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ARTICLE

Role of Information in Shaping Energy Efficiency Attitude: Case of Indian Urban Households

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Abstract

Extant literature has shown that traditional instruments are inept to bring the desired levels of energy efficiency, giving way to ex-post models that attempt in bringing behavioral changes in households. Influenced by these latter models the study attempts to assess if the information provided to residential urban Indian energy consumers nudges them towards being energy efficient. For this purpose, we assess two types of information. First, innovative billing is provided by smart energy meters which provide information regarding consumers' 'own' energy consumption and energy consumption by neighbors.Second, the information is provided through awareness programs by the government.

Since the Indian Government has recently announced the replacement of energy meters with smart meters, the study takes into account the information provided through smart meters, which shall have implications not only for the government but also for the marketers of smart meters.

By surveying 1751 urban Indian households and analyzing the data using two factorial ANOVA, the study finds that consumption-related information feedback through smart devices shall favorably shape the attitude towards energy efficiency. Our paper also looks into the impact of several independent variables that are hypothesized to be affecting the energy efficiency attitude, e.g. willingness to spend on smart meters and awareness of government programs related to energy efficiency.

Keywords: Energy efficiency attitude; Smart meters; Information; Innovative billing; Consumption-related feedback; ANOVA

1 Introduction

The NITI Aayog (established by the Government of India to achieve sustainable development goals) in their draft National Energy Policy, released on June 27, 2017, mentioned that electricity demand in India is likely to grow 4.5 times between 2012 and 2040. Being the third-largest consumer of electricity in the world, the residential sector in India contributes to a significant proportion of the country's total energy consumption. With ambitious goals of taking electricity to every household by 2022, as promised in the budget of 2015-16, this proportion is only going to grow. It is estimated that improved energy efficiency alone can reduce India's energy demand by 17% in 2040. The recent success of the Ujala (LED lighting) program, saving electricity worth ₹12,000 crores, has shown the tremendous potential of replacing inefficient appliances with more efficient ones.

The government's focus on ensuring energy efficiency has been mainly through the promotion of star-rated appliances (i.e. energy-efficient appliances) but the goals of the government are far from being achieved. Early literature on energy efficiency focuses on the assessment of the cost-efficiency of conventional instruments and policies (Gillingham et al., 2006; Urge-Vorsatz and Novikova, 2008; Filippini et al., 2014; Oikonomou et al., 2007) with ex-ante models that estimated

and compared the expected results of each instrument. Recent studies have been shifting their thrust to the ex-post models that focus on bringing in behavioral changes in the consumers to nudge them towards energy efficiency (Allcott and Mullainathan, 2010; Dyner and Franco, 2004; Ramos et al., 2015).

The present paper takes the latter stance and believes that one of the ways to close the energy efficiency gap is to deal with behavioral failures of energy consumers which can be attested by empowering them with information on their energy consumption. In the present paper, we attempt to assess the impact of information on the energy efficiency attitude of consumers.

For the first type of information, the present study contemplates that detailed information may be provided to consumers regarding appliance-wise energy consumption, energy consumption when appliances are on stand-by mode vis-à-vis 'in use' mode, daily/weekly consumption pattern, comparison of consumption over past periods, and comparing energy consumption with the neighborhood. For the second type of information, we specifically focus on the awareness campaigns by the government to understand if these awareness programs affect the energy efficiency attitude of the consumers.

The information of the first type may be provided to consumers through smart meters/devices. According to the announcement by the Government of India in 2019 of converting all electricity meters to smart meters by 2022 ((Bhaskar, 2019)), we believe that including the first type of information by way of innovative features/functionalities in the smart devices shall achieve better results in terms of achieving energy efficiency. Presently, the government is more focused on two aspects of energy efficiency, first on installing smart meters to achieve efficiencies in billing that will further reduce the loss of revenues of distribution companies and secondly, by empowering consumers through the awareness programs especially designed to impart consumers with the subsidies and benefits available for being energy efficient.

The **paper surveys** 1751 urban Indian households to understand if the information provided to them (either in the form of innovative billing or spreading awareness) will nudge them towards an energy efficiency attitude. Since the informational and behavioral problems are much more frequent with residential consumers as compared to commercial users the study assesses the impact of information in shaping the energy efficiency attitude of urban Indian households.

The **study finds** that information empowered consumers to tend to display an energy-efficient attitude and hence the government should design awareness programs in educating the consumers about efficient consumption of energy. We find that the level of education is not enough! What matters is educating the consumers! Further, the study finds that a smart device that has functionalities of providing information related to energy consumption shall lead to a favorable energy efficiency attitude. We also modelin the factor for 'willingness to pay for such a device and find that irrespective of the willingness to pay, these functionalities shall promote an energy efficiency attitude among urban Indian households. The findings are relevant for marketers in designing smart meters, targeting the right consumers with appropriate promotion messages, and setting the price range for the smart meters.

The **paper's contribution** rests on being the first attempt, to the best of our knowledge, of providing empirical evidence on how by empowering the consumers with information about energy consumption (through smart meters) and by launching awareness programs, they can be nudged towards displaying energy efficiency attitude. Lack of information and awareness are the most critical barriers to the improvement of energy efficiency. Removing information inefficiencies, through information disclosure shall lead to an energy efficiency attitude in households. Based on a large data of 1751 households, the present research provides interesting suggestions both for manufacturers of smart devices and energy policy-makers.

2 Deploying Smart Meters In India

Under the Government of India's recent Smart Meter National Programme to deploy smart meters across the country, the Government has successfully installed one million smart meters across India in the states of Uttar Pradesh, Delhi, Haryana, and Bihar as of February 2020 .To smoothen the transition and create an ecosystem for smart meter use, the Central Government in 2017, created the Energy Efficiency Services Ltd (EESL), a joint venture between several public-sector enterprises helmed by the power ministry.

A smart metering system would reduce meter-reading and data-entry errors and costs, thereby increasing the revenues of distribution companies through efficient billing. Smart meters shall help in monitoring the efficiency of per-unit electricity supplied and improve the billing of smart meters. Traditional meters only record energy consumption for billing purposes. These smart meters would also estimate consumer demand, letting utilities forecast and contract for power requirements more accurately. These smart devices shall not only help the distribution companies to manage their revenues, but an often ignored aspect is that these devices are equipped with proper information, and can nudge people in building or strengthening their energy efficiency attitude.

There has been a lack of incentives for the residential sector in India to invest in cost-effective energy efficiency measures, leading to the energy efficiency gap that needs to be plugged. The need of the hour is not just providing these incentives, but rather to infuse behavioral changes in people to promote energy efficiency. Hence, the present study tries to understand the impact on the energy efficiency attitude of residential urban households when they are empowered with information– either through the awareness programs of the government or the innovative billing/feedback through smart devices. As the frequency with which the household receives the feedback increases, its effectiveness also tends to increase (Ehrhardt-Martinez et al., 2010). Since, smart meters as a tool of information help in increasing the frequency of the feedback received by the households; as a result of this, their response to saving energy consumption also increases.

The information contained in the smart meters can be transmitted to the consumers through bills, web-based services, or by the way of in-house display (Ramos et al., 2015). The data provided by the traditionally installed low-tech energy meters were often not seen by the households due to their out-of-sight placement and installation (Owen and Ward, 2006). However, real-time wireless energy meters can be placed anywhere in the home and thus provide easy vision to the households about their energy consumption (Abrahamse et al., 2005). A reduction of 15% in the energy consumption could be witnessed in the households that received real-time energy consumption feedback by way of smart meters (Darby, 2006). Various researchers have witnessed a reduction in energy consumption with the installation of smart meters i.e. a 7% reduction in a study conducted by (Faruqui et al., 2010) an 11-17% reduction in the study by (Gans et al., 2013), while 5.7% reduction in a study conducted by (Houde, 2013).

3 Lack of Information Among Households and Energy Efficiency Attitude

Lack of information to the consumers about the appliances they use, the savings that may accrue if they efficiently consume energy, and the expenses they shall incur to use energy-efficient appliances have been some of the reasons that have deterred these households from adopting the energy-efficient attitude. Usually, households face an energy efficiency gap due to information failures wherein consumers are not able to take advantage of a technology that may be profitable to them in terms of energy efficiency (Sola and Ayala, 2021).

The absence of such information leads to greater perceived risks and a reluctance to invest in such smart devices. Reducing the information gap was one of the ways suggested in the prior studies to address the barriers to improving energy efficiency (Hirst and Brown, 1990). A lack of knowledge surrounding the benefits of increasing energy efficiency, including monetary savings, comfort, and environmental benefits, has been suggested as a partial contributor to the energy efficiency gap (Sanstad and Hanemann a W. M., 2006; Granade et al., 2009). In 2019 Government of India announced the installation of smart meters, and we believe that the innovative billing through these devices shall play a role in reducing the information gap and shall mark a move towards energy efficiency.

3.1 Providing Information Through Feedback

Another information tool that has gained recognition over the years is Feedback. The basic premise is,that households shall be encouraged to minimize their energy consumption when innovative billing/feedback is provided to them by making them aware of their energy usage and the cost that they are paying for such consumption. Behavioral failures in the form of disbelief about energy consumption as well as information failures in the form of incomplete information are mitigated with the help of proper feedback (Ramos et al., 2015). It is observed that as the frequency of the information received from the feedback increases, the frequency of the energy savings by the households also increases (Abrahamse et al., 2005). Also, energy-saving behavior in households is, to a large extent, influenced by the design of the feedback system i.e. how the feedback is provided (Geelen et al., 2019). Real-time feedback about energy consumption with the help of a meter or monitor leads to a 5-15% reduction in energy usage (Filippini et al., 2014). Another study confirmed that feedback to the households about their high energy consumption with the help of cell phone texts or email also lead to a reduction in their energy usage by approximately 3% (Gleerup et al., 2010). The design of the applications (apps) also determines the energy-saving behavior among households. These apps must provide concrete, relevant and meaningful information about the levels of energy consumption over time (Geelen et al., 2019). Not just this, feedback with the help of posts on web portals also leads to a 4.5% annual reduction in their electricity usage (Schleich et al., 2013). However, in cases where households are already consuming less energy, feedback may act as a negative tool and instead may promote them to consume more energy than they are presently consuming (Ramos et al., 2015). Feedback as the source of information is one of the most effective measures in motivating households to reduce their energy consumption (Geller et al., 1982).

3.1.1 Energy Bills with Comparative Information

Energy, being an invisible resource, an important mechanism to encourage energy-efficient behavior of consumers is to provide feedback on their energy consumption. The positive role played by feedback in eliciting energy-efficient behavior has been emphasized in the literature time and again (Kluger and DeNisi, 1996); (Farhar and Fitzpatrick, 1989). The energy consumption can be compared to a customer's previous consumption (historical comparison) or similar households (social or normative comparison, e.g. (Allcott, 2011)). Hence, the present study takes into account the impact of information (feedback) provided through smart devices on the energy efficiency attitude of the households.

Thus, to remove the asymmetric information it becomes important to make the consumers know about the true worth of the appliances that they use. The smart meters may help in overcoming the asymmetric information by providing the information on the savings done through the purchase of energy-efficient appliances, i.e. whether the labeled products lead to energy savings. Hence, it removes the trust issues of the customer.

Accordingly, we hypothesize:

Hypothesis 3.1. *The feedback (innovative billing) by smart meters significantly affects the energy efficiency attitude of urban Indian households*

Financial Incentives and Willingness to Pay: Examining the last thirty years of policies relating to energy efficiency revealed that among others, financial incentives are a major factor that influences energy-efficient consumer behavior (Geller et al., 2006). Rising energy prices are considered to be an important reason for the people attempting to conserve energy, especially for low-middle income groups (Olsen, 1981). It was evident that respondents who witnessed high energy costs were highly motivated to invest in energy-efficient practices (Nair, 2010). Another study found that the level of regional energy prices impacted the level of consumer knowledge about energy classes of products, again supporting the cost consideration factor in promoting energy-efficient behavior (Mills and Schleich, 2010).
Accordingly, we hypothesize:

Hypothesis 3.2. *Willingness to spend on smart meters by urban households significantly affects the energy efficiency attitude of urban Indian households*

Also, information about energy consumption and savings was found to be more relevant in the lower price product category, indicating that consumers who were more price-sensitive tend to focus on energy savings more than less price-sensitive consumers (Anderson and Claxton, 1982). Hence, we also check for the interaction between feedback and willingness to pay for smart meters in shaping the energy efficiency attitude of Indian households via the following hypothesis:

Hypothesis 3.3. *There exists an interaction between feedback (innovative billing) and willingness to spend on smart meters by urban households in significantly affecting their attitude towards energy efficiency.*

Income is directly related to the implementation of technical measures since lower-income groups find it difficult to implement technical measures, such as purchasing energy-efficient appliances (Poortinga et al., 2003).
Accordingly, we hypothesize:

Hypothesis 3.4. *Income of the household significantly affects the energy efficiency attitude of urban Indian households.*

Further, we also checked for the impact of willingness to pay for such a smart device providing consumption related feedback for a given income level of the household via the following hypothesis:

Hypothesis 3.5. *There exists an interaction between income level and willingness to spend on smart meters by urban households in significantly affecting their attitude toward energy efficiency.*

3.2 Providing information through Awareness programs

Notwithstanding the growing use of energy labels, consumers are still unaware of the purpose of these energy labeled devices (Almeidaa et al., 2011; Strielkowski et al., 2019). A study also shows that despite providing free energy audit programs, only 15% of the households participated in this informative program even though they incurred no direct cost for such participation (Fowlie et al., 2015). Hence, it becomes important to increase awareness among consumers about such initiatives and programs government to bring about changes in the behavior of consumers and nudge them toward energy efficiency (Bastida, 2019).
Investment subsidies and economic incentives along with effective communication programs, educate the households about the benefits available and encourage them to transform their behavior towards adopting energy-efficient measures (Nair, 2010). For improved levels of energy efficiency, better and efficient communication between decision-makers, technical experts, stakeholders, and the public is required.
Accordingly, we hypothesize:

Hypothesis 3.6. *The awareness of government subsidies does not affect the energy efficiency attitude of urban Indian households.*

Besides communicating with consumers and spreading awareness among them, the level of education is another important factor associated with household energy consumption, wherein, higher levels of education lead to the adoption of energy-efficient technology and conservation practices. Higher levels of education encourage energy savings for greenhouse gas reductions (Mills and Schleich, 2012). Education levels play a significant role while determining the households' behavior toward energy efficiency, wherein, for people with lower levels of education, it becomes troublesome to accurately understand the existing energy-efficient measures and technology (Nair, 2010). According to (Brounen et al., 2013) education impacted rational decision-making more significantly than the conservative attitude, thus emphasizing the importance of education in improving energy literacy.
Thus, we hypothesize:

Hypothesis 3.7. *The energy efficiency attitude of households of different education levels is the same.*

We also hypothesize the existence of interaction between awareness and education level of urban Indian households, represented via the following hypothesis statement:

Hypothesis 3.8. *There is an interaction between awareness and education level i.e. the effect of awareness level of urban Indian households is the same at any education level.*

4 Study Design and Methodology

We recruited 20 students each from undergraduate commerce honors and MBA of the University of Delhi and Delhi Technological University respectively to assist in data collection for this survey. Each one of them was handed fifty questionnaires for getting filled from their neighborhood households. Thus, in total 2000 questionnaires were sent out for collection, however, 1780 questionnaires were received, achieving a response rate of 89%. Out of these 1780 responses, 1751 were found to be complete and fit for use in the analysis. The surveys were later encoded and entered into the software for statistical analysis by the authors themselves. To ensure uniformity in data collection, students were trained for the meaning of the constructs so that they are better able to explain them in case interviewees found it difficult to comprehend. Since our research question required investigating the impact of more than one independent variable on the dependent variable energy efficiency attitude, and interaction effects between the IVs, we applied factorial ANOVA to test our hypotheses. Two-way ANOVA examines the influence of different categorical independent variables on one dependent variable. The two-way ANOVA can not only determine the main effect of contributions of each independent variable but also identifies if there is a significant interaction effect (cross effect) between the independent variables/factors.

4.1 Measurement of Variables

Attitude towards energy efficiency (AEE) was measured using four Likert scale items on a five-point scale which was anchored by 1 = strongly disagree and 5 = strongly agree. The scale was carefully designed to include aspects reflecting attitude toward energy efficiency after a thorough literature review and taking experts' opinions, such as discussing monthly bills, sharing ways of saving energy consumption with knowns (acquaintances), having knowledge of energy bills of self and knowns, and overall environment-friendly attitude. The reliability of the scale was measured by Cronbach's alpha which was 0.744 for the construct AEE suggesting high internal consistency. The inter-item correlation was found to be above 0.6 for all the scale items indicating consistency. Further factor analysis was used to corroborate the dimensionality of the scale items. Results of factor analysis reported a single factor for all these four scale items.
The other variables used in the study were categorical or single item Likert scales, e.g., for measuring *attitude towards innovative billing/feedback* a single scale item such as whether users will appreciate detailed energy consumption related feedback was asked on a five-point Likert scale. The *willingness* to spend on a smart device was measured through a categorical question indicating prices for such devices at several levels from zero to above 20,000. Similarly, Education was measured through a categorical question indicating several levels of education from primary school to doctorate. *Awareness of government schemes* was designed as a dichotomous question asking yes or no to their awareness of the government's incentivizing schemes for reduced energy consumption. Income was measured through a categorical question asking the total annual Income of the household at several levels from less than ₹1,00,000 to above ₹50,00,000.

4.2 Participants' Profile

The surveyed population is representative of the urban population of Delhi as according to 2012 Delhi census data, 97.63% of Delhi's population is urban. The surveyed responses revealed that 34% of respondents had a master's degree and only 6% were less literate. 37% of the respondents belonged to the income group of ₹5-10 lakh followed by the second highest respondents coming from the income group of ₹10-15 lakh. The majority of the respondents were female (57%) in the survey.

5 Results

5.1 Impact of Innovative Billing and Consumers' willingness to spend on smart devices in shaping energy efficiency attitude of Indian urban households **Hypothesis 3.1**

The results for the two-way full factorial ANOVA (see Table 1) indicated a significant main effect for the Innovative billing/feedback (Att IB), $F(2,1611)= 10.760$, $p<.05$, partial $\eta 2 = .013$ There is no evidence of statistically significant main effects for willingness to spend (amount WS). The interaction effect of innovative billing (feedback) and the willingness to spend by households on smart devices also does not emerge significantly. Thus, Hypothesis 3.1 is rejected.

To further deeply evaluate the difference between attitudes of households towards innovative billing (feedback), we conduct pairwise comparisons of various categories of attitudes (see Table 2). The pairwise comparisons conducted with Bonferroni adjustment were employed to ensure that Type -I error remained at p-value=.05 (while one school of statistical thought maintains that this adjustment is not necessary for comparisons identified a priori, this point of view is not universally supported). The Bonferroni adjustment was applied because its use affords the most stringent tests of hypotheses. The results demonstrated that the difference between the marginal means of attitude towards energy efficiency (AEE) is highest (md=2.3613, p=.000) when innovative billing is strongly desired.

Table 1. ANOVA results

Dependent Variable: AEE (Attitude towards Energy Efficiency)						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1224.909[a]	16	76.557	5.818	.000	.055
Intercept	34433.991	1	34433.991	2616.939	.000	.619
amount_WS	82.185	5	16.437	1.249	.284	.004
Att_IB	283.172	2	141.586	10.760	.000	.013
amount_WS *Att_IB	74.307	9	8.256	.627	.774	.003
Error	21197.727	1611	13.158			
Total	258634.000	1628				
Corrected Total	22422.636	1627				

[a] R Squared = .0.055 (Adjusted R Squared = .045)

5.2 Impact of Income of households and willingness to spend in shaping energy efficiency attitude of urban households (Hypothesis 3.2)

The results for the ANOVA (see Table 2) indicated a significant main effect ofthe education level of the respondents on the energy efficiency attitude of the urban households, $F(5,1685)= 4.570$, $p<.01$, partial $\eta 2= .013$.
The interaction effect of the education level of the respondents and the awareness is statistically significant at $p=.10$, $F(5,1685)$ 2.059, $p<.10$, partial $\eta 2= .006$ Table 2. The main effect of household awareness about government schemes in encouraging energy efficiency is however not found to be statistically significant ($p= 0.189$).

Table 2. ANOVA results

Dependent Variable: AEE (Attitude towards Energy Efficiency)						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	748.667[a]	39	19.197	1.384	.059	.032
Intercept	21728.256	1	21728.256	1567.034	.000	.490
amount_willing to spend	139.419	5	27.884	2.011	.074	.006
Income	127.690	6	21.282	1.535	.163	.006
amount_willing to spend * Income	470.986	28	16.821	1.213	.205	.020
Error	22601.331	1630	13.866			
Total	263782.000	1670				
Corrected Total	23349.998	1669				

[a] R Squared = .032 (Adjusted R Squared = .009)
[b] Computed using alpha = .05

Multiple comparisons of the mean differences between different education levels of the participants indicate the highest mean difference between primary educated and Ph.D.holders, towards energy efficiency (though not statistically significant, $p=1.0$). On the contrary, the mean difference between participants having a Master's degree and primary education showed statistically significant differences ($p= .017$).

5.3 Impact of awareness of government schemes in shaping Energy efficiency attitude of households (Hypothesis 3.3)

The results for the two-way full factorial ANOVA (see Table 3) indicated a non-significant main effect for income, $F(6,1630)= 1.535$, $p>.05$, partial $\eta 2 = .006$ and also for willingness to spend (amount Wiling to spend), $F (5,1630)= 2.011$, $p>.05$, partial $\eta 2 =.006$. The interaction effect of income of the household and their willingness to spend on smart devices is also not statistically significant, $F(28,1630)= 1.213$, $p>.05$, partial $\eta 2 = .020$. The descriptive analysis also shows the highest mean for attitude towards energy efficiency for spending ₹5,000-10,000.

Table 3. ANOVA results

Dependent Variable: AEE (Attitude towards Energy Efficiency)						
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	705.426[a]	11	64.130	4.690	.000	.030
Intercept	44472.590	1	44472.590	3252.223	.000	.659
Edu	312.455	5	62.491	4.570	.000	.013
Awareness_GS	23.563	1	23.563	1.723	.189	.001
Edu * Awareness_GS	140.792	5	28.158	2.059	.068	.006
Error	23041.569	1685	13.675			
Total	268187.000	1697				
Corrected Total	23746.995	1696				

[a] R Squared = .0.030 (Adjusted R Squared = .023)
[b] Computed using alpha = .05
Edu – Education level; Awareness_GS = awareness of Government schemes

6 Discussion

The significant independent main effect of attitude towards innovative billing (feedback) provided by smart devices (Hypothesis 3.1) implies that attitude towards innovative billing information provided by smart devices is significantly different across all the households surveyed. The positive attitude is shaped and reflected irrespective of their willingness to spend on such a smart device for energy efficiency. This indicates the importance of providing consumption-related information to households in shaping their attitude towards innovative billing. The pairwise comparisons of various categories of attitudes also corroborate our findings that people's attitude toward innovative billing affects attitude toward energy efficiency significantly.

The interaction effect of education level and the awareness level on energy efficiency attitude (Hypothesis 3.3) indicates that participants with high awareness levels have a higher efficiency attitude on average than those with low awareness levels. However, for the given awareness level of participants there seem to be significant differences across participants belonging to different education groups. Similarly, there is a significant difference between those participants who are aware of government schemes but belong to different education levels. The interaction effect explains only a 0.6% variation (refer to Table 3, where partial eta squared ($\eta 2$) = 0.006) in the energy efficiency attitude of the households.

Hence, this indicates that the government's efforts to promote an energy efficiency attitude should be focused on creating awareness campaigns, designed differently for people with varying educational backgrounds. Government can spread awareness starting right from primary schools, high schools, and higher education institutes. For example, in India, National Energy Conservation day is celebrated every year on November 14 with painting competitions organized across the country to make students aware of the importance of energy conservation and energy efficiency .

The significant interaction between awareness about government programs related to energy efficiency and education indicates that awareness levels vary across people with different educational backgrounds. The government should disseminate energy-consumption-related information to people by designing its awareness programs targeted at individuals with specific educational backgrounds, especially in regional languages to overcome the language barrier. One size doesn't fit all! Thus, the Hypothesis 3.6 and Hypothesis 3.8 is not rejected.

The results also revealed that the subsidies provided by the government for using LED lights, Re. 1 subsidy, slab rates for electricity consumption, etc. (used as a proxy for measuring the awareness levels in the questionnaire) motivated people to keep a check on their energy consumption. This further corroborates our conviction that Government must further devise its awareness programs, which must be tailored for the masses depending on their education level.

The results for Hypothesis 3.2 indicate that the energy efficiency attitude and willingness to spend extra on a smart device that provides feedback on energy consumption is not largely driven by the income levels of the households, which is quite perplexing. This means that if the willingness to pay by the households for smart meters is encouraged (by some dedicated efforts), they shall be nudged to spend and buy such smart meters and display a more energy efficiency attitude. Moreover, the results reveal that respondents who are willing to spend between ₹5,000-10,000 on an energy-efficient device most likely will display an energy-efficient attitude

7 Conclusion

Extant literature has shown that traditional instruments and assumptions have not been bringing the desired levels of energy efficiency in households in the residential sector, giving way to the ex-post models that attempt to achieve the goal by bringing in the behavioral changes in households. Going by these latter models the present paper attempts to assess how information empowered consumers to tend to display energy-efficient attitudes which shall ultimately close the 'energy efficiency paradox'. We specifically assess two types of information provided to consumers: first, innovative

billing (feedback) provided by smart meters; second, awareness programs of the government.

By conducting a survey on 1751 urban Indian households, and using two factors ANOVA, the study finds that a typical urban Indian is open to getting innovative bills that provide detailed appliance-related consumption as well as daily or weekly consumption of electricity, and is willing to spend on a device providing such information, irrespective of his income levels. The provision of this information through smart devices shall favorably shape the attitude towards energy efficiency.

The study also observes the moderating role of the amount of money that people are willing to spend on smart devices and suggests that it is indeed an important variable that shall guide the marketers of smart devices to appropriately target the market and price their products.

The study also looked into the awareness of respondents about various government initiatives/incentives/schemes related to energy efficiency and their impact on the energy-efficient attitude of people. Our results suggest that the government should design awareness campaigns tailored for households belonging to different educational levels, in their regional languages, to nudge even less educated ones towards an energy-efficient attitude. It is not only the education level of the households that matter in shaping their energy efficiency attitude, but educating them about energy efficiency also matters.

8 Policy Implications

The study has several policy implications. Firstly, smart meter developers should incorporate consumption-related information in their devices to significantly nudge urban households towards energy efficiency. The marketers should also promote smart meters by emphasizing innovative billing and consumption-related information. Further, an interesting marketing implication that emerges from the results is that the marketers for smart meters should target the market segment that strongly desires greater insights (or details) into their home- energy consumption.

Secondly, Government must focus on spreading the importance of smart meters in contributing to sustainability through its awareness programs, which should be tailored for masses with different educational backgrounds.

Thirdly, marketers and Government should devise suitable promotions and programs, respectively which shall motivate and nudge consumers/masses to spend on such energy-efficient smart devices. Our survey indicates that if the marketers set the price range of ₹5,000-10,000, it shall elicit a high energy efficiency attitude from the consumers. Such promotion and programs shall result in shaping the energy efficiency attitude of consumers and move society towards being more sustainable.

9 Limitation of the Study

The scope of the present study caters to only urban Indian households. The study has surveyed respondents that have been selected from only the Delhi NCR region. Further, higher statistical tests in terms of predictive modeling may be used to strengthen the results in terms of modeling the energy efficiency behavior of the households. The design of the scale was also exploratory which may be further improved by future researchers.

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