constructs used in the structural model, several statistical tests were conducted, including Cronbach's Alpha, Composite Reliability (rho_A and rho_C), and Average Variance Extracted (AVE). These measures are essential in verifying the internal consistency, convergent validity, and overall reliability of each construct in the study. According to Hair et al. (2019), values above 0.70 for Cronbach's Alpha and Composite Reliability indicate acceptable reliability, while an AVE value above 0.50 confirms adequate convergent validity. These thresholds were used as benchmarks to evaluate whether each construct in the model—such as Attitude (ATT), Perceived Behavioral Control (PBC), Subjective Norms (SN), and others—meets the minimum acceptable levels of consistency and validity. Ensuring these constructs are statistically sound is critical before interpreting the relationships among them in the structural model. The results for these assessments are presented in Table 4 below. This table summarizes the calculated values for each construct to determine if the measurement model is suitable for further analysis.

Table 4.

Construct Reliability and Validity Tests

	Cronbach's Alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)

ATT	0.768	0.785	0.852	0.591
EP	0.805	0.814	0.873	0.634
ESB	0.766	0.766	0.865	0.682
ESI	0.819	0.819	0.880	0.648
PB	0.728	0.741	0.830	0.551
PBC	0.898	0.907	0.928	0.764
PQ	0832	0.862	0.898	0.748
SN	0.725	0.722	0.824	0.540

As shown in Table 4, all constructs in the model demonstrate acceptable levels of reliability and validity based on the recommended thresholds. Cronbach's Alpha values range from 0.725 (SN) to 0.898 (PBC), all surpassing the 0.70 benchmark, thus confirming internal consistency. Composite reliability scores (rho_C) also exceed 0.80 for all constructs, with Perceived Behavioral Control (0.928) and Perceived Quality (0.898) showing particularly strong reliability. Furthermore, Average Variance Extracted (AVE) values for all constructs are above the minimum requirement of 0.50, indicating adequate convergent validity. Notably, Perceived Behavioral Control (PBC) and Perceived Quality (PQ) achieved the highest AVE scores, at 0.764 and 0.748 respectively, reflecting strong indicator loading and shared variance. Even Subjective Norms (SN), which had the lowest AVE at 0.540, still met the acceptable threshold. These results confirm that the measurement model is robust, reliable, and valid, providing a strong foundation for examining the structural relationships and hypothesis testing in the subsequent analysis.

CONCLUSION

In addressing the pressing issue of sustainable energy consumption among youth, this research successfully met its objectives through a focused investigation of students' intentions and behaviors. Through a detailed examination of attitudes, subjective norms, perceived behavioral control, perceived

benefits, perceived product quality, and understanding of energy policies, the study provided a comprehensive view of the psychological and contextual determinants that shape students' willingness to engage in sustainable energy consumption. These insights reflect the importance of not only internal motivations and beliefs but also the external influences that guide students' intentions. The findings support the value of educational and social environments in cultivating responsible energy behaviors. By integrating local context and student perspectives, the study deepened the understanding of how youth form intentions to conserve energy. This achievement contributes significantly to the field of sustainability education and highlights which factors deserve focus when designing future interventions.

The research also met its second objective, which was to examine how students' energy-saving intentions translate into actual household behaviors. The study clearly identified that many students who expressed a strong intention to conserve energy were also engaging in simple but impactful practices such as turning off lights, unplugging appliances, and minimizing unnecessary electricity use. These findings demonstrate a meaningful correlation between intention and action, suggesting that when students are informed and motivated, they tend to follow through in their daily lives. This connection underscores the importance of intention as a strong predictor of behavior, particularly in the context of youth-led sustainability efforts. By linking these specific practices to their corresponding motivations, the study also helped identify which intentions are most actionable, thereby offering useful insights for behavior-focused programs. As a result, the research provides evidence that fostering intention through education and engagement can be an effective strategy for promoting household energy conservation.

Lastly, the third research objective was achieved by constructing and applying a structural model using Partial Least Squares Structural Equation Modeling (PLS-SEM). The model enabled the analysis of complex relationships among the identified variables and confirmed the roles that each factor played in shaping both intentions and behaviors. This modeling approach provided a data-driven structure that future research can build upon and adapt for different contexts or populations. The results offer a validated framework for understanding how various psychological and contextual factors work together to promote energy conservation among students. Additionally, the model can inform the design of targeted interventions by emphasizing the factors that have the strongest influence. Through this, the study not only validated the usefulness of PLS-SEM for this kind of research but also contributed a practical and theoretical model that can help institutions and policymakers design more effective energy-saving initiatives. In sum, all research objectives were effectively met, supporting the study's aim of advancing sustainability among the youth.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are offered to promote sustainable household energy consumption behaviors among senior high school students and similar populations:

Recommendations for Practice

Educational institutions, particularly Mapúa University, should integrate comprehensive energy conservation education into their curricula. This integration should move beyond the traditional approach of simply providing information; it should actively engage students in a deeper understanding of the environmental and economic benefits associated with energy-saving practices. To achieve this, institutions can employ a variety of pedagogical methods, including interactive workshops that allow for hands-on learning, practical activities that demonstrate energy-saving techniques, and the analysis of real-world case studies that illustrate the impact of energy consumption. Furthermore, these educational initiatives

should aim to shape positive attitudes towards energy conservation by fostering a sense of responsibility and highlighting the direct connection between individual actions and broader environmental consequences. A key component of this education should be increasing students' awareness of their crucial role in mitigating climate change and promoting a more sustainable future.

To leverage the influence of subjective norms, schools and families should collaborate to cultivate a social environment that actively promotes and rewards energy-saving behaviors. This collaboration can involve establishing peer-to-peer advocacy programs, where students encourage and support each other in adopting sustainable practices, creating a network of positive influence and shared responsibility. Additionally, schools and families can organize campaigns that highlight the collective impact of individual actions, demonstrating how small changes in energy consumption, when adopted by many, can lead to significant reductions in overall energy use. The effectiveness of these campaigns can be further enhanced by showcasing positive role models within the school community and the broader society, individuals who have successfully adopted sustainable practices and are recognized for their commitment to environmental stewardship.

Addressing the relatively weak influence of perceived behavioral control requires a multifaceted approach that empowers students with the knowledge, skills, and resources necessary to take action. Schools can play a vital role by organizing practical workshops that provide students with concrete guidance on how to implement energy-saving measures within their homes. These workshops can cover a range of topics, including optimizing the use of household appliances to maximize energy efficiency, identifying and reducing energy waste through simple behavioral changes, and effectively advocating for energy-efficient practices within their families and communities. To further enhance students' sense of agency and ability to contribute to household energy conservation, schools should also provide them with access to relevant resources and tools, such as energy-saving checklists, information on available energy-efficient products, and guidance on how to access available incentives or support programs.

Given the influence of perceived product quality on energy-saving intentions, concerted efforts should be made to promote the adoption of energy-efficient appliances and technologies among students and their families. Educational campaigns can play a crucial role in highlighting the long-term cost savings associated with investing in high-quality, energy-saving products, as well as emphasizing the significant environmental benefits that these products offer in terms of reduced energy consumption and carbon emissions. To further encourage the adoption of these products, schools can collaborate with local businesses and government agencies to provide students and their families with access to reliable information, practical demonstrations, and financial incentives, such as rebates or subsidies. By making energy-efficient products more accessible and appealing, these collaborations can help to overcome barriers related to initial costs and lack of awareness.

To enhance the impact of energy policies on behavior, it is crucial to increase students' awareness and understanding of relevant regulations and initiatives at both the local and national levels. Schools can serve as important hubs for disseminating information about key energy-saving policies, such as the Renewable Energy Act of 2008 and the Energy Efficiency and Conservation Act, ensuring that students are informed about the legal and regulatory frameworks that govern energy consumption. Furthermore, schools can organize engaging discussions and interactive sessions that explore the importance of these policies, explaining how they contribute to broader sustainability goals and outlining the specific actions that individuals and households can take to support their implementation. By fostering a sense of civic responsibility and empowering students to become active participants in energy conservation efforts, these

initiatives can promote greater compliance and encourage students to advocate for stronger environmental policies.

Recognizing the significant influence of the household environment on students' energy consumption behaviors, it is essential to actively involve parents in energy-saving initiatives. Schools can play a key role in facilitating this involvement by organizing workshops and seminars specifically designed for parents, providing them with valuable education about energy-efficient practices and equipping them with the necessary resources to implement these practices effectively within their homes. These workshops can offer practical guidance on topics such as optimizing home energy use, selecting energy-efficient appliances, and creating a family culture that prioritizes sustainability. Moreover, schools can encourage open and ongoing communication between students and their parents about energy consumption habits, fostering a shared commitment to sustainability within the family and creating a supportive environment for behavior change.

Recommendations for Future Research

Future research should address the limitations of this study and expand upon its findings to provide a more comprehensive understanding of energy-saving behaviors among young people. Longitudinal studies, for example, could be designed to examine the long-term effectiveness of interventions aimed at promoting sustainable energy consumption behaviors among students. Comparative studies could also be valuable, investigating the differences in energy-saving intentions and behaviors across various student populations, age groups, and cultural contexts to identify potential variations and develop more tailored interventions. Additionally, future research could explore the role of other factors that may influence energy consumption patterns, such as socio-economic status, cultural values, access to technology, and the built environment. Based on a deeper understanding of the intention-behavior gap, future research should prioritize the development and rigorous evaluation of targeted interventions aimed at bridging this gap and translating students' energy-saving intentions into consistent and sustained action. These interventions could incorporate a range of behavioral change techniques, such as goal setting, feedback mechanisms, social comparison, and the use of prompts or reminders.

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