

A Case Study on Consumer Intention to Purchase Household Energy - Efficient Appliances in NCR, India

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Abstract:-

These invaluable phrases resonate deeply within human civilization as we witness the advancements in energy efficiency within the current energy industry. The concept of electric energy efficiency has garnered global attention and importance. Today, energy efficiency, health, and safety are paramount in both corporate environments and society. In our modern world, people utilize electric energy for various purposes, leading to numerous innovative energy generation and efficiency initiatives worldwide. These efforts aim to maximize the efficiency of energy generation, storage, transmission, and utilization, while the demand for electric energy continues to grow significantly.

The findings from our analysis emphasize the importance of being an energy saver for the benefit of the Earth. "Energy saved is energy gained." As social developments progress, public awareness of regulations and the protection of public health against pollution and other negative business impacts increases. This research study, involving a sample size of 586 from multiple stores, employs tools such as structured equation modeling and multiple regression analysis. The study concludes that sustainable development, sustainable energy, and renewable energy are essential components alongside energy sustainability. These areas are intrinsically linked to the health of our natural resources and the sustainability of electric energy.

Keywords: *Green Marketing, Energy- Efficient Appliances, Sustainability, consumer choices.*

INTRODUCTION:

Energy productivity refers to the capability to achieve the highest level of energy services while using less energy overall (Lopes et al., 2012). When other factors remain constant, a machine's energy efficiency can eliminate the need for excess energy sources, reduce greenhouse gas emissions, and avoid fossil fuel extraction (Shwom, 2011). Additionally, energy efficiency involves maximizing the use of available services and investing in technologies that reduce energy consumption without necessitating behavioral changes from users.

In studying energy efficiency behaviors across two income groups, both descriptive and inferential statistics were employed. The researcher examined various factors related to energy use, including motivations for reducing consumption, methods used to achieve reductions, and attitudes towards energy conservation. The survey encompassed a wide range of behavioral categories, such as alternative technology options, energy-saving settings on appliances, investment decisions for energy-efficient appliances, low-cost investments, maintenance practices, turning off machines, and disconnecting devices when not in use. Researchers found that providing information alone does not always lead to the desired outcomes and may sometimes have a neutral effect on behavior.

OBJECTIVE OF THE RESEARCH STUDY:

RO1: To determine the relationship between consumers' environmental knowledge and their attitude towards energy-efficient appliances.

RO2: To determine the relationship between consumer attitudes towards energy-efficient appliances and their willingness to purchase energy-efficient appliances.

RO3: To determine the relationship between environmental knowledge and perceived behavioral control.

RO4: To determine the relationship between perceived behavioral control and the willingness to purchase energy-efficient appliances.

RO5: To determine the moderating relationship between consumer attitudes towards energy-efficient appliances and behavioral control.

RO6: To determine the moderating relationship between perceived behavioral control towards energy-efficient appliances and consumer attitudes.

HYPOTHESIS OF THE RESEARCH STUDY

Ha1: There is a significant relationship between environmental knowledge and consumer attitude towards energy-efficient appliances.

Ha2: There is a significant relationship between consumer attitudes towards energy-efficient appliances and willingness to purchase energy-efficient appliances.

Ha3: There is a significant relationship between environmental knowledge and perceived behavioral control.

Ha4: There is a significant relationship between perceived behavioral control and willingness to purchase energy-efficient appliances.

Ha5: Consumer attitude towards energy-efficient appliances moderately affects perceived behavioral control.

Ha6: Perceived behavioral control towards energy-efficient appliances moderately affects consumer attitude.

SAMPLE DESIGN:

A sample design is the structure or guide that serves as the basis for selecting a survey sample and influences many other important aspects of a survey as well. For analyzing the research study, we selected the top stores of energy-efficient appliances from DELHI/NCR.

SAMPLE SIZE:

COMPOSITION OF THE SAMPLE			
S.No	Name ofStore	Location	Number of Consumers
1	Samsung Electronics	Gurgaon	18
2	LG Electronics	Noida	58
3	Bosch	Delhi	46
4	Whirlpool	Gurgaon	26
5	Panasonic	NOIDA	58
6	Godrej	Ghaziabad	41
7	Haier	Delhi	26
8	Hitachi	Faridabad	36
9	Voltas	Faridabad	35
10	Philips	NOIDA	45
11	Havells	Delhi	26
12	Usha	Noida	56
13	Bajaj	Ghaziabad	44
14	Lifelong	Gurgaon	26
15	IFB	Noida	45
	Total=15	Total=15	Total =586

We have selected 15 stores of energy efficient appliances from Delhi/Ncr. From Delhi we selected the 3 stores named as Bosch, Haier, Havelles. From Ghaziabad we selected 2 stores Godrej, Bajaj. From Faridabad we selected 2 stores Voltas, Hitachi. From Noida we selected 4 stores Panasonic, Philips, Usha, IFB. From Gurgaon region we selected 3 stores which was Samsung electronics, whirlpool lifelong. From Delhi region we got 98 consumers, from Noida we got 206 consumers, from Ghaziabad we got 85 consumers, from Faridabad we got 71 consumers and from Gurgaon we got 70 consumers.

DATA COLLECTION METHOD:

A survey is a research tool consisting of a series of questions or prompts designed to collect information from a group of respondents. In most research contexts, a survey will include various types of questions—primarily closed-ended and some open-ended—to gather both quantitative data, which can be analyzed to draw conclusions, and qualitative data, which provides more detailed, nuanced explanations.

QUESTIONNAIRES WERE DESIGNED INTO FIVE PARTS:

- (1) Questionnaire part (A) On Demographic Characteristics
- (2) Questionnaire part (B) On environmental knowledge
- (3) Questionnaire part (C) On consumer attitude
- (4) Questionnaire part (D) On willingness to purchase
- (5) Questionnaire part (E) On perceived behaviour control

RELIABILITY AND VALIDITY OF THE RESEARCH:

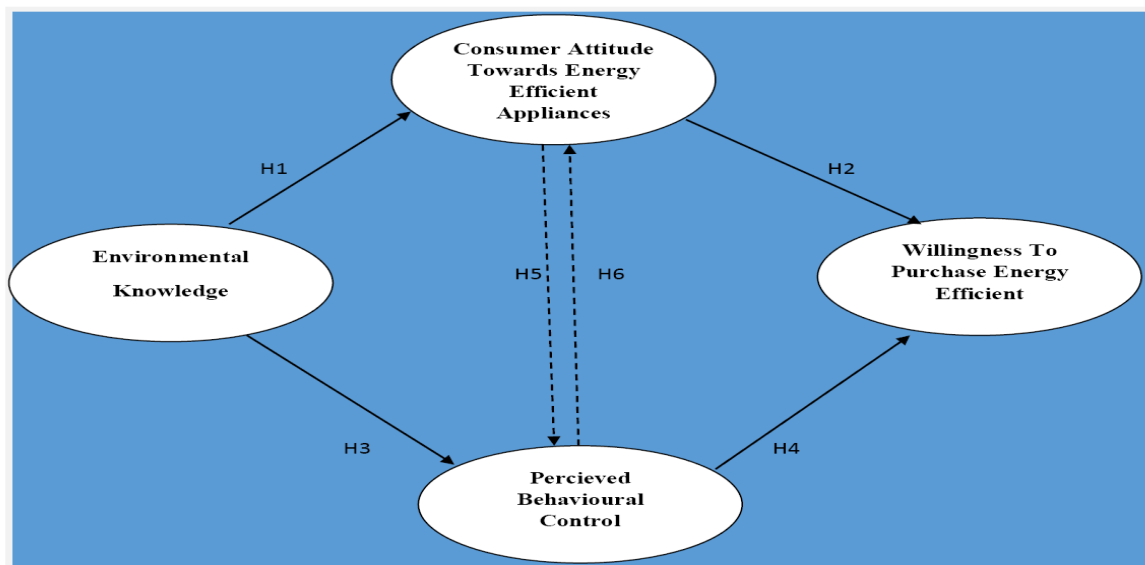
The Cronbach's alpha is a measure of internal consistency, which indicates how closely related a set of items are within a scale. It is used to assess the reliability of the constructs in a survey. A higher Cronbach's alpha value suggests greater internal consistency among the items, reflecting the reliability of the scale. The value of Cronbach's alpha was considered in evaluating the reliability of the constructs (Cronbach, 1951).

Cronbach alpha	N of Items
.717	586

The Cronbach's alpha value for the study is .717, indicating acceptable internal consistency. The research will proceed using the questionnaire prepared for the study.

Validity refers to how well a measurement instrument captures what it is intended to measure (Rosenthal & Rosnow, 1991). It is crucial in descriptive studies because poor validity might require a larger sample size to achieve reliable results. Validity assesses whether differences in observed scale scores reflect true differences among objects on the characteristic being measured, rather than systematic or random error. In this research, content validity was evaluated by having three subject-area experts review the measurement instrument and provide feedback. The questionnaire was revised based on their suggestions to enhance its validity.

Conceptual Framework:



MODEL TESTING:

To analyze hypotheses Ha2 through Ha7, Structural Equation Modeling (SEM) was employed. This involved identifying factors and confirming them through Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA). CFA was used to test whether the measures of a construct align with the researcher's understanding of that construct.

Hypotheses:

Ha1: There is a significant relationship between environmental knowledge and consumer attitude towards energy-efficient appliances.

Ha2: There is a significant relationship between consumer attitude towards energy-efficient appliances and willingness to purchase energy-efficient appliances.

Ha3: There is a significant relationship between environmental knowledge and perceived behavioral control.

Ha4: There is a significant relationship between perceived behavioral control and willingness to purchase energy-efficient appliances.

Ha5: Consumer attitude towards energy-efficient appliances moderately affects perceived behavioral control.

Ha6: Perceived behavioral control moderately affects consumer attitude towards energy-efficient appliances.

The analysis began with Exploratory Factor Analysis (EFA) using SPSS version 23 to identify and refine the factors. Confirmatory Factor Analysis (CFA) was then conducted to assess validity and reliability, ensuring that only constructs with good validity and reliability were included in the research for path analysis (Hair et al., 2010). Path analysis was performed using covariance-based Structural Equation Modeling (SEM), evaluating the hypothesized relationships among the independent and dependent variables. SEM was analyzed using Analysis of Moment Structures (AMOS) version 23 to test the causal relationships among the variables. Additionally, moderation effects were examined, including the influence of consumer attitude towards energy-efficient appliances on perceived behavioral control, and the moderating effect of perceived behavioral control on consumer attitudes towards energy-efficient appliances.

EFA: EXPLORATORY FACTOR ANALYSIS

Exploratory Factor Analysis (EFA) is a statistical technique used to reveal the underlying structure of a large set of variables. Its primary goal is to identify the relationships between measured variables and uncover latent constructs that explain the observed data. EFA is particularly useful when developing a scale, which is a collection of questions designed to measure a specific research topic.

As a prerequisite for conducting EFA, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were performed to assess data suitability. The study results show that the KMO value falls within the acceptable range of 0.5 to 1.0 (Hair et al., 2009; Kaiser, 1974), indicating that the data is suitable for principal component analysis for data reduction.

Additionally, Bartlett's test of sphericity yielded a statistically significant value ($p < .001$), confirming that there is sufficient correlation among the variables to proceed (Field, 2009). The Cronbach's Alpha value of 0.897 for all 586 items is considered acceptable, demonstrating good internal consistency (Hair et al., 2015).

KMO and Bartlett's Test		
Cronbach 's Alpha		0.897
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.913
Bartlett's Test of Sphericity	Approx. Chi-Square	13560.114
	df	702
	Sig.	0.000

CONSTRUCT LOADINGS

	Consumer Attitude towards energy efficient appliances	willingness to purchase energy efficient Appliances.	Environmental knowledge consumer	Perceived Behavioral Control
CA1	0.806			
CA2	0.843			
CA3	0.842			
WP1		0.716		
WP2		0.871		
WP3		0.875		
EK1			0.880	
EK2			0.875	
EK3			0.801	
PBC1				0.869
PBC2				0.901
PBC3				0.854

CONFIRMATORY FACTOR ANALYSIS

Confirmatory Factor Analysis (CFA) is a theory-driven statistical technique used to verify the factor structure of a set of observed variables and to test hypotheses regarding the relationships between these variables and their underlying latent constructs (Schreiber, Stage, & King, 2006; Suhr, 2006). CFA combines theoretical knowledge with empirical research to postulate and test prior relationship patterns within a research model.

This technique involves specifying the model in advance, including which variables load onto which factors (Jonathan, 2011).

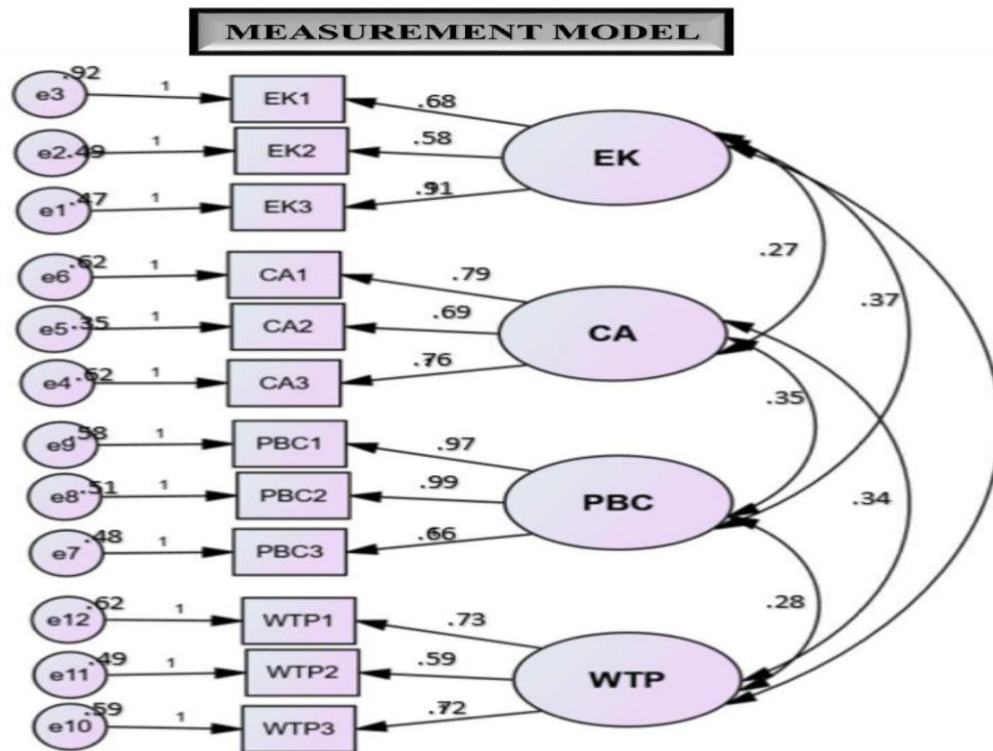
Unlike Exploratory Factor Analysis (EFA), which is used to discover underlying factor structures without prior assumptions, CFA requires that researchers define the model's aspects ahead of time (Brown, 2006). The measurement model for this study is based on the conceptual framework, which includes independent variables such as environmental knowledge, consumer attitude, perceived behavioral control, and willingness to pay. The study aims to assess the impact of these independent variables on the dependent variable, consumer willingness to purchase energy-efficient appliances. Additionally, the study explores how consumer attitude towards energy-efficient appliances moderately affects perceived behavioral control and how perceived behavioral control, in turn, moderately affects consumer attitude towards energy-efficient appliances.

MODEL FIT STATISTICS FOR MEASUREMENT MODEL

Fit statistic	Acceptable limits	Obtained	Remark
CMIN/df	< 3 Good; <5 acceptable	2.106	Acceptable
GFI	>.95 great ; >.090traditional	0.992	Great
CFI	>.95 great ; >.090traditional	0.995	Great
NFI	>.95 great ; >.090traditional	0.984	Great
AGFI	>.95 great ; >.090traditional	0.978	Great
RMSEA	<.05 Good; .05-.10 moderate	0.024	Good

From the table provided, it is evident that the values obtained for various indices assessing the overall model fit of the measurement model are satisfactory. Key fit indices such as Chi-square, GFI, CFI, NFI, AGFI, and RMSEA were used to evaluate the model. The goodness-of-fit measures confirm that the revised model fits the data well, indicating that no further adjustments are necessary. This suggests that the model maintains its uni-dimensionality (Hair et al., 2013).

To evaluate how effectively the manifest variables represent the latent constructs and how these constructs interrelate, a measurement model incorporating different parameters was conceptualized and tested for its fit.



CONSTRUCT VALIDITY & RELIABILITY

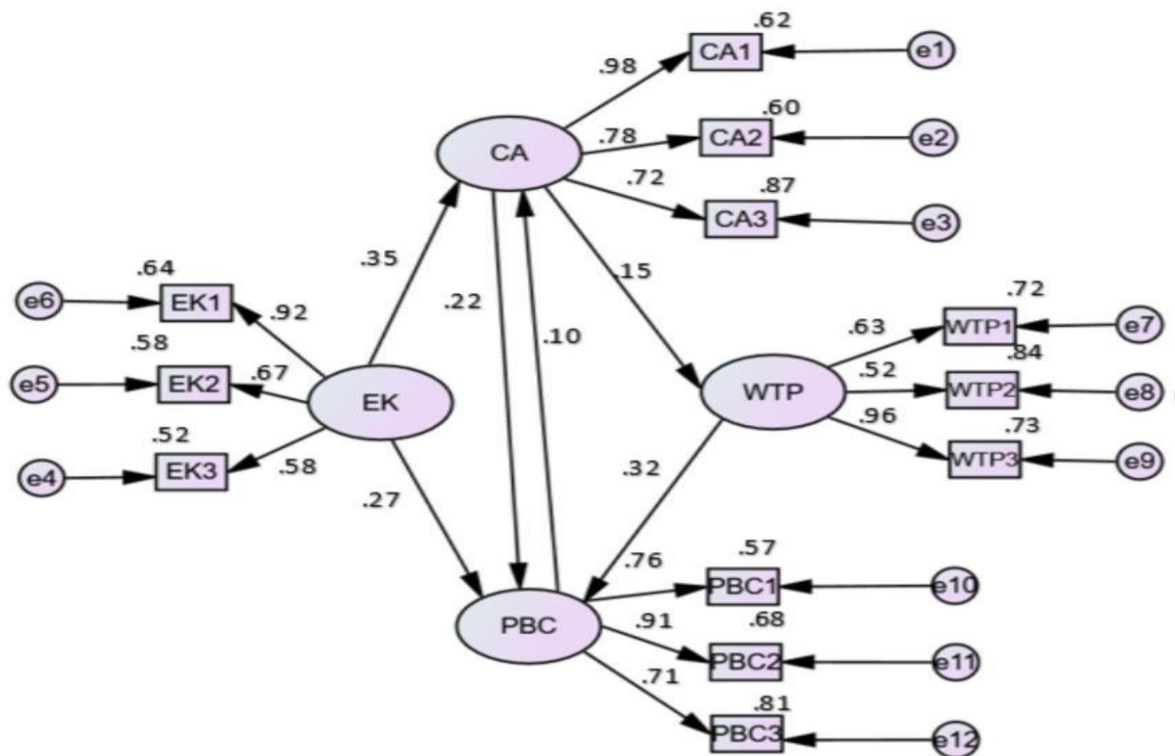
	ronbachAlpha	CR	AVE	MSV
EK	0.892	.751	.527	.156
CA	0.912	.950	.831	.125
WTP	0.895	.741	.548	.134
PBC	0.896	.755	.524	.134

Thus, the validity and reliability of the measurement model were established. After accessing the validity and reliability, structural model and hypothesis testing were accessed.

MODEL FIT STATISTICS FOR STRUCTURAL MODEL

Fit statistic	Acceptable limits	Obtained	Remark
CMIN/df	< 3 Good; <5 acceptable	2.106	Acceptable
GFI	>.95 great; >.090 traditional	0.992	Great
CFI	>.95 great; >.090 traditional	0.995	Great
NFI	>.95 great; >.090 traditional	0.984	Great
AGFI	>.95 great; >.090 traditional	0.978	Great
RMSEA	<.05 Good; .05-.10 moderate	0.024	Good

Fig: STRUCTURAL MODEL



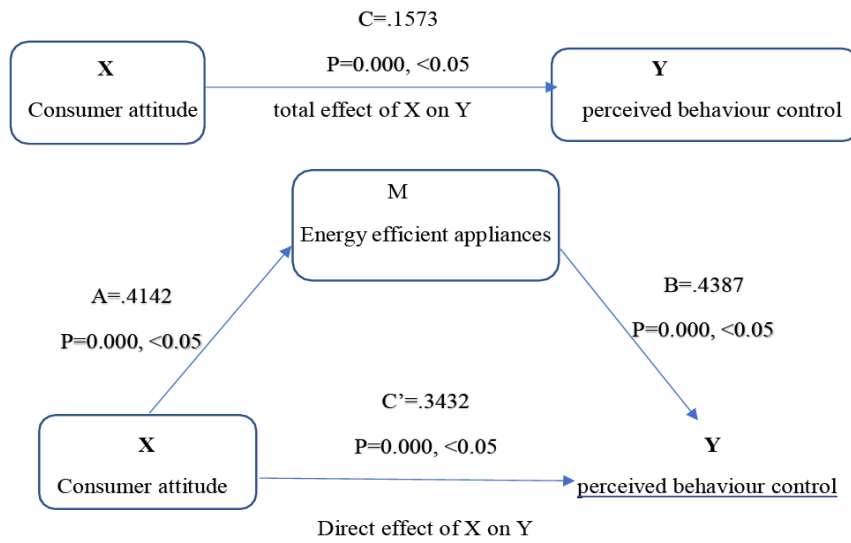
MODERATION EFFECT:

MEDIATION MODEL -1

	Coeff.	SE	t	P value	LLCI	ULCI
(Path A) consumer attitude energy efficient appliances	.4142	.0278	17.6744	0.000	.4823	.5328
(Path B) Energy efficient appliances perceived behaviour control	.4387	.0154	16.2950	0.000	.1264	.1662
(Path C) Consumer attitude → perceived behaviour control	.1573	.0235	9.4582	0.000	.3454	.5218
(Path C') Consumer attitude perceived behaviour control	.3432	.0324	13.7653	0.000	.2354	.2314

*** The moderate relationship between consumer attitude towards energy efficient appliances and Behavioral Control**

ENERGY EFFICIENT APPLIANCES AS A MEDIATOR BETWEEN CONSUMER ATTITUDE AND PERCEIVED BEHAVIOUR CONTROL.



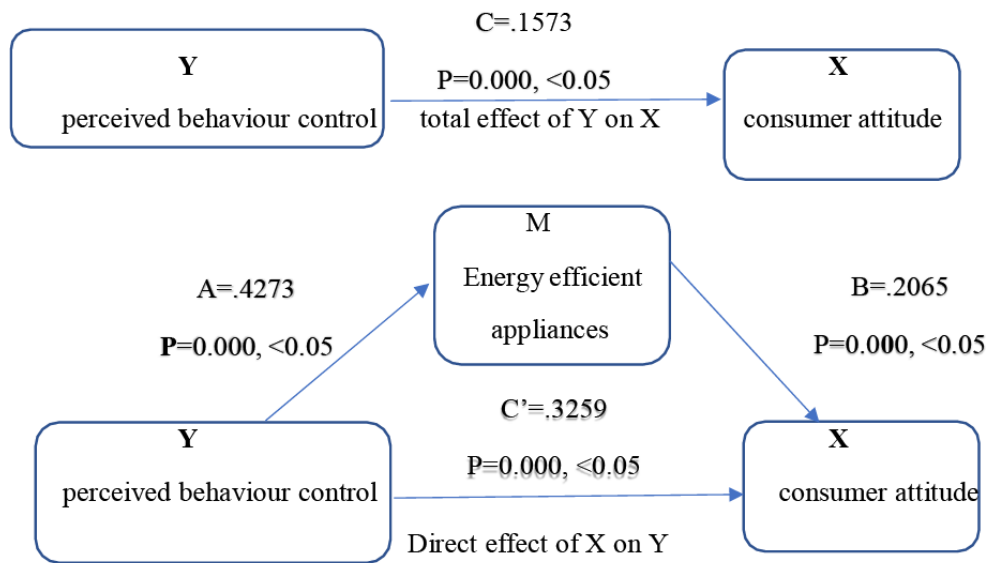
Results For Indirect Effect of Consumer Attitude On Perceived Behaviour Control For Energy Efficient Appliances

	EFFECT	BOOT SE	Boot LLCI	Boot ULCI
EEK	.0612	.0098	.0431	.0912

MEDIATION MODEL -2

	Coeff.	SE	t	P value	LLCI	ULCI
(Path A) perceived behaviour control efficient appliances energy	.4273	.0244	17.5298	0.000	.3795	.5751
(Path B) Energy efficient appliances Consumer attitude	.2065	.0177	11.6904	0.000	.1719	.2411
(Path C) perceived behaviour control Consumer attitude	.1573	.0324	13.7653	0.000	.3454	.5218
(Path C') perceived behaviour control Consumer attitude	.3259	.0254	12.810	0.000	.2760	.3758

***The moderate relationship between perceived Behavioral Control towards Energy efficient appliances and consumer attitude**



Results For Indirect Effect of Consumer Attitude On Perceived Behaviour Control For Energy Efficient Appliances

	EFFECT	BOOT SE	Boot LLCI	Boot ULCI
EEK	.0653	.0105	.0471	.0981

HYPOTHESES RESULT

S.NO	OBJECTIVES	HYPOTHESIS	ANALYSIS TOOL	RESULT
Ha1:	To determine the relationship between environmental knowledge of consumers and consumer attitude towards energy efficient appliances.	There is a significant relationship between environmental knowledge and consumer attitude towards energy efficient appliances	SEM	Accepted
Ha2:	To determine the relationship between consumer attitude towards energy efficient appliances and willingness to purchase energy efficient appliances	There is a significant relationship Between consumer attitude towards energy efficient appliances and willingness to purchase energy efficient appliances.	SEM	Accepted
Ha3:	To determine the relationship between environmental knowledge and perceived BehavioralControl.	There is a significant relationship between environmental knowledge and perceived BehavioralControl.	SEM	Accepted

Ha4:	To determine the relationship between perceived Behavioral Control and willingness to purchase energy efficient appliances.	There is a significant relationship between perceived Behavioral Control and willingness to purchase energy efficient appliances.	SEM	Accepted
Ha5:	To determine the moderate relationship between consumer attitude towards energy efficient appliances and Behavioral Control.	Consumer attitude towards energy efficient appliances moderately affects the perceived Behavioral Control.	Multiple regression	Accepted
Ha6:	To determine the moderate relationship between perceived Behavioral Control towards Energy efficient appliances and consumer attitude.	Perceived Behavioral Control moderately affects consumer attitude towards energy efficient appliances.	Multiple regression	Accepted

Note: All hypotheses were tested at 5 % level of significance and found significant (p value<.05)

CONCLUSION:

The findings from the analysis highlight the critical importance of energy efficiency for the well-being of our planet. In a world where electric energy is essential for various aspects of modern life, significant efforts are being made globally to enhance energy generation, storage, transmission, and utilization. The demand for electricity is expected to increase exponentially in the coming years, far surpassing the consumption levels of previous decades. In India, the majority of electricity is currently generated from fossil fuels, primarily coal. However, the projected depletion of these fossil fuels and the inefficiencies in energy transmission contribute to substantial energy wastage. There is a growing consensus on the urgent need to conserve electric energy through improved efficiency and sustainability measures. Research in this field aims to identify strategies to enhance energy efficiency in electrical home appliances, conserve natural resources, and mitigate environmental impacts. The goal is to use energy in a way that minimizes negative environmental effects while also reducing energy costs, ensuring that resources are available for future generations. Sustainability involves reducing carbon emissions, protecting the environment, transitioning to renewable energy sources, and maintaining ecological balance. Efforts in this direction not only help preserve the environment but also foster innovations that benefit society. Sustainability also emphasizes the preservation of human civilization and the responsible use of natural resources, aiming to enhance the quality of life while maintaining economic and social stability. By improving sustainability literacy, individuals and communities can better understand environmental conservation and the potential risks of neglecting these issues. This awareness is crucial for promoting responsible energy consumption and protecting both current and future generations from the adverse effects of energy waste and environmental degradation.

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