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RURAL CONSUMERS' BEHAVIOUR TOWARDS ENERGY CONSERVATION AND EFFICIENCY

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ABSTRACT

Human behavior plays a pivotal role in achieving greater energy savings. Choices such as setting indoor temperatures, using energy-efficient (star-labeled) appliances, and engaging in demand-response programs are all closely tied to individual actions and attitudes. Ultimately, people are at the heart of energy efficiency efforts. The obstacles to adopting energy-saving practices are often not just technical—they are deeply rooted in social and behavioral factors. Hence, the study aimed to know the rural consumers' behaviour towards energy conservation and efficiency in Erode District. To achieve the objectives of this study, both primary and secondary data were extensively utilized. Primary data was collected using the questionnaire method. First-hand information was obtained from 100 rural consumers in the Erode district through convenience sampling. Respondents were selected based on their availability and willingness to participate. A structured questionnaire was used for the sample survey and was duly completed by the participants. The collected data was then analyzed and interpreted using multivariate statistical techniques, specifically multi-discriminant analysis. Designing effective behavioral interventions requires a clear understanding of how behaviors are formed and the factors that can influence them. People's decisions—both conscious and unconscious—are shaped by various cognitive biases, often leading them to act in predictably irrational ways. These biases significantly affect how consumers respond to policy measures. Therefore, incorporating insights from behavioral economics and social sciences is essential for developing strategies that effectively guide and influence consumer behavior.

KEYWORDS: Behaviour, Energy, Efficiency, Technical, Strategies

INTRODUCTION

While many national and regional institutions actively encourage energy efficiency, no single international body currently exists with the sole mandate to further this aim at a global level. In India, both environmental sustainability and fulfillment of climate goals require a high priority for energy efficiency. There is a twofold challenge for the country: declining natural resources and very fast-

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growing energy demand. Between 2000 and 2020, India's major energy consumption jumped from around 450 million tonnes of oil equivalent to 880 million. This high growth indicates that it is imperative for the country to undergo system-level changes in the energy sector. In order to address this increasing demand, lower greenhouse gas emissions, and achieve the national goal of reducing energy intensity of GDP by 45% by 2030, India's power sector needs to deploy new technologies and enhance operational efficiency. A multifaceted approach is necessary—this consists of initiating conducive policy and regulatory environments, providing consumers and producers of energy-efficient appliances with incentives and subsidies, and making investments in research and development to fuel innovation in sustainable energy technologies.

Need of the study

To meet India's environmental sustainability and climate change commitments, prioritizing energy efficiency is essential. The country faces a pressing challenge as its natural resources are limited while energy demand continues to rise rapidly. Over the past two decades, India's primary energy consumption has nearly doubled, increasing from approximately 450 million tonnes of oil equivalent in 2000 to about 880 million tonnes by 2020. This significant growth underscores the urgent need for a strategic approach to managing energy resources more sustainably. Addressing these increasing energy requirements, while simultaneously reducing greenhouse gas emissions and striving toward the ambitious target of lowering the energy intensity of GDP by 45% by 2030, requires a transformative shift in the power sector. Specifically, adopting cutting-edge technological innovations and improving the efficiency of energy generation, transmission, and consumption processes are crucial steps. To achieve these goals, a comprehensive suite of measures must be implemented. These include robust policy and regulatory frameworks that encourage energy-efficient practices, financial incentives and subsidies aimed at both consumers and manufacturers of energy-saving equipment, and significant investment in research and development to foster innovation in energy-efficient technologies and products. Together, these strategies can create an enabling environment that supports the transition to a more energy-efficient economy. Among these measures, fostering widespread awareness and sensitization regarding energy conservation and efficiency stands out as the most cost-effective and straightforward approach. By educating individuals and communities about the importance of energy efficiency and encouraging behavior change, policymakers can effectively promote the adoption of energy-saving technologies and practices. This bottom-up approach not only complements technological and policy initiatives but also plays a vital role in driving sustainable energy consumption patterns across the country.

Problem identification

Energy efficiency is of great importance as it has an enormity of a contribution in reducing the effects of climate change and speeding up global energy transition. Actions taken under energy efficiency can

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reduce emissions by as much as 55%, making the clean energy transition the correct one. Of these strategies, the most widely accessible and inexpensive measure would be to promote awareness and culture of energy conservation. By educating and informing people about the significance and advantages of energy efficiency, people can be influenced to integrate energy-saving practices and technologies, ultimately helping to achieve national and international goals of sustainability. The shift to energy-saving appliances, like ceiling fans, thus offers tremendous world-scale potential. To illustrate this, conventional fans usually take around 70 watts of power, while their equivalent energy-saving versions do so at about 25 watts. Although this comes across as a relatively small difference, let us view this in terms of volume. Assuming there are three fans employed in a household on average, embracing energy-efficient versions can lower the power usage by 45 watts per fan, which amounts to behold. When we extrapolate this information globally, considering more than a billion households operating fans around the globe, the overall energy saved is quite significant. Institutions and individuals are initially resistant to the adoption of energy-efficient appliances and technologies because of increased prices, inability to measure their effects, and lack of perceived reliability. Lack of awareness and sensitization and the lack of affordable means for energy-efficient appliances and technology present numerous challenges in the adoption of energy-efficient measures.

OBJECTIVE OF THE STUDY

The present study aimed to know the rural consumers' behaviour towards energy conservation and efficiency in Erode District.

MATERIALS AND METHODS

Research on rural consumers' awareness and behavior toward energy conservation reveals a complex interplay of knowledge, attitudes, and socio-economic factors influencing energy use in these communities. Studies indicate that while rural households often recognize the importance of saving energy and the benefits of efficient usage, actual conservation practices remain limited due to barriers such as lack of access to information, low-income levels, and limited availability of energy-efficient technologies (Kibelloh & Bao, 2014). Additionally, cultural norms and reliance on traditional energy sources further complicate the adoption of energy-efficient behaviors. However, the flexibility offered by modern energy solutions, especially through digital and remote learning platforms, has shown promise in enhancing awareness and facilitating behavior change among rural populations (Boelens, De Wever, & Voet, 2017). Effective strategies to promote energy conservation in rural areas emphasize tailored educational programs, policy incentives, and community engagement to overcome infrastructural and informational challenges. Overall, increasing rural consumers' awareness through context-specific interventions is critical for achieving broader energy efficiency and sustainability goals.

To achieve the objectives of this study, both primary and secondary data were extensively utilized.

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Primary data was collected using the questionnaire method. First-hand information was obtained from 100 rural consumers in the Erode district through convenience sampling. Respondents were selected based on their availability and willingness to participate. A structured questionnaire was used for the sample survey and was duly completed by the participants. The collected data was then analyzed and interpreted using multivariate statistical techniques, specifically multi-discriminant analysis.

Table 1

Group Statistics					
Behaviour on energy efficiency and conservation		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Low	family type	1.31	.466	55	55.000
	age	2.18	.964	55	55.000
	educational status	1.42	.658	55	55.000
	marital status	2.78	.937	55	55.000
	occupational status	1.15	.356	55	55.000
	monthly income	1.02	.135	55	55.000
	family size	1.64	.485	55	55.000
	residential area	1.24	.429	55	55.000
	experience in energy conservation	1.42	.762	55	55.000
	gender	2.31	.836	55	55.000
	residential status	1.53	.634	55	55.000
High	family type	1.00	.000	45	45.000
	age	2.20	.842	45	45.000
	educational status	2.02	.839	45	45.000
	marital status	2.71	.869	45	45.000
	occupational status	1.49	.506	45	45.000
	monthly income	1.02	.149	45	45.000
	family size	1.76	.435	45	45.000
	residential area	1.07	.252	45	45.000
	experience in energy conservation	1.51	.727	45	45.000
	gender	2.24	1.048	45	45.000
	residential status	1.42	.690	45	45.000
Total	family type	1.17	.378	100	100.000
	age	2.19	.907	100	100.000

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	educational status	1.69	.800	100	100.000
	marital status	2.75	.903	100	100.000
	occupational status	1.30	.461	100	100.000
	monthly income	1.02	.141	100	100.000
	family size	1.69	.465	100	100.000
	residential area	1.16	.368	100	100.000
	experience in energy conservation	1.46	.744	100	100.000
	gender	2.28	.933	100	100.000
	residential status	1.48	.659	100	100.000

The group statistics reveal notable differences between the two behavioural groups toward energy efficiency and conservation. Group 2 (likely representing more energy-conscious individuals) has higher average scores in **educational status (2.02 vs. 1.42)** and **occupational status (1.49 vs. 1.15)** compared to Group 1, suggesting that more educated and professionally active individuals are more likely to adopt energy-efficient behaviours. Additionally, Group 2 shows a slightly larger **family size (1.76 vs. 1.64)** and higher **experience (1.51 vs. 1.42)**, possibly indicating that more experienced household heads or larger families are more aware of energy usage. Interestingly, **family type** in Group 2 is uniformly coded as 1.00 (with no variation), whereas Group 1 shows a mix, which may point to a structural difference in household compositions between groups. The **residential area** score is lower in Group 2 (1.07 vs. 1.24), indicating a more rural setting, which could be linked to greater sensitivity to energy conservation needs. Overall, these statistics suggest that higher education, formal occupation, and contextual household factors (such as area and experience) are associated with more positive energy-conserving behaviour.

Table 2

Tests of Equality of Group Means					
	Wilks' Lambda	**F**	**df1**	**df2**	**Sig.**
family type	.832	19.729	1	98	.000
age	1.000	.010	1	98	.921
educational status	.858	16.280	1	98	.000
marital status	.998	.150	1	98	.699
occupational status	.861	15.822	1	98	.000
monthly income	1.000	.020	1	98	.887
family size	.984	1.638	1	98	.204

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residential area	.947	5.488	1	98	.021
experience in energy conservation	.996	.383	1	98	.537
gender	.999	.118	1	98	.732
residential status	.994	.627	1	98	.430

The **Tests of Equality of Group Means** table identifies which variables significantly differentiate the two groups based on their behavior toward energy efficiency and conservation. Variables with a **significance (Sig.) value less than 0.05** are considered statistically significant contributors to group separation. In this case, f**amily type (F = 19.729, p = .000)**, **educational status (F = 16.280, p = .000)**, **occupational status (F = 15.822, p = .000)**, and **residential area (F = 5.488, p = .021)** show statistically significant differences between the two groups. These variables play a key role in influencing consumer behavior towards energy conservation. Variables such as **age**, **marital status**, **monthly income**, **family size**, **experience in energy conservation**, **gender**, and **residential status** are not statistically significant ($p > 0.05$), indicating that they do not meaningfully contribute to distinguishing between the two behavioral groups in this study. Hence, **educational level, occupation, family type, and residential area** are the most critical demographic and socio-economic variables associated with rural consumers' energy-efficient behavior.

Table 3

Eigenvalues				
Function	**Eigenvalue**	**% of Variance**	**Cumulative %**	**Canonical Correlation**
1	.624[a]	100.0	100.0	.620
a. First 1 canonical discriminant functions were used in the analysis.				

The **Eigenvalues** and **Wilks' Lambda** tables provide insights into the effectiveness of the discriminant function in differentiating between the two groups based on their behavior toward energy efficiency and conservation. The **eigenvalue** for the single discriminant function is **0.624**, indicating a **moderate level of discriminating power**. A higher eigenvalue would suggest stronger group separation. The **canonical correlation** is **0.620**, which implies that approximately **38.4%** (since 0.6202=0.3840.620^2 = 0.3840.6202=0.384) of the variance in the grouping variable is explained by this function. This suggests a reasonably good fit and association between the discriminant scores and group membership.

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Table 4

Wilks' Lambda				
Test of Function(s)	**Wilks' Lambda**	**Chi-square**	**df**	**Sig.**
1	.616	44.869	11	.000

From the **Wilks' Lambda** table, the value of **Wilks' Lambda is 0.616**, which measures the proportion of total variance not explained by the model. The lower the value, the better the discriminating power of the function. The associated **chi-square (44.869)** is statistically significant **($p < .001$)**, indicating that the discriminant function significantly differentiates between the two groups.

Chart 1

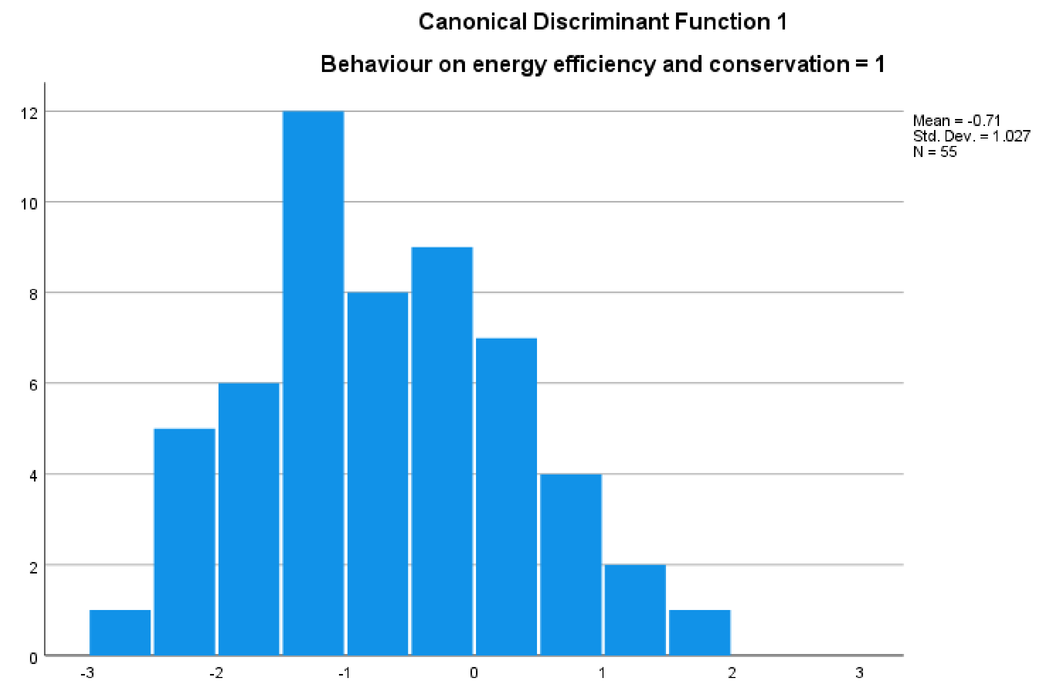

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Table 5

Functions at Group Centroids	
Behaviour on energy efficiency and conservation	**Function**
	1
Low	-.708
High	.865
Unstandardized canonical discriminant functions evaluated at group means	

The **group centroid** for consumers with **low energy conservation behavior (Group 1.00)** is **-0.708,** while for those with **high conservation behavior (Group 2.00),** it is **0.865.**

Table 5

Prior Probabilities for Groups			
Behaviour on energy efficiency and conservation	**Prior**	**Cases Used in Analysis**	
		Unweighted	**Weighted**
Low	.550	55	55.000
High	.450	45	45.000
Total	1.000	100	100.000

Group 1.00 (lower conservation behavior) makes up **55%** of the sample (n = 55). Group 2.00 (higher conservation behavior) accounts for **45%** (n = 45). The substantial difference between group centroids indicates that the discriminant function effectively separates consumers based on their behavior. Given the prior probabilities are fairly balanced and the centroids are well-spread, the model is statistically sound and likely performs well in accurately classifying rural consumers' energy behavior.

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Chart 2

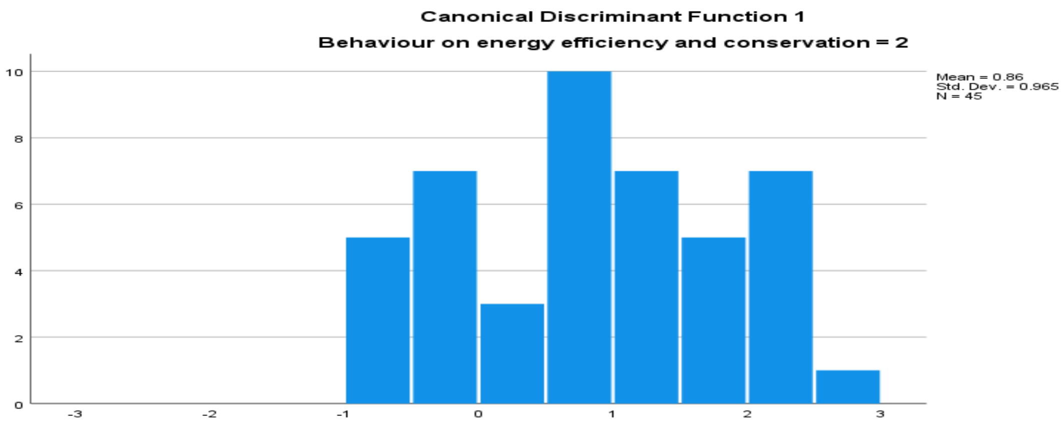

Table 6

Classification Results					
		Behaviour on energy efficiency and conservation	Predicted Group Membership		Total
			Low	High	
Original	Count	Low	44	11	55
		High	12	33	45
	%	Low	80.0	20.0	100.0
		High			
		Low	26.7	73.3	100.0
		High			
Cross-validated[b]	Count	Low	39	16	55
		High	14	31	45
	%	Low	70.9	29.1	100.0
		High	31.1	68.9	100.0
a. 77.0% of original grouped cases correctly classified.					
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.					
c. 70.0% of cross-validated grouped cases correctly classified.					

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The classification accuracy—**77% originally** and **70% with cross-validation**—demonstrates that the discriminant model performs well in distinguishing between consumers with different levels of energy conservation behavior. This indicates the model is both **practically useful** and **reasonably reliable**, although there is some overlap in behavior patterns between the two groups.

CONCLUSION

Designing effective behavioral interventions requires a clear understanding of how behaviors are formed and the factors that can influence them. People's decisions—both conscious and unconscious—are shaped by various cognitive biases, often leading them to act in predictably irrational ways. These biases significantly affect how consumers respond to policy measures. Therefore, incorporating insights from behavioral economics and social sciences is essential for developing strategies that effectively guide and influence consumer behavior. Tailor energy awareness and conservation programs based on significant predictors. For example, target less-educated or specific occupational groups with customized interventions. The study indicates that socio-demographic factors—particularly education, occupation, family type, and residential environment—significantly shape energy-related decision-making in rural settings. Discriminant analysis shows that these elements effectively differentiate households with strong energy-efficient practices from those with weaker ones. Conversely, variables such as age, income, and gender had little influence. These insights point to the importance of designing targeted behavioral interventions that enhance awareness, strengthen educational initiatives, and engage community leaders to foster sustainable energy habits. In conclusion, advancing energy-efficient behavior in rural areas requires more than technological interventions—it calls for context-sensitive, behaviorally grounded approaches that address social norms, close information gaps, and tap into motivational factors to drive lasting change.

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