Willingness to Utilise Solar Energy in Malaysia: A Case of Gen-Z

Nurain Sakinah Mohd Arshad *
Universiti Tenaga Nasional
Email: aenkeynah@gmail.com

Siti Fara Fadila Abd Razak
Universiti Tenaga Nasional
Email: SitiFara@uniten.edu.my

Mohd Zulkeflee Abd Razak
Universiti Tenaga Nasional
Email: Zulkeflee@uniten.edu.my

Noor Awanis Muslim
Universiti Tenaga Nasional
Email: Awanis@uniten.edu.my

Normaisarah Abdul Manaf
Universiti Tenaga Nasional
Email: Sarah@uniten.edu.my

Dasilah Nawang
Universiti Tenaga Nasional
Email: Dasilah@uniten.edu.my

Feninferina Azman
Universiti Tenaga Nasional
Email: Ferina@uniten.edu.my

Inas Sofiya Mohd Zamri
Universiti Tenaga Nasional
Email: inassofiya@gmail.com

* Corresponding Author

Abstract
Purpose: This paper discusses the consumer's willingness to utilise solar energy among generations Z in Malaysia.
Design/Methodology/Approach: This research was conducted using the data collection method. The surveys/questionnaires were distributed to 112 respondents among generation Z in Selangor and literature reviews to hypotheses development.
Findings: The findings support all the hypotheses. The hypotheses measure how the factors influence the willingness of gen Z towards solar energy utilisation. Notably, neighbours' perceptions of participation had a small impact. As a result, generation Z has aware of solar energy but the intention to utilise it in their life is still little. This research suggested recommendations to policymakers to strengthen the policy and the initiatives to increase

awareness. Campaign and social media are important to influence generation Z regarding utilising solar energy and the best way to reserve sustainable energy in the future.

Research limitations/implications: The research allows industry players to view the willingness to utilise solar energy among generation Z (Gen-Z).

Practical implications: The outcome of this paper will provide a significant view of industry players in utilising solar energy.

Originality/value: This research provides original data from generation Z in all states.

Paper type: Research paper

Keywords: Solar energy, Willingness to utilise, Generation Z

Introduction

The recent issue that worldwide faced is energy demand it exceeded the capacity of installed generation. This crucial issue needs thorough attention to suit the current situation of energy security and reliability. On top of that, renewable energy sources also must be aggressively investigated. Following this investigation, it indicates that renewable energy has the potential to meet up the excess demand for energy. It a common for many countries in the world to utilize solar as renewable energy. Solar energy has several unique characteristics of energy that are cheap, no machinery is needed, and most importantly it cleans energy and can save the environment.

As a result, a new energy structure must be created. Wind, solar, and biomass alternative energy sources would be utilised in this new energy system, which would cut the cost of oil imports while also resolving climate issues. Malaysia, for example, included various initiatives in its 8th Malaysia Plan in 2001 to speed up the integration of renewable energy into the national grid. The transition to renewable energy in Malaysia has been difficult due to several obstacles, including financial difficulties, unappealing pricing and the lack of awareness of renewable energy and a lack of understanding among key decision-makers in the industry.

Malaysia's government has raised its renewable energy target to 31 per cent by 2025 and 40 per cent by 2035. The objective of 40% renewable energy by 2035 is ambitious. The installed capacity of RE, for example, is currently at 7,995 MW. RE is expected to have an installed capacity of 18,000 MW by 2035, which is more than twice the current installed capacity. Solar energy has been chosen as the renewable energy source with the most potential in Malaysia's sunny climate.

Due to the abundance of solar energy resources in Malaysia, solar energy has been used as an important energy strategy for the country. The Malaysian government has set several policy goals to boost the development of solar energy projects to reduce reliance on conventional fuels and lower carbon emissions. Consumers' willingness to use solar energy should, nevertheless, be analysed in order to establish whether the government's goal of adopting solar energy into the province is reaching the desired effects.

This research focused on Malaysia's Generation Z (Gen-Z), which is currently the largest age group in the country. Malaysian Gen-Z is a technologically adept generation that spends an average of 8 hours per day on screens, primarily to cellphones and social media. They're also well-educated, powerful, and entrepreneurial. In addition, most of them also already have permanent jobs and are married. Thus, it will influence Gen- Z to utilise solar energy regarding their high income, way of thinking concerning climate change and willingness to utilise solar energy in their life. Objectives for this research are to assess acceptance factors among Gen-Z towards solar energy and to measure the relationship between acceptance factors of Gen-Z willingness towards solar energy. This research is structured following by literature review, hypotheses and methodology, conclusion and discussion.

Literature Review

Due to the general rise in energy consumption, a lot of emphasis is being focused on renewable energy sources. The importance of solar energy for power generation has been widely recognised, however, utilisation attempts of said energy resources is still insignificant in Malaysia.

Human interests level and social acceptance of solar energy have been explored in the study by Solangi, Islam, and Saidur (2015). The study also examines the challenges of solar energy consumption as well as the future opportunities of solar energy in Malaysia. According to the survey results, 80 percent of respondents has a high interest in solar energy. However, some obstacles were pointed out by the respondents which are the high cost of solar panels and the lacking of solar energy usage accurate information. Hence, the better option chosen by the respondents is fuel-generated electricity.

A study conducted by Solangi, Badarudin, Kazi, Lwin, and Aman (2013), stated that government decisions on the main choices of electricity generation are coming from the most influential factor; social acceptability, that will satisfy the increasing energy demand by the people. This finding indicates that the level of confidence among the investor. However, proper knowledge and awareness of solar energy are still lacking within society.

In addition, Makki and Mosly (2020) researched the factors that influence public willingness to accept renewable energy technologies. The findings of the investigation grouped all aspects into five primary components that influence the propensity to adopt RETs. Cost and government rules and policies, public awareness and the local market, the environment and public infrastructure, residential construction, and RET systems are the components of these elements. The study concludes that the Saudi public's readiness to adopt RETs is dependent on these five primary components. Furthermore, the study highlights the complicated aspects influencing public desire to adopt RETs, implying that RET stakeholders share responsibility. As a result, governments, regulators and legislators, marketing companies, and investment will be better able to develop more focused rules and policies, as well as gain a better understanding of public concerns and coping strategies, as well as needs and adoption facilitators.

Shwetha (2019) highlighted that Gen Z is increasingly concerned about environmental concerns such as Clean Technology, Sustainability, Renewable Energy, Green Initiatives, and showing green behaviour for a sustainable future. Gen Z has taken a stand against industries that cause damage to the environment, preferring to "Go Green" in terms of using green products, recycling, lowering energy use, and using low energy. Finally, they can claim that Gen Z is concerned about the environment.

Another study by Han, Biying, Cudjoe, and Yuan (2020) found that education level, monthly household income, energy-related issues knowledge and concerns, and solar energy benefits awareness plays a big role in the respondents' willingness to pay factor. On the other hand, an insignificant impact is found on their willingness to pay decisions towards the bid prices.

Carlisler, Kane, Solan, Bowman, and Joe (2015) found that predictors and their impact on support and resistance to solar development differ depending on psychological and physical distance. Overall, we find that environmentalism, the perception that developers receive too many incentives, and trust in project developers are all significantly associated to support and opposition to solar development in general among respondents in the United States Southwest. Concerning the above previous findings, below is the explanation of the modelling framework. The framework mainly adopted TPB (Theory of Planned Behaviour).

Modelling Framework

The Theory of Planned Behaviour (TPB) was used to establish the research framework for this study. TPB explains and predicts consumer behaviour and has been used by academics in a variety of consumer study circumstances, including green energy behaviour, e-commerce, and organisational behaviour, and recognises that TPB successfully examines consumer behaviour (McBride et al., 2020). According to the concept, a person's behavioural intentions control his or her actions. Individuals have a rough understanding of what will happen if they engage in certain behaviour. Following that, individuals engage in that specific behaviour, which results in the desired outcome (Ajzen, 1991).

As a result, the researcher expanded the theoretical framework by including numerous new variables (perception of self-effectiveness, belief in solar energy benefits, and perception of neighbour participation). Consumers' intentions are directly influenced by their perceptions of self-effectiveness, and their behaviour is influenced indirectly by their perceptions of self-effectiveness. The perception of neighbours' engagement is defined as the impact of neighbours' actions on people's purchase decisions, whereas belief in solar energy advantages is defined as a person's favourable assessment of solar energy usage in the form of reduced carbon emissions. In this context, customer desire to use solar energy is described as their acceptance and belief in solar energy's ability to address energy crises, mitigate environmental issues, and reduce reliance on conventional fuels.
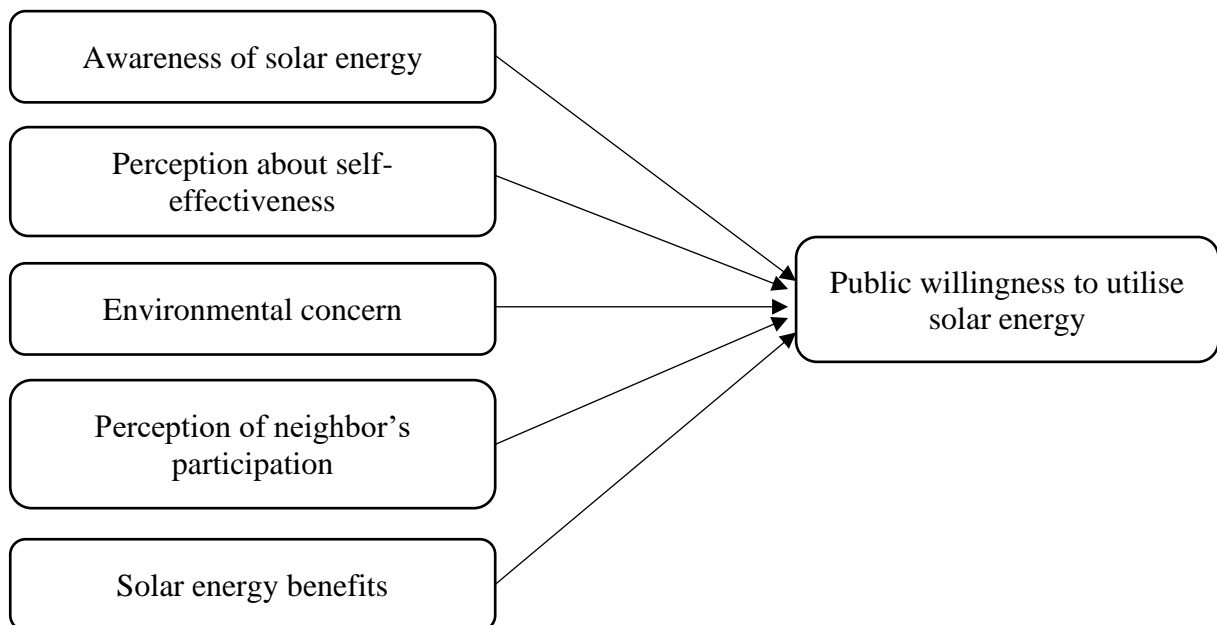

Figure 1: Research Framework Presenting the Influence Factors of Solar Energy utilisation

Hypotheses Development

Awareness of Solar Energy

Understanding solar energy is an important component in deciding whether or not to use it. (Kesari et al., 2021). Users' knowledge of solar energy, as well as their comprehension of energy benefits, reliability, and related concerns, is defined as solar energy awareness (Rai & Beck, 2015). Awareness of solar energy performs a vital role in consumers' decisions to utilise solar energy (Shin et al., 2014). According to Vand et al. (2019), awareness is highly linked to

consumer propensity to use green energy sources, with 97 percent of respondents switching from traditional to renewable energy sources after learning more about the challenges associated with conventional power. People who understand that solar energy cuts carbon emissions make major attempts to change their current lifestyles to create a carbon-free environment (Simpson & Clifton, 2016). The researcher hypothesised as a result of these observations.

H1. Awareness of solar energy positively affects consumers' willingness to utilise solar energy

Perception about Self-effectiveness

Regarding solar energy, people perceptions of self-efficacy are linked to how simple or tough it is for them to use solar energy. The challenge with technology adoption is a significant factor that influences individuals' perceptions of self-effectiveness. Perception about self-effectiveness has been shown in several studies to have a considerable impact on customers' intentions to use green energy. Perception about self-effectiveness has a beneficial impact on consumers' perceptions of solar energy, according to Irfan et al. (2020). According to Rai and Beck (2015), people who are concerned about climate change caused by the excessive use of fossil fuels have a strong preference for solar energy. All of these findings support the second hypothesis, which states that customer estimates of self-effectiveness influence their propensity to adopt solar energy.

H2. Perception about self-effectiveness positively affects consumers' willingness to utilise solar energy.

Environmental Concern

The intensity of environmental concern is defined as understanding and concern among individuals about resolving environmental issues. Individuals around the world are becoming more conscious of their daily consumption habits and the impact these habits have on the environment (Canova et al., 2020). This mindset is defined by a straightforward approach to green technologies as well as a desire to protect the environment (Kalkbrenner & Roosen, 2015). Environmental concern and its impact on purchasers' decisions about green technologies have been studied by academics. Individuals with high environmental concerns regularly monitor their energy usage patterns and are optimistic about the use of solar energy (Lin & Syrgabayeva, 2016). Based on the findings of the investigation, the third hypothesis was developed as follows:

H3. Environment concern positively affects consumers' willingness to utilise solar energy

Perception of Neighbours' Participation

The impact of neighbours' behaviours on users' solar energy purchase decision making is stated as a perception of neighbour participation in the perspective of solar energy. Regarding prior research, consumers' perceptions of their neighbours are a key factor influencing their energy conservation intentions. Rogers et al. (2012) stated that developing new societal norms for power production makes public green energy projects more difficult to implement. Besides, Jayaraman et al. (2017) also stated that the actions of neighbours have a considerable impact on people' aspirations to purchase solar PV. As a result, it is critical to look into the impact of this significant aspect on customers' willingness to utilise solar energy in Malaysia.

H4. Perception of neighbour's participation positively affects consumer's willingness to utilise solar energy

Energy Benefits

The belief in solar energy advantages is defined as consumers' opinion that solar energy has numerous benefits such as energy security, climate change mitigation, and energy efficiency (Komendantova & Yazdanpanah, 2017). People distinguished between conventional and solar energy sources and made purchasing selections based on their socioeconomic status (Colmenares-quintero et al., 2020). As a result, efforts must be made to improve inhabitants' understanding of the benefits of solar energy use, such as improved air quality. In figure 1, a study framework depicting the variables that impact the use of solar energy. Given these arguments, we propose the following hypothesis:

H5. The benefits of solar energy positively affect consumers' willingness to utilise solar energy

Methodology

Research Design

To assess respondent intention, the TPB was quantitatively tested using survey methodology. The questionnaire used to collect data for this study was developed from a previous paper that was already tested with a Pilot test. The questionnaire was designed to evaluate the TPB's main components. The questionnaire takes approximately 15–20 minutes to complete. There were no intermediaries engaged in the processing or interpretation of the results because researchers received all completed questionnaires straight after the survey.

To avoid the statistical problem of excessive skewness, the questions were graded on a 1–5 point scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree). Scales with many items were designed based on recommendations to measure each of the following psycho-social variables: willingness to utilise, awareness, perception about self-effectiveness, environmental concern, perception of neighbour's participation, and energy benefits. It is worth noting that the items we used to test TPB factors closely matched the measurements of these constructs employed in previous studies.

Data Analysis

Statistical analyses are performed through SPSS software packages. Data for demographics were analysed in descriptive statistics while independent variables were analysed in correlation. Moreover, the correlation coefficient test was used to determine how effective the relationship is between the variables. Correlation standardises the interdependence of five variables and hence indicates how closely they interact. As a result of the formulas, a value between 0 and 1 is provided. In this case, the Anova test is used to determine whether or not survey or experiment results are significant.

Findings

Demographic

A total of 112 respondents were chosen at random from all Malaysian states. With the condition of the Covid-19 pandemic's third wave in Malaysia, this study was undertaken using an online survey method. Regardless of the strategy used, sufficient data is gathered. The primary focus of the research was on Gen-Z, with respondents ranging in age from 1996 to 2012. Table 1 shows the descriptive statistics and figure 2 shows the percentage. The gender is divided by 2 which are male and female while education is divided by 3 as followed by SPM/STPM/Certificate, Diploma/Degree, and Master/PhD. As a result, the percentage for females is 78% and followed by males 34%. In this survey, the result shows that the majority of the respondent has diploma and degree (98%) and the rest are from SPM/STPM/Certificate (13%) and master/PhD (1%).

Table 1: Descriptive Statistics

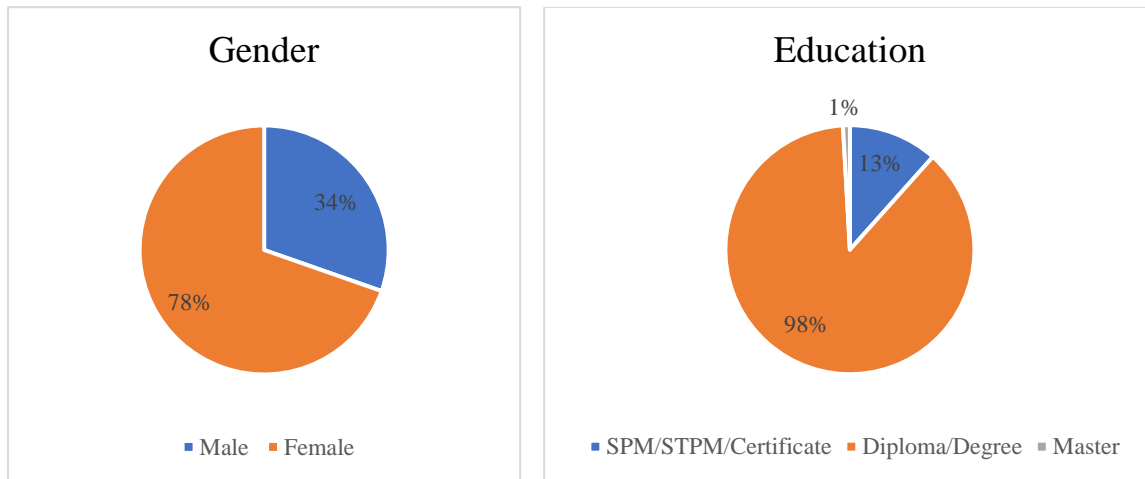|	N	Minimum	Maximum	Mean	Std. Deviation
Gender	112	1	2	1.70	.462
Education	112	1	3	1.89	.338
Valid N (listwise)	112				

Figure 2: Pie Chart

Reliability

To determine the questionnaire's reliability and validity, the data were analysed using SPSS packages. Table 2 shows that the alpha coefficient for the 15 items is .919. This indicates that the items have a high level of internal consistency, which is appropriate in most social science research scenarios.

Table 2: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.919	.930	15

Table 3: Item Statistics

Factors	Mean	Std. Deviation	N
Awareness			
I am aware that solar energy is an alternative power source.	4.8036	.48098	112
I am aware that solar energy-based solutions are available in the market.	4.5982	.67730	112
Self-Effectiveness			
I have the essential knowledge about solar energy.	4.3929	.86323	112
I have full control to utilise solar energy.	3.8036	.99403	112
Environment concern			
I have concerns about environmental issues.	4.6696	.60610	112
I have concerns about climate change.	4.6786	.58839	112
Solar energy utilisation would solve environmental issues.	4.6429	.61303	112
Perception of neighbours' participation			
Neighbour's involvement in purchasing solar energy encourages me to utilise solar energy.	3.6786	.98835	112
Energy benefits			
The utilisation of solar energy improves the environment.	4.7232	.52350	112
The utilisation of solar energy will strengthen energy security. (uninterrupted availability of energy sources)	4.5268	.72236	112
New solar energy programs will increase job opportunities.	4.6161	.67444	112
Willingness to utilise solar energy			
I am willing to utilise solar energy because I can afford it.	3.8125	1.06146	112
I am willing to utilise solar energy due to its energy-saving behaviour.	4.3750	.72441	112
I am willing to spend more on solar energy compared to conventional energy.	4.2857	.86398	112
I am willing to utilise solar energy due to its clean nature.	4.4911	.71023	112

Prior Analysis towards Hypotheses Testing

The correlations between independent and dependent variables are shown in Table 3. The correlation is significant at the 0.01 level. The findings of this study confirmed the hypothesis that consumers' awareness of solar energy has a positive impact on their willingness to utilise it, demonstrating that people who have a strong understanding of solar energy. The significance shows that at (0.000) level. According to (Kesari et al., 2021), consumers' willingness to use solar energy is positively influenced by awareness, which is consistent with our findings.

The findings also revealed that consumers' perceptions of self-effectiveness have a positive impact on their willingness to use solar energy, which is consistent with previous research findings (Irfan et al., 2020; Liu et al., 2013). Solar energy's energy efficiency, energy savings, and environmentally friendly nature are all factors that may encourage generation Z to utilise it. Generation Z assessments of technology and knowledge of how to use it will boost consumer confidence in solar power technologies as vital dynamics in the future.

The results of the environmental concern have a significant impact as can see in H3 (0.000). One of the main factors is the existence of a stable policy framework. The government is concerned about climate change and believes that solar energy is a potential alternative to fossil fuels. Malaysia has already implemented Large Scale Solar (LSS) as an alternative to generating electricity. Solar energy has the potential to contribute favourably to environmental improvement and help the government accomplish its long-term environmental goals.

Consumers' desire to use solar energy is unaffected by the results of the neighbour engagement. Recent investigations by Shakeel and Rahman (2018) and Jabeen et al. (2019) disagree with the findings, which found that subjective norms have a significant impact on people's willingness to utilise solar energy. Malaysia has a distinct culture and society, with no influence from friends, neighbours, classmates, or other cultural groupings on individual purchasing decisions. Although past studies have revealed that social norms have a considerable impact on consumer behaviour, in Malaysia, neighbours' opinions had little impact on purchasing decisions. In Malaysia, solar energy development is still in its infancy stages. The H4 is significant at the (0.66) level, as seen in table 4. The participation of neighbours has little influence on the assessment of solar energy.

Last but not least, state that respondents' belief in the benefits of solar energy has a positive impact on their willingness to use solar energy. These findings are in line with a previous study, which found that customers make purchases based on a favourable belief in the benefits of the item they want to buy. Residents will embrace solar energy if they can understand the real-world advantages of utilising it over traditional energy sources (Colmenares-quintero et al., 2020). One reason could be that the Malaysian government advertises the various benefits of solar energy during its deployment stage, and people prefer it. For example, programs concerning solar energy thru social media.

Table 4: Correlations

		H1	H2	H3	H4	H5
H1	Pearson Correlation	1	.671**	.684**	.174	.646**
	Sig. (2-tailed)		.000	.000	.066	.000
	N	112	112	112	112	112
H2	Pearson Correlation	.671**	1	.637**	.395**	.636**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	112	112	112	112	112
H3	Pearson Correlation	.684**	.637**	1	.336**	.785**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	112	112	112	112	112
H4	Pearson Correlation	.174	.395**	.336**	1	.281**
	Sig. (2-tailed)	.066	.000	.000		.003
	N	112	112	112	112	112
H5	Pearson Correlation	.646**	.636**	.785**	.281**	1
	Sig. (2-tailed)	.000	.000	.000	.003	
	N	112	112	112	112	112

**. Correlation is significant at the 0.01 level (2-tailed).

Based on the table below shows the model summary in regression which describes the summary research model. The model summary table reports the strength of the relationship between the model and the dependent variables. The first model is about awareness of solar

energy. R shows 42% means have a strong relationship regarding awareness and the R Square is 17% to shows the change acceptance to willingness. The factor of self-effectiveness shows that respondents have full control and essential knowledge about solar energy. The change R square between both shows that a little change acceptance to willingness solar energy. Next, factors on environmental have a strong relationship between willingness. The R shows 52% and the change acceptance of solar energy is only 27%. As a result, the dependent variable, willingness to use solar energy, has a strong relationship with the model.

a) Awareness of solar energy

Model Summary

Model	R	R Square	Adjusted R Square	Std. An error of the Estimate	Sig. F Change
1	.423[a]	.179	.172	.63174	.000

a. Predictors: (Constant), I am aware that solar energy-based solutions are available in the market.

b) Self-effectiveness

Model Summary

Model	R	R Square	Adjusted R Square	Std. An error of the Estimate	Sig. F Change
1	.526[a]	.277	.270	.59299	.000
2	.564[b]	.318	.305	.57861	.012

a. Predictors: (Constant), I have full control to utilise solar energy.

b. Predictors: (Constant), I have full control to utilise solar energy,
I have the essential knowledge about solar energy.

c) Environmental concern

Model Summary

Model	R	R Square	Adjusted R Square	Std. An error of the Estimate	Sig. F Change
1	.528[a]	.279	.272	.59212	.000
2	.554[b]	.307	.294	.58313	.038

a. Predictors: (Constant), I have concerns about environmental issues.
b. Predictors: (Constant), I have concerns about environmental issues,
Solar energy utilisation would solve environmental issues.

d) Neighbours' participation

Model Summary

Model	R	R Square	Adjusted R Square	Std. An error of the Estimate	Sig. F Change
1	.491ᵃ	.242	.235	.60731	.000

   a. Predictors: (Constant), Neighbor's involvement in purchasing solar energy encourages me to utilise solar energy.

e) Solar energy benefits

Model Summary

Model	R	R Square	Adjusted R Square	Std. An error of the Estimate	Sig. F Change
1	.560ᵃ	.314	.308	.57762	.000
2	.614ᵇ	.377	.366	.55282	.001

   a. Predictors: (Constant), New solar energy programs will increase job opportunities.
   a. Predictors: (Constant), New solar energy programs will increase job opportunities, The utilisation of solar energy improves the environment.

Conclusion

This section highlights all the findings in the previous chapter. The findings show that all hypotheses are supported. These findings are aligned with Irfan (2021) but if we looked at the general perspective that is end-user. But this paper mainly focused on generation Z. Toward this paper investigation, there is no finding yet on generation Z and solar energy consumption perspective in Malaysia. Observing the results of the survey, generation Z's willingness to use solar energy is influenced by their perceptions of self-effectiveness, environmental concern, solar energy awareness, and belief in solar energy benefits. Consumers' willingness is unaffected by their perception of their neighbours' participation. This is because generation Z aware regarding solar energy but utilising it is still moderate. The outcomes of the research, on the other hand, imply that the government should increase public awareness of climate change concerns and the role that solar energy could play in addressing them. An increase in awareness, self-effectiveness and environmental concern by generation Z might lead to an increase in the acceptance and willingness to utilise solar energy.

Theoretical Implications

These findings are about the relationship between the awareness and willingness of Gen-Z to utilise solar energy. The findings provide the willingness of Gen-Z in Malaysia trending in solar energy utilisation. It explains that while understanding solar energy and being aware of it can help solve environmental issues are not sufficient to accept solar energy in their daily consumptions.

Practical and Social Implications

The outcome of this paper will provide a significant view of industry players in utilising solar energy. A thorough study could be a necessary step toward Gen-Z willingness of solar energy consumption, either totally or partially. The policymakers should also think about increasing

public awareness. Finally, it influences Gen-Z well-being and contributes to a better global environment.

Limitations and Suggestions for Future Research

This research also encourages future research to make a comparison between Gen-Z and Gen-Y (older). It can be seen that between both which are more attracted to utilise solar energy and it will easier to targeting in promote utilise solar energy. Future research should look into more effective methodologies and tools to determine the relationship or outcome of the study.

Acknowledgement

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