

# Consumer Awareness and Willingness Level at Banlat Gas Stations Regarding Biofuel Act: Bases for Sustainable Energy Transition and Education Strategies

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## ABSTRACT

In the pursuit of sustainable energy practices, the study focuses on assessing the awareness and willingness of selected respondents at 11 well-known gas stations in Banlat regarding the Biofuel Act. Against the backdrop of global efforts to mitigate environmental impact and promote renewable energy sources, understanding consumer perspectives becomes paramount. This study aims to shed light on the intricate interplay between consumer awareness, demographic characteristics, and their willingness regarding the Biofuel Act.

Using a quantitative research approach with 440 respondents sampled through quota sampling, the study examines the demographic profile (age, education, socio-economic status). Findings show most respondents are aged 23–44, with bachelor's degrees, and from the lower-middle-income bracket. While awareness of the Biofuel Act is low ("Slightly Aware"), there's notable willingness ("Somewhat Willing") to support it. There's a weak relationship between demographic factors and awareness, except for education level, which has a moderate impact, suggesting higher education correlates with greater awareness. Similarly, demographic factors show weak correlation with willingness. These insights are crucial for policymakers and stakeholders to refine consumer education strategies and promote sustainable energy practices.

## INTRODUCTION

### Nature and Scope of the Problem Investigated

The global pursuit of sustainable energy solutions has catalyzed a paradigm shift towards renewable resources, notably biofuels, in response to environmental concerns and energy security imperatives. As nations navigate this transition, understanding consumer awareness and willingness towards biofuel initiatives becomes paramount. This research addressed critical questions surrounding consumer awareness and willingness towards the Biofuel Act.

### Research Problems and Objectives

This research endeavors to address several key problems and objectives. Firstly, it aimed to gauge the current level of consumer awareness concerning the Biofuel Act within known gas stations in the Banlat Area. Secondly, it aimed to evaluate consumers' willingness to comprehend and support the Biofuel Act. Furthermore, the study endeavors to explore the correlation between the levels of awareness and willingness among consumers in Banlat regarding the Biofuel Act and the identified demographic

variables. Lastly, based on the findings, actionable recommendations are proposed. These recommendations are designed to capitalize on the identified levels of awareness and willingness among consumers in Banlat, aiming to develop effective consumer education strategies tailored to facilitate a sustainable energy transition in the Philippines under the provisions of the Biofuel Act.

### Research Framework

Drawing from both theoretical and conceptual frameworks, the study identified demographic characteristics, along with the level of awareness on the Biofuel Act, as independent variables. Dependent variables included behavioral factors reflecting individuals' readiness to comprehend and support biofuel blending, as well as their level of awareness regarding the Act's environmental implications. Upon examining these interrelationships, the study was able to provide comprehensive insights thus, contributing to informed decision-making for promoting sustainable energy practices in the Philippines.

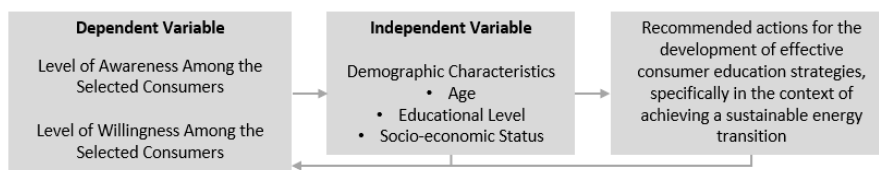


Figure 1. Conceptual Framework of the Study

### Research Significance

This study on Biofuel Act contributes to the theoretical advancements in engineering management, practices, policies, and theories. The findings also provided practical insights for stakeholders, aiding in targeted educational efforts, and potentially promoting sustainable energy practices in the Philippines. Additionally, the research offered valuable insights for policymakers, facilitating smoother policy implementation to support biofuel adoption and achieve national energy and environmental goals.

### Philosophical Lens

The research was grounded in positivism - aims to establish explanatory connections or causal relationships that ultimately enable the prediction and control of the phenomena under examination to emphasize scientific methods for studying social phenomena and it is suitable for this study due to its emphasis on empirical data analysis (Park, Y., Konge, L., & Artino, A. R. (2020).

### Scope and Limitations

This study focused on selected gasoline stations in the Banlat area, totaling 11 establishments and is capped at 440 respondents. This study was held only to the said respondents, therefore, not generalizable. The limitations observed in this study was mainly on time and resources. Also, reliance on survey questionnaires introduced self-reporting bias. On the other hand, the study did not include perspectives from stakeholders like gas station operators and policymakers and did not explore economic feasibility, limiting a comprehensive understanding of consumer behavior. Lastly, other than the demographic variables were not considered.

### Definition of Terms

**Awareness.** Refers to the extent of knowledge and understanding of consumers at the surveyed gas stations in the Banlat Area about the provisions and goals of the Biofuel Act of 2006. This includes knowledge about the act's specific mandates for biofuel blending, its environmental benefits, and its intended impact on Philippine energy independence.

**Biofuel Blending.** The process of blending biofuel in all liquid fuels for motor and engines.

**Biofuel.** These are liquid fuels produced from renewable biological sources, including plants and algae.

**Environmental Sustainability.** The ability to maintain an ecological balance in our planet's natural environment and conserve natural resources to support the wellbeing of current and future generations.

**Willingness.** Reflects the disposition or inclination of consumers to support and embrace the objectives, and refers to the extent to which an individual or group has the confidence, commitment, and motivation to accomplish a specific task.

### Review of Pertinent Literatures

In the Philippines, where the demand for sustainable energy solutions meets the challenges of environmental preservation and economic growth, the concept of biofuel blending arises as a symbol of optimism. Rooted in the global discourse on energy security and climate change mitigation, biofuel blending represents a strategic pathway toward a more resilient and environmentally conscious future. As Devarajan et al. (2021) assert, this practice, which combines traditional fossil fuels with renewable biofuels, not only reduces dependence on finite resources but also mitigates the impact of oil price volatility.

Within this context, the Biofuel Act stands as a testament to the Philippines' commitment to curbing climate change through mandated biofuel blending, as elucidated by Mishra et al. (2019). However, the success of such initiatives hinges not only on policy frameworks but also on public awareness and acceptance. Technological innovations, as highlighted by Khan et al. (2022), play a pivotal role in enhancing the efficiency and sustainability of biofuel production, offering promising avenues for scaling up adoption.

Yet, as the policy landscape evolves, policymakers struggle with the delicate balance between promoting biofuel development and addressing socio-economic and environmental concerns. Wang et al. (2019) underscore the importance of sustainability certification and international cooperation in shaping effective biofuel policies. Achieving this balance requires nuanced strategies that navigate the complex interplay between rural development, land use, and environmental conservation, as noted by Correa et al. (2019).

Central to this narrative is the role of consumers in driving the transition towards sustainable energy. Consumer acceptance and perception, as highlighted by Zhao et al. (2020), are pivotal in shaping the trajectory of biofuel adoption. Access to accurate information, transparent communication about technology, and supportive government policies are essential in fostering positive attitudes towards biofuels, as emphasized by Varella et al. (2021).

## MATERIALS AND METHODS

### Research Design

This research utilized quantitative research design due to its deductive approach and emphasis on numerical data analysis. It enabled the use of questionnaires with closed-ended questions that measured the understanding and support for the act.

### Research Locale

The study was conducted in the 6th District of Quezon City, also known as the Banlat Area. Within the Banlat area, there were eleven (11) known gasoline stations which were the focused research locale of this study: 2 Petron Gas Stations, 4 Shell Gas Stations, 1 Total Gas Station, 2 Phoenix Gas Stations, and 2 Caltex Gas Stations.

### Population and Sampling Design

The study focused on consumers associated with 11 identified gasoline stations. The total population is estimated to be around 8800 consumers, with each gas station serving approximately 700-1000 customers

daily. To ensure statistical reliability, a sample size of approximately 342 consumers was determined using Cochran's formula, aligning with the decision to include 40 willing consumers per location.

The sampling design employed is quota sampling. Each gasoline station serves as a stratum, with 40 willing consumers selected from each station, resulting in a total sample size of 440 consumers.

**Research Instruments**

The survey tool selected for this study is an online survey questionnaire and a paper survey questionnaire, which is a researcher-made questionnaire. The survey questionnaire contained demographic data of the respondent and 5-point Likert scale questions that assessed both willingness and awareness of the selected population. It includes 10 questions each to assess the level of awareness and willingness of the selected consumers.

**Data Gathering Procedure**

Prior to data collection, the researcher obtained the necessary ethical approvals that outlines the purpose of the study, voluntary participation, confidentiality measures, and the rights of the participants. In the study, participants were approached at gas stations in the Banlat Area and were invited to take part. Those who agreed provided informed consent. They were then directed to scan a QR code linked to a Google form or use the paper questionnaire.

**Management and Treatment of Data**

After the data was gathered, the study analyzed demographic variables such as age, education, and socio-economic status using frequency distribution and descriptive statistics. The mean was primarily used to measure central tendency. Frequency distribution highlighted the distribution of values and their impact on consumer awareness and willingness. Data was grouped into intervals, and tables and histograms were used to visualize patterns. Pearson's and Spearman's Rank Correlation Coefficients were used to assess relationships.

**RESULTS AND DISCUSSION**

**I. Level of Awareness of the Respondents**

The statement "I am aware of the Biofuel Act of 2006" topped among participants, representing 37.95% of the total population, with a mean of 2.44 falling within the "slightly aware" range. Secondly, the statement that specifies the act's provisions got a mean of 2.15 wherein, it represents 36.59% of the total population. Lastly, the statement that denotes the government's objectives and goals received the lowest mean of 1.63, with 55.91% representing the total population.

**Table 1. Overall level of Awareness of the Respondents**

Survey Statement n=440	Percentage of respondents per scale					Weighted Mean	Description
	Not at all aware	Slightly aware	Somewhat Aware	Moderately Aware	Extremely Aware		
I am aware that there is a law known as the "Biofuel Act of 2006."	20.45%	37.95%	24.77%	10.91%	5.91%	2.44	Slightly Aware
I understand and I am aware the specifics of biofuel blending practices in our country.	36.59%	28.86%	22.50%	6.82%	5.23%	2.15	Slightly Aware
I am aware and informed about the environmental benefits associated with using biofuels, as promoted by the Biofuel Act of 2006.	41.36%	27.73%	20.23%	6.14%	4.55%	2.05	Slightly Aware
I am aware that, according to the Biofuel Law, there is a mandated 10% bioethanol blend in gasoline and 2% biodiesel blend in diesel fuel.	44.77%	27.05%	18.41%	5.68%	4.09%	1.97	Slightly Aware

I am aware and I comprehend the objectives and goals behind the Philippine government's implementation of the Biofuel Act of 2006.	36.36%	38.41%	16.82%	5.00%	3.41%	2.01	Slightly Aware
I am knowledgeable and aware about the impact of biofuel utilization on reducing carbon emissions.	42.27%	34.09%	15.91%	4.77%	2.95%	1.92	Slightly Aware
I have a clear understanding of the economic advantages related to implementing the Biofuel Act of 2006.	44.77%	33.64%	15.00%	4.32%	2.27%	1.86	Slightly Aware
I am aware with the role of biofuels in reducing dependency on fossil fuels.	49.55%	31.82%	14.55%	2.27%	1.82%	1.75	Slightly Aware
I know about the advancements and innovations in biofuel technology in line with the Biofuel Act of 2006.	48.86%	32.95%	13.64%	2.50%	2.05%	1.76	Slightly Aware
I am aware of the regulatory measures taken to ensure compliance with the Biofuel Act of 2006.	55.91%	29.55%	11.82%	1.59%	1.14%	1.63	Slightly Aware
<b>Overall Weighted Mean for the Level of Awareness of the Selected Respondents</b>						<b>1.95</b>	<b>Slightly Aware</b>

## II. Level of Willingness of the Respondents

The statement that denotes collaboration and engagement towards the act, topped the survey representing 55.68% of the total population with a 4.44 mean. Secondly, the statements that displays being well-educated and being an advocate to the act got a mean of 4.22, wherein, 51.14% and 48.86% represent the total population. Lastly, the statement that denotes lifestyle change got a mean of 2.92, placing it as the least willing aspect. Whereas, 26.36% of the responses falls under the “slightly willing” scale.

**Table 2. Overall Level of Willingness of the Respondents**

Survey Statement n=440	Percentage of respondents per scale					Weighted Mean	Description
	Not Willing	Slightly Willing	Undecided	Somewhat Willing	Willing		
I am willing to deepen my understanding of the Biofuel Act of 2006.	2.05%	6.36%	10.68%	29.77%	51.14%	4.22	Somewhat willing
I am willing to actively engage in educational programs focused on the Biofuel Act of 2006.	2.73%	4.09%	10.45%	33.86%	48.86%	4.22	Somewhat willing
I am willing in supporting initiatives that emphasize the importance of environmental conservation through the Biofuel Act of 2006.	1.82%	4.32%	21.82%	27.95%	44.09%	4.08	Somewhat willing
I am willing in advocating for increased awareness and adherence to the Biofuel Act of 2006.	3.41%	7.27%	46.59%	25.45%	17.27%	3.46	Undecided
I am willing in participating to discussions regarding the benefits of biofuels and their role in sustainability.	10.91%	17.95%	27.05%	20.68%	23.41%	3.28	Undecided
I am willing to adjust my lifestyle or habits to align with the objectives of the Biofuel Act of 2006.	20.23%	26.36%	15.00%	17.95%	20.45%	2.92	Undecided
I am willing in investing time and effort into learning about the implications of biofuels on our society and environment.	3.64%	25.00%	42.95%	18.86%	9.55%	3.06	Undecided
I am willing to promote the benefits of biofuels within my community or social circle.	3.86%	13.41%	19.77%	25.00%	37.95%	3.80	Somewhat willing
I am willing to collaborate with organizations working towards the successful implementation of the Biofuel Act of 2006.	3.86%	3.41%	35.45%	37.05%	20.23%	3.66	Somewhat willing
I am willing to stay informed about the progress and developments related to biofuel initiatives outlined in the Biofuel Act of 2006.	1.59%	2.05%	2.73%	37.95%	55.68%	4.44	Somewhat willing
<b>Overall Weighted Mean for the Level of Willingness of the Selected Respondents</b>						<b>3.71</b>	<b>Somewhat willing</b>

## III. Degree of relationship of the level of awareness and willingness and the demographic characteristics of the selected respondents

### A. LEVEL OF AWARENESS

The study found that age has little correlation with consumer awareness of the Biofuel Act, suggesting age does not significantly impact awareness levels. Conversely, educational level showed a moderate correlation, indicating that higher education corresponds to greater awareness. Socioeconomic status displayed negligible correlation, suggesting it doesn't significantly influence awareness.

### B. LEVEL OF WILLINGNESS

The study found that age, educational level, and socioeconomic status have very weak correlations with consumer willingness regarding the Biofuel Act, indicating that none of these factors significantly

influence willingness levels.

## RESEARCH IMPLICATIONS

### Summary of Findings

#### I. Level of Awareness

The overall percentage mean for the parameter "Level of Awareness" was 1.95, classifying respondents as "Slightly Aware." It underscores a varied landscape of awareness levels among the surveyed population. While some aspects of the Biofuel Act have garnered a reasonable level of recognition, others demand immediate attention. Bridging the gap in understanding the mandated blending ratios and elucidating the economic benefits of biofuel implementation should be prioritized in educational campaigns. A targeted outreach strategy, considering the top-performing statements, can amplify awareness and foster a more informed and engaged public in the realm of sustainable energy practices. In essence, these insights should guide policymakers and educators in crafting interventions that not only inform but also inspire a collective commitment towards the goals of the Biofuel Act.

#### II. Level of Willingness

The overall percentage mean for the parameter "Level of Willingness" was 3.71, indicating respondents were "Somewhat willing." This reflects a generally positive attitude toward the Biofuel Act, with respondents expressing a high willingness to stay informed, deepen their understanding, and actively engage in educational programs. However, challenges exist in encouraging lifestyle adjustments and fostering active participation in discussions. Understanding these dynamics is crucial for tailoring communication and outreach strategies to enhance public support for biofuel initiatives. Overall, the survey provides valuable insights into the public's readiness to embrace and champion sustainable practices outlined in the Biofuel Act.

#### III. Degree of relationship of the Demographics of the Respondents with the Level of Awareness and Willingness on the Biofuel Act

Consumer awareness of the Biofuel Act shows a very weak correlation with age but a moderate correlation with education level, indicating higher education leads to greater awareness. However, socioeconomic status has minimal impact on awareness. Regarding willingness to support biofuels, correlations across demographics are weak. Higher education correlates negatively with promoting biofuel benefits but positively with advocating increased awareness. Socioeconomic status shows weak positive correlations with various aspects of willingness, while a weak positive correlation exists between staying informed and age.

### Conclusions

Consumer awareness of the Biofuel Act correlates weakly with age but moderately with education, suggesting higher education fosters greater awareness. Socioeconomic status has minimal impact. Willingness to support biofuels shows weak correlations across demographics. Higher education negatively correlates with promoting biofuel benefits but positively with advocating awareness. Socioeconomic status weakly correlates positively with willingness. Regarding staying informed, a weak positive correlation exists with age. Respondents recognized the legislation and environmental benefits of biofuels but need better understanding of blending ratios and economic advantages. They are "Slightly Aware" and "Somewhat Willing," indicating a need for targeted education efforts. Education level is a key

determinant, with socioeconomic status subtly influencing attitudes. These findings guide effective promotion of biofuel initiatives in Banlat and similar contexts.

### Research and Policy Recommendations

The study highlights key recommendations for enhancing awareness and support for biofuels and related legislation. To tackle the prevailing "Slightly aware" status, a targeted awareness campaign is advised, using age-appropriate language and visuals and collaborating with local businesses and gas stations to offer incentives that appeal to lower middle-income individuals. Emphasizing the economic benefits of biofuels and developing interactive online platforms are suggested to address socio-economic diversity. Community engagement programs should be customized for different demographic groups, with incentives adjusted accordingly. Advocacy efforts must also be tailored to address the specific needs and concerns of diverse demographics, engaging policymakers for effective policy implementation. Additionally, future research should investigate biofuel production challenges and environmental impacts, while the government should launch a campaign program to raise awareness of the Biofuel Act's importance among all users, promoting its benefits and encouraging widespread adoption.

### WORK CITED

1. Correa, D. F., Beyer, H. L., Fargione, J. E., Hill, J. D., Possingham, H. P., Thomas-Hall, S. R., & Schenk, P. M. (2019). Towards the implementation of sustainable biofuel production systems. *Renewable and Sustainable Energy Reviews*, 107, 250–263. <https://doi.org/10.1016/j.rser.2019.03.005>
2. Devarajan, B., Saravanakumar, R., Sivalingam, S., Bhuvaneshwari, V., Karimi, F., & Rajeshkumar, L. (2021). Catalyst derived from wastes for biofuel production: a critical review and patent landscape analysis. *Applied Nanoscience*. <https://doi.org/10.1007/s13204-021-01948-8>
3. Mishra, S. K., Negri, M. C., Kozak, J., Cacho, J. F., Quinn, J., Secchi, S., & Ssegane, H. (2019). Valuation of ecosystem services in alternative bioenergy landscape scenarios. *GCB Bioenergy*, 11(6), 748–762. <https://doi.org/10.1111/gcbb.12602>
4. Park, Y., Konge, L., & Artino, A. R. (2020). The Positivism Paradigm of Research.. *Academic medicine : journal of the Association of American Medical Colleges*, 95 (5). <http://dx.doi.org/10.1097/ACM.0000000000003093>
5. Shamshad Khan, M., Naushad, M., Iqbal, J., Bathula, C., & Al-Muhtaseb, A. H. (2022). Challenges and perspectives on innovative technologies for biofuel production and sustainable environmental management. *Fuel*, 325, 124845.
6. Varela, J., Burgués, C., & Rösch, C. (2020). Acceptability of genetically engineered algae biofuels in Europe: opinions of experts and stakeholders. *Biotechnology for Biofuels*, 13(1). <https://doi.org/10.1186/s13068-020-01730-y>
7. Wang, Z., Pashaei Kamali, F., Osseweijer, P., & Posada, J. A. (2019). Socioeconomic effects of aviation biofuel production in Brazil: A scenarios-based Input-Output analysis. *Journal of Cleaner Production*, 230, 1036–1050. <https://doi.org/10.1016/j.jclepro.2019.05.145>
8. Zhao, Q., Cai, X., Mischo, W., & Ma, L. (2020). How do the research and public communities view biofuel development? *Renewable and Sustainable Energy Reviews*, 133, 110265. <https://doi.org/10.1016/j.rser.2020.110265>