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Explaining the Awareness and Attitude of the Delhi Households in context of Electricity Consumption

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ABSTRACT: *Electricity has attained a very important place in every household on this planet. It is a major contributor towards improvement of the standard of living of any individual, family and society at large. The consumer habits constitute an important factor in deciding the electricity consumption. Also, it will help in policy making for the conservation of electricity. The household awareness is also identified by probing in the consumer behaviour. The respondents are the Delhi households. Through stratified random sampling, 395 households were selected for collection of data. Likert scale is used to find out the trend in consumer behaviour, awareness and habits of the households. It is found that households need to take conservation steps in order to make judicious use of the electricity. Households are found to have the environmental awareness with respect to electricity consumption and generation but availability of various electrical appliances makes it difficult for the household to stop the electricity wastage.*

Keywords: Delhi; Electricity; Attitude; Awareness; Household

1. Introduction

The task of understanding energy-consuming behaviours has presented substantial complexities. The complexities as per Ritchie et al. (1981), involve determining both the factors that influence electricity-consuming behaviours and the nature of each influence. The potential factors which influence electricity consuming behaviours include climatic conditions, house/product/vehicle characteristics, household demographics, and attitudinal variables.

The investigations on consumers' willingness to change habits and undertake energy savings are relevant for the present study. In the literature, attitudes have been found to correlate with electricity conservation behaviour. Psychology-based studies show mixed results. "Mass information has limited success. Targeted information campaigns can be more effective" (OECD 2002). Gatersleben et al. (2002), through the results of two large-scale surveys of Dutch households,

showed that, among other things, households with high pro-environmental attitudes were often not aware of the environmental impacts of their energy consumption, both directly and indirectly.

Gardner & Ashworth (2007)¹ came out with substantial results from their study in the context of consumer behaviour and attitude. People who already use less electricity, women, and people with more pro-environmental beliefs, attitudes and past behaviour have stronger intentions to reduce their energy consumption. People with higher levels of knowledge tended to polarise, reporting either very high or very low intentions to reduce consumption. These results are in line with previous findings and with psychological theory. The findings for acceptance of both demand management and distributed generation were fairly similar, even though individual survey respondents only assessed one technology. Younger, more educated, working people, with moderate size households including children and higher income levels, were more likely to accept these technologies. People scoring higher on pro-environmental beliefs and behaviours, those with positive attitudes and subjective norms towards energy reduction, and those with higher levels of knowledge about energy/environment issues were also more likely to accept both technologies. In direct demand management applications, air conditioners and pool pumps are the two high-load appliances most likely to be controlled.

Collins (2010) says that the behavioural patterns for using appliances progress from knowledge based to skill-based more rapidly when operation is less complex. Once a person is operating an appliance using skill-based behaviour, the behaviour is harder to change. Another thing pointed by him is that the people use instruction manuals less when the appliance is less complex.

“Encouraging the electricity efficiency through an alteration of ‘lifestyles’ could be difficult as this would involve changing how people live (which is a difficult and questionable task for a government or any group to undertake), but also because changing lifestyles means changing socialised ideas of taste and norms, which does not happen quickly” (McMichael, 2007).

¹ The survey was developed with reference to psychological theory.

Collins (2010) also suggests that a household may have at least three motivations for changing their energy use habits:

- a. Financial: saving money on their monthly utility bill.
- b. Environmental: reducing their carbon footprint.
- c. Competitive: outperforming neighbours in saving energy.

Initially he looked at three mechanisms in particular: offering people cash rebates for reducing use, providing them with more frequent feedback, and giving them tips on how to conserve energy. Not surprisingly, the cash payments tended to work best, while the conservation tips showed the smallest impact.

As per Jensen et al. (2011), “Small investments typically involve purchasing and installing the gadget and a change of habits requiring time and effort, whereas the financial cost of the investment itself is often small”. It is this kind of change in habits that the electricity saving programmes are designed to induce. But the results from the literature are much more inconclusive. According to Jensen et al. (2011), some studies find that willingness to change habits depends on income, age, education, and household size, but most studies have not found these effects. The only consistent result seems to be that the ownership status of the dwellings has no effect.

In fact, it has been observed by Collins, (2010) that households could also increase their use of electricity if they see that their neighbours are using substantially more than they are”. This phenomenon has been termed as the “Demonstration effect” in the fundamentals of economics. The consumers feel peer pressure to remain in sync with the neighbourhood and hence have to maintain a status level similar to the neighbours.

Reiss & White (2002) recognised that each household faces private costs of reducing consumption in response to the public appeals. Through individual efforts, there remains a virtually zero possibility of bringing about any tangible benefit with respect to the electricity crisis. But what works for individuals is that there exists a considerable incentive to free-ride on whatever efforts are made by others. The nature of individuals’ free-rider problem here and the lack of private incentives

for electricity conservation leave largely “moral suasion”- type arguments to explain their behaviour: consumers individually wanting to “do their part” to mitigate the electricity crisis, and so forth.

Delhi is one of the biggest and most populous metropolitans in the world. The growth in the population, density and the number of households in Delhi over the past three decades is clearly visible from table 1.

Table 1 Population of Delhi (1981-2011)

S.No	Item	1981	1991	2001	2011
1	Total population	6220406	9420644	13850507	16753235
2	Density of Population	4194	6352	9340	11297
3	Number of households	1211784	1860748	2554149	3340538

Source: Directorate of Census operations, Delhi

Along with population and income of Delhi, the domestic electricity consumption and the number of domestic consumers has also increase steadily over the period of 2009-2013 (refer table 2).

Table 2 Domestic Consumption of Electricity in Delhi

S.No	Period	Domestic consumers	Domestic Electricity Consumption (in million units)
1	2009-10	3000383	8753
2	2010-11	3258647	9723
3	2011-12	3464611	10396
4	2012-13	3616611	10796

Source: Delhi Electricity Regulatory Commission (DERC)

Over the period of 2000-11, the share of domestic electricity consumption out of the total electricity consumption of Delhi has gone up from 23% to 25.2%². Over the period of 2006 to 2012, the annual per capita electricity consumption has increased from 671.9 kWh to 879.22 kWh³. This indicates towards an achievement of Delhi’s power sector both in terms of quantum of power supply as well as the efficiency in generation and transmission of power.

Attitude of the consumers and their approach towards the consumption of power mould the consumption pattern of electricity. Awareness towards the scarcity of electricity is one of the factors which determine the attitude of a household for conservation of electricity. Attitude of a consumer

² Ministry of Power/ Central Electricity Authority

³ August Report 2013, CEA

towards the consumption of a good or service is greatly affected by the family culture, habits, lifestyle and awareness.

This paper examines the habits of the household in context of the pattern of electricity consumption in the households. The other section of the paper deals with the awareness level of the households with respect to the raw material required for power generation, impact of power generation on environment etc. This section identifies the awareness level in two parts. Finally, the paper proceeds to the electricity conservation and future intentions of the household in order to highlight the optimal or judicious consumption of power.

Though, electricity has emerged as a major source of improvement of the living standard of the residents of Delhi, very few detailed quantitative estimates exist which provide information on consumer behaviour with respect of electricity consumption.

2. Methodology and Database

Likert scale is applied in order to identify the habits, awareness and intentions of the household. The average score on the likert scale clearly indicates the consumer inclination with respect to various statements pertaining the electricity consumption. Both, the primary and secondary data are used for the present work. The study is undertaken for Delhi wherein the National Capital Region⁴ has been excluded. The data is composed from a number of sources. The respondents, i.e., the households were selected on the basis of stratified random sampling technique. The data is collected through primary survey of 395 households⁵. The data on lifestyle choices, electricity use habits of the households and various socio-demographic variables is collected in order to draw a valid database.

⁴ Gurgaon, Faridabad and Noida.

⁵ A group of persons normally living together and taking food from common kitchen constitute a household. The word 'normally' means that the temporary visitors are excluded. 'Living together' is usually given more importance than 'sharing food from a common kitchen' in drawing the boundaries of a household. (NSS 66th round)

The basic statistics available with census reports, statistical abstracts by the government of NCT of Delhi, CMIE reports, NSS rounds, reports by various government agencies like CEA, DERC, government budgets, economic survey, reports made by NGOs and research institutions have been referred to.

3. Consumer Attitude

In the literature, attitudes have been found to correlate with electricity conservation behaviour. Psychology-based studies show mixed results. As per OECD (2002), mass information has limited success and targeted information campaigns can be more effective.

To examine the attitude of Delhi consumers or households towards the usage of electricity, certain statements were provided for which the respondents were supposed to choose one option out of the following five: Always, Mostly, Occasionally, Rarely and Never. The results are provided below.

1. 83% of families mostly or always switch off the lights and fans when no one is in the room.
2. 75% families mostly or always switch off the TV from power plug after switching off from remote.
3. 68.6% of households rarely or occasionally leave switch on after laptop/mobile is fully charged.
4. 40% of households leave geyser on even after the light of geyser goes off automatically.
5. 65% of households mostly or always use them on power saving mode while 28.6% households occasionally use appliance on power saving mode.
6. 75.7% of households never or rarely talk on phone while TV is on or hold long conversations with the family.
7. 53.2% households never use TV for listening while doing household chores.
8. 24.3% always iron all the pending clothes in one go, while 24.6% mostly do that and 25.6% only occasionally iron all clothes at one stretch.

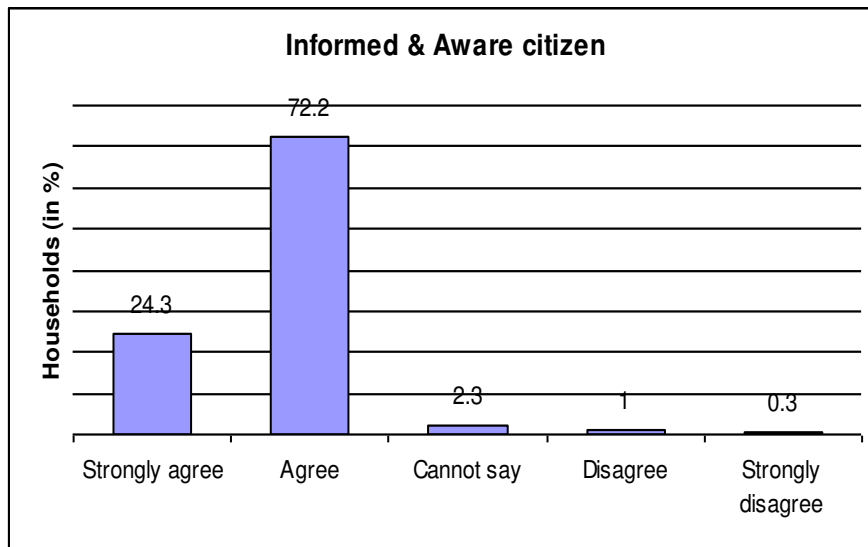
9. 49.1% of the households rarely keep warm food in the fridge but a good proportion of the households i.e. 39.2% never store hot or warm food in the refrigerator.
10. 69% of households mostly or always see BEE label on the appliance before buying it.
11. 21% households occasionally use manuals for appliances while 71.7% mostly or always use manuals.

After going through the above mentioned results, it seems that the habits of a typical household are not too bad in terms of carelessness towards power consumption. However, there are certain areas where corrective measures for the attitude towards electricity are required. Households still have individuals who 1) leave the switch of the TV, laptop charger and geyser “on” when these appliances are not in active use 2) do not refer to the manuals of the appliances before using them 3) switch on the TV and talk over phone or keep doing household chores 4) leave the fans and lights on in the room when there is no one in that room. It is important to probe the awareness level of the households for it will give a better clarity as to why the power consuming attitude still requires improvement.

4. Awareness of the Households

Awareness in general means knowing or being informed. For judicious use of electricity, it is important that the consumers are well aware of the use and misuse of the electricity. The consumers of electricity were asked if they are the informed and aware citizen of the state. The majority of the households i.e. 72.2% agree (refer figure 1) that they are aware and informed and 24.3% strongly agree that they are well informed and aware citizens of the state.

Figure 1 Citizen Awareness



On the other hand a very small percentage of households i.e. 2.3% cannot say whether they are aware and informed or not. This indicates a confused state of the citizens.

To understand the dynamics of power sector and power consumption by households, it is important that the consumers of electricity have a certain level of awareness about the, generation and use of electricity. Hence, the study aims at assessing the awareness level of the households in general and specific to electricity. The awareness of households is assessed and divided into two parts for clear understanding.

4.1 Households' Awareness - I

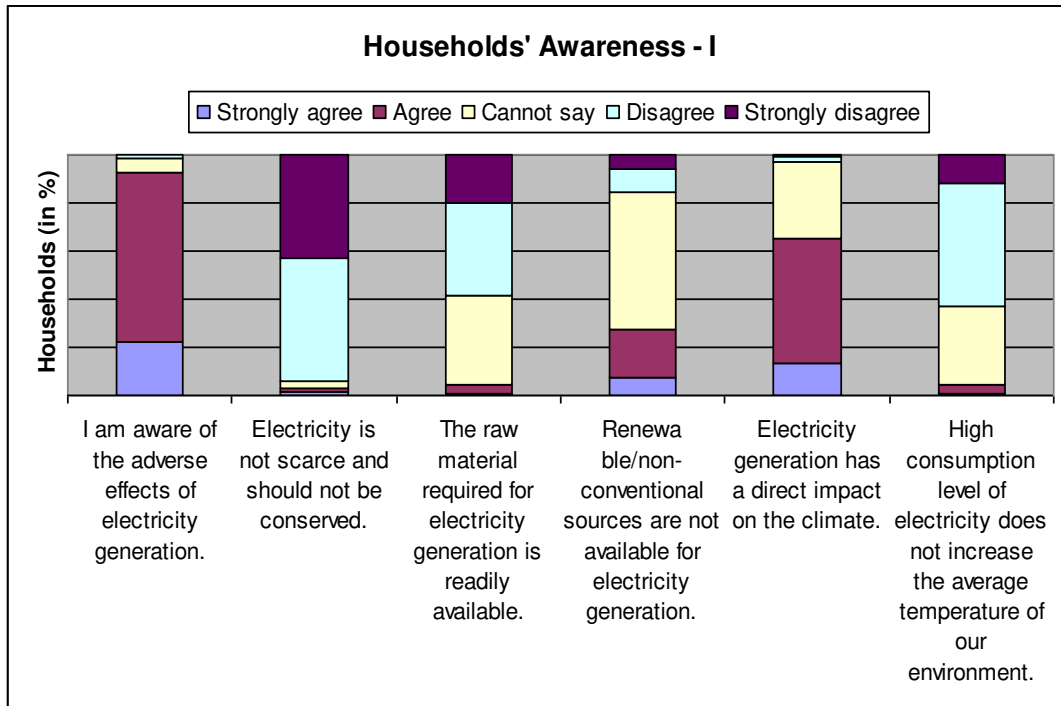
This part deals with the awareness of households related to electricity generation, inputs, implications etc. The response options which were given to the households were strongly agree, agree, cannot say, disagree and strongly disagree. The likert scale provided a great help in analysing the households' responses. The statements asked in the questionnaire have been mentioned below along with their results. As the responses were measured on likert scale, the average or mean score of the likert scale is found and compiled in table 3.

A) I am aware of the adverse effects of electricity generation: The majority of the households (69.9%) agree that they are aware of the fact that the electricity generation has adverse effects. The households which strongly agree to this statement are 22.5% of the total sample. These results indicate that a general household knows that the electricity generation leads to some adverse effects.

B) Electricity is not scarce and should not be conserved: Majority of the households (51.4%) have disagreed to this statement and the second majority i.e. 42.8% strongly disagrees that the electricity is not scarce and should not be conserved. This indicates that the general citizen of the state has a fair understanding of the scarcity of electricity. The households also believe that electricity should be conserved.

C) The raw material required for electricity generation is readily available: The raw material which is largely required for generating electricity comprises of coal (thermal plants) and water (Hydro plants). Only 38.5% of the households disagree and 20.3% of the households strongly disagree that the raw material required for electricity is readily available. But, proportion as high as 36.7% “cannot say” whether the raw material is readily available or not. The figures indicate that the households are not well aware about the availability of the raw material for electricity generation. This is mainly due to the fact that households do not find it important to know the dynamics of the supply side of electricity and are just bothered with the availability of the electricity at their homes.

Figure 2 Households' Awareness-I



D) Renewable/ Non-conventional sources are not available for electricity generation: The results found for this statement are very much in sync with the previous point. The households have a poor level of awareness about the renewable/ non-conventional sources to generate electricity. The majority i.e., 57.2% of the households “cannot say” anything about such sources for electricity generation and only 20% households agree that such sources are not available for electricity generation.

E) Electricity generation has a direct impact on climate: As discussed in the previous chapter, electricity generation has adverse effects on the climate and the environment around us. The majority of households i.e. 51.4% agree and 13.7% strongly agree that the climate gets directly affected by the electricity generation. But an important thing to notice here is that 31.6% of the household “cannot say” that the electricity generation has a direct impact on climate. This again indicates a low level of awareness on the part of households.

Table 3 Mean score of Household Awareness-I

S.No	Statement	SA (%)	A (%)	CS (%)	D (%)	SD (%)	Mean score of likert scale
1	I am aware of the adverse effects of electricity generation.	22.5	69.9	6.3	1.3	0	1.14
2	Electricity is not scarce and should not be conserved.	1.5	1.8	2.5	51.4	42.8	-1.32
3	The raw material required for electricity generation is readily available.	0.8	3.8	36.7	38.5	20.3	-0.74
4	Renewable/non-conventional sources are not available for electricity generation.	7.1	20	57.2	9.9	5.8	0.13
5	Electricity generation has a direct impact on the climate.	13.7	51.4	31.6	2.3	1	0.74
6	High consumption level of electricity does not increase the average temperature of our environment.	0.8	3.8	32.7	51.1	11.6	-0.69

Note: Scores and full forms; SA=Strongly Agree (2), A=Agree (1), CS=Cannot Say (0), D=Disagree (-1) and SD=Strongly Disagree (-2)

F) High consumption level of Electricity does not increase the average temperature of our environment: A majority of households i.e. 51.1% disagree that higher electricity consumption does not increase the average temperature of our environment but on the other hand 32.7% of the households “cannot say” this. Such households either are not able to connect the adverse effects of electricity generation with the effect in average temperature around us or they do not have awareness that the electricity generation can lead to some adverse effects, at first place.

4.2 Households’ Awareness -II

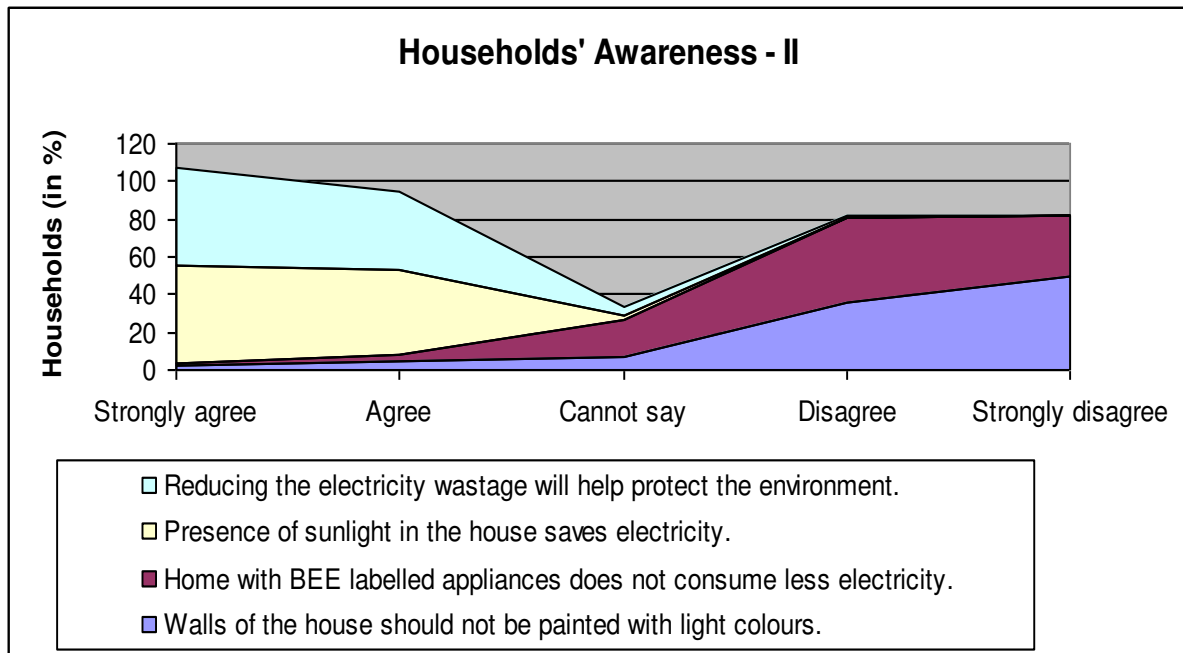
The second category of households’ awareness deals with awareness related with the house and electricity consumption. The statements like a) presence of sunlight in the house saves electricity, b) walls of the house should not be painted with light colours, c) home with BEE labelled appliances does not consume less electricity and d) reducing the electricity wastage will help protect the environment; have been tested with the households in this section. The likert scale was applied for recording the responses of the households. The visual representation is shown in

figure 3 while the mean score of the likert scale along with percentage results are provided in table 2.

A) Presence of sunlight in the house saves electricity: The presence of sunlight in the houses gives enough light in the rooms and due to that less electricity is required in the day time. The majority of the households (51.6%) strongly agree with this fact and 45.8% agree that presence of sunlight in the house saves electricity. Another observation in this context is that many households which do not have windows in certain rooms of their houses or located at the ground-floor in high rise residential complexes or colonies do not get enough sunlight in their houses. Hence the sunlight does not affect the electricity consumption significantly in such cases.

B) Walls of the house should not be painted with light colours: The colours of the walls inside the house affect the reflection of light in the house. It has been commonly observed that a house wherein the walls are painted with light colours reflects more light as compared to the house wherein the walls are painted with dark colours. In the second type of houses, more electricity is consumed to have the same level of brightness in the house/room. The majority of the households i.e. 49.1% strongly disagree and 36.2% of the households disagree with the statement that the walls in the house should not be painted with light colours. This indicates a good level of awareness amongst the households.

Figure 3 Households' Awareness-II



C) Home with BEE labelled appliances does not consume less electricity: BEE labelled appliances are energy efficient appliances. Such appliances consume less electricity to do the same task e.g. BEE labelled TV will consume less electricity when used as compared to a non-BEE labelled TV. The majority of the households i.e. 44.6% disagree and 32.7% strongly disagree that the houses which have BEE labelled appliances do not consume less electricity. These results also indicate a good level of awareness amongst the households with respect to the BEE labelled electrical appliances.

D) Reducing the electricity wastage will help protect the environment: The majority of the households feel that reducing the electricity wastage will help protect the environment. These households are well aware that consumption of electricity has repercussions on environment and hence the electricity consumption shall be reduced through judicious use of electricity. A proportion as high as 52.9% strongly agree and 41.3% of households agree that reducing the electricity wastage will help protect the environment.

Table 4 Mean score of Household Awareness-II

S.No	Statement	SA (%)	A (%)	CS (%)	D (%)	SD (%)	Mean score of likert scale
1	Reducing the electricity wastage will help protect the environment.	52.9	41.3	5.1	0.3	0.3	1.47
2	Presence of sunlight in the house saves electricity.	51.6	45.8	2	0.5	0	1.49
3	Walls of the house should not be painted with light colours.	2.8	4.8	7.1	36.2	49.1	-1.24
4	Home with BEE labelled appliances does not consume less electricity.	0.5	2.8	19.5	44.6	32.7	-1.06

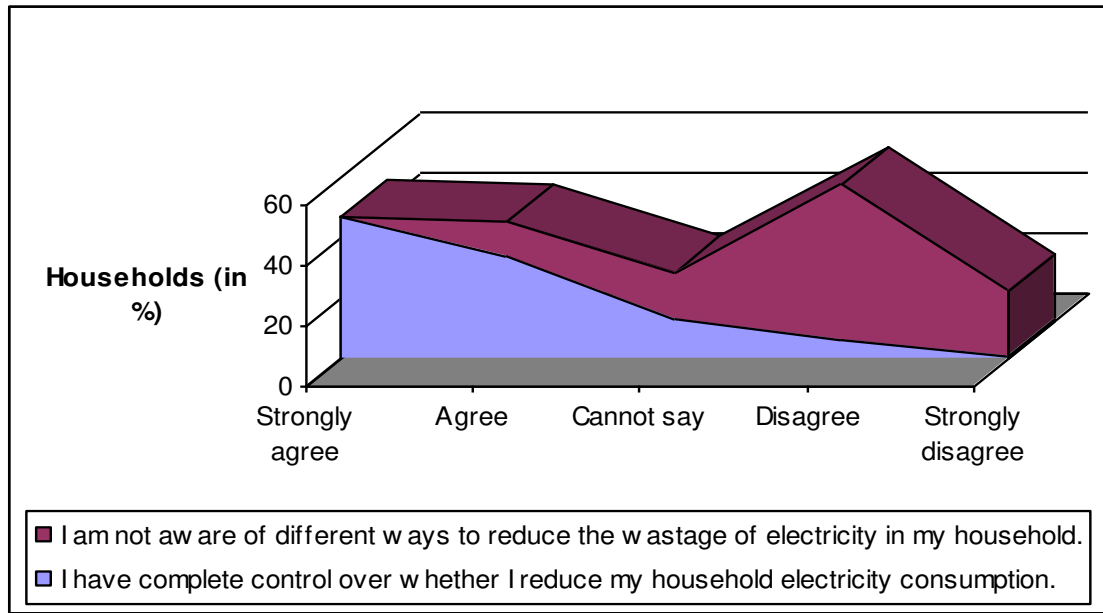
Note: Scores and full forms; SA=Strongly Agree (2), A=Agree (1), CS=Cannot Say (0), D=Disagree (-1) and SD=Strongly Disagree (-2)

5. Electricity Conservation

Over the past few years, electricity being scarce and power failures still prevalent, some households are observing steps to reduce the electricity consumption or to reduce the wasteful usage of electricity. When consumers make decisions to conserve energy – such as; by using less hot water or turning lights off around the house – it is likely they lose some utility by having to expend the extra effort in the conservation. With perfect information relating consumption to cost, they will only conserve when the utility of lowering their bill (and reducing their GHG footprint) outweighs the disutility of using less energy. The present study investigates the steps of conserving electricity by the households in this section.

Majority of the households agree (33.9%) and strongly agree (46.6%) that they have complete control over reducing the household electricity (refer figure 4) and a majority disagrees (51.6%) and strongly disagrees (21.5%) that they are not aware of different ways to reduce the wastage of electricity.

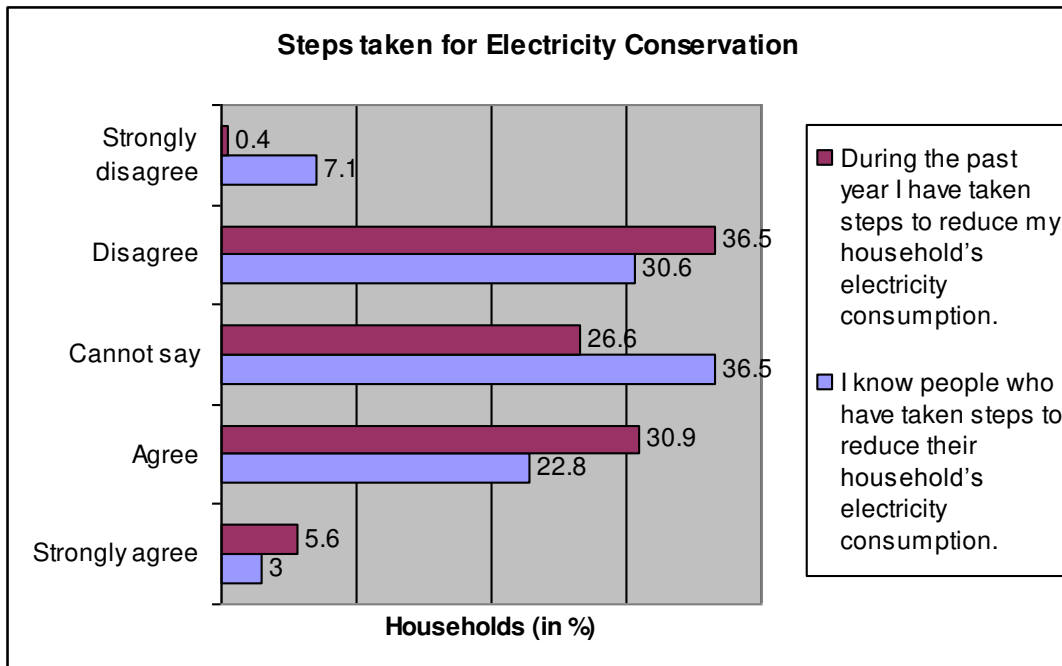
Figure 4 Control and Awareness



Looking at figure 5, we observe that 36.5% of households disagree that they have taken steps to reduce the electricity consumption during the past year, while 26.6% households are uncertain and hence cannot say whether they have taken steps to reduce their electricity consumption. Only 30.9% of the households agreed to have taken electricity conservation steps.

Surroundings of mankind influence the living in many ways. Having people around who take steps to reduce the electricity consumption helps the person in reducing his/her electricity wastage too. Hence, it was asked to the households whether they know people who have taken steps to reduce their electricity consumption. Majority of the households i.e. 36.5% cannot say if they know such people around them. This indicates that they do not come across such families/individuals who take steps for conservation of electricity.

Figure 5 Electricity Conservation Steps

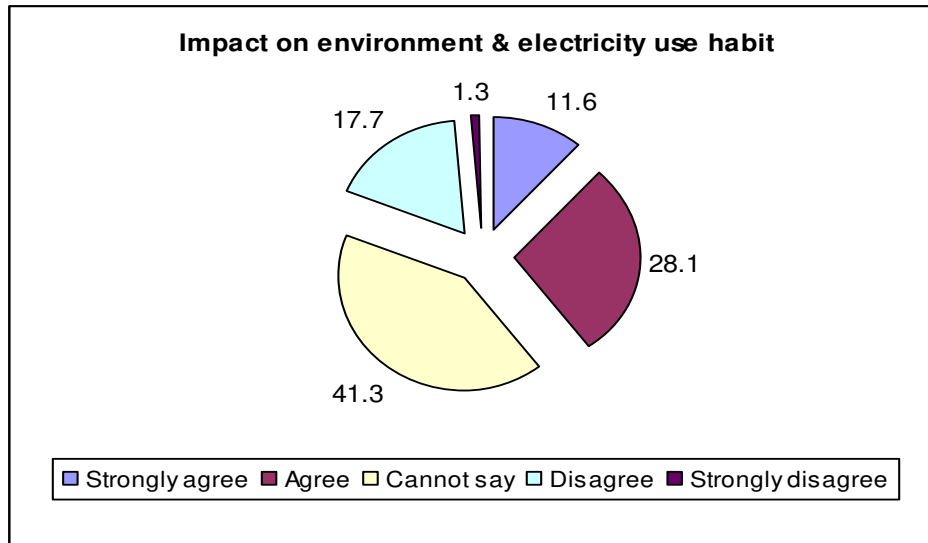


This may also mean that people, in general, are not taking steps to reduce wasteful use of electricity. This is also supported by a result mentioned in the last paragraph where 36.5% of households disagreed that they have taken steps to reduce electricity consumption or wasteful usage.

On the other hand, 20.8% of households agree that they know such people who have taken steps to reduce electricity consumption. We can say that such people are those who agreed to the statement (as mentioned earlier) that they have taken steps to reduce the electricity consumption. Now, let us discuss few statements in the same context which were provided to the respondents along with response options. The results are provided along with each statement.

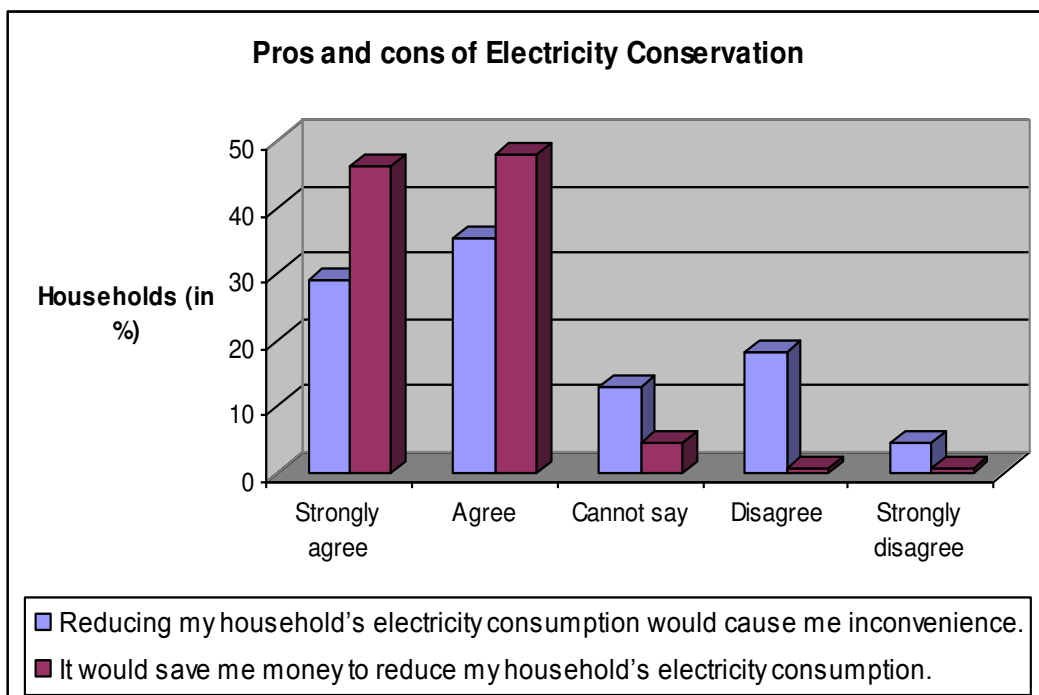
A) Impact on environment acts as a motivator to change the electricity use habit of the households: Majority of the households cannot say that the impact of electricity generation on environment acts as a motivator to change their habits in context of electricity consumption while 28.1% of the households strongly disagree that the impact on environment acts as a motivator to use the electricity more judiciously.

Figure 6 Environmental Impact as Motivation



B) Pros and cons of electricity conservation: The households were enquired about the outcomes of their taking steps in order to conserve the electricity. It was observed that the drawback of conserving electricity is that the households will have to bear certain level of inconvenience while doing so. The merit is that the households will save money if they reduce their electricity as the electricity bill amount will be less.

Figure 7 Pros & Cons of Electricity Conservation



The majority of households agree (48.1%) and strongly agree (46.1%) that they will save some money if they choose to reduce the electricity consumption for their household. But, the majority also agrees (35.4%) and strongly agrees (29.1%) with the statement that they will be caused inconvenience if they reduce the electricity consumption. But, an important thing to notice here is that 18.2% of households disagree that reducing their electricity consumption will cause them inconvenience.

5.1 Issues in Collective action

Public appeals for energy conservation by government officials have a long history in times of energy crises. Reiss and White (2008) found that the households' electricity consumption fell quite substantially when prices were not changing. It was attributed to the influence of public appeals on the citizens. But, in economic terms, voluntary conservation is a collective-action problem which is subject to extreme free-rider issues. Substantial benefits accrue only if the aggregate consumer participation is high, and no one can be excluded from the benefits of collective success.

The major hindrance is that the chance of any single household's effort being pivotal in averting a power blackout is very small. The main idea is that each household faces private costs of reducing electricity consumption in response to the public appeals which means there is a virtually zero possibility of bringing about any substantial benefit with respect to the power crisis through individual household effort. In other words, there lies a considerable incentive to free-ride on whatever efforts are made by other individuals or households.

In these respects, voluntarily conserving electricity in response to public appeals is like contributing anonymously to a public good. The reason behind this anonymity is that there is no real way to know whether a particular household is conserving electricity or not, even among our immediate neighbours. The nature of individuals' free-rider problem here and the lack of private

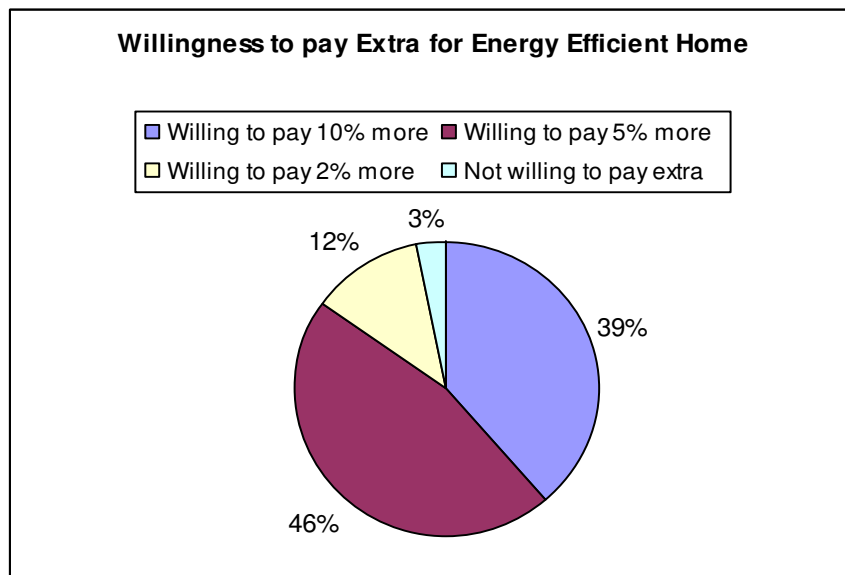
incentives for electricity conservation largely lead to the “moral suasion”- type arguments in order to explain the noted behaviour. The households are individually wanting to “do their part” to mitigate the electricity crisis but are not incentivised in a visible manner.

5.2 Households’ Intentions

A few questions in the questionnaire aimed at knowing the intentions of the households in context of electricity conservation.

A) Willingness to pay extra for an energy efficient home: The households were asked if they would be willing to pay some extra amount on the price of a house which is energy efficient. It was observed that 46% of the households were willing to pay 5% more on the price of the energy efficient house while 39% households are willing to pay even 10% over and above the cost of such house (see figure 8). Only 3% of the sample households indicated that they are not willing to pay higher price for an energy efficient home.

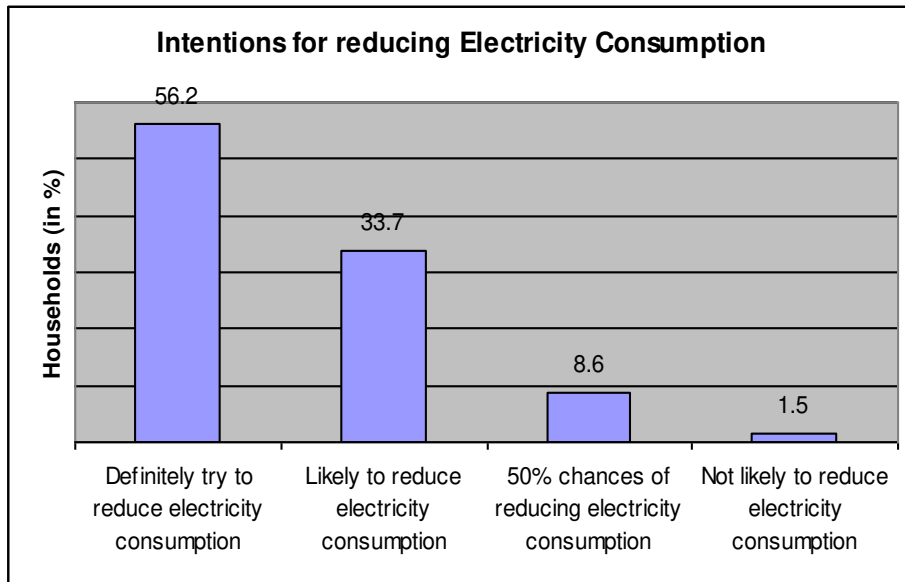
Figure 8 Willingness to pay for Energy Efficient Home



B) Intentions of reducing electricity consumption: The households were asked about the intentions of reducing their electricity consumption in the coming year. It was observed that 56.2%

of the households will definitely try to reduce the electricity consumption while 33.7% of households would likely reduce the electricity consumed in their households.

Figure 9 Intentions to reduce Electricity Consumption



It was observed during the data collection that the people who already use less electricity, women, and people with more pro-environmental beliefs, attitudes and past behaviour have stronger intentions to reduce their electricity consumption. On the other hand, people with higher levels of knowledge tend to polarise. They report either very high or very low intentions to reduce consumption. These results are found in sync with previous findings and with psychological theory.

6. Conclusion

This paper assessed the attitude and awareness of households as electricity consumers. The paper enabled us to know the lifestyle, habits and approach towards electricity consumption for a typical household of Delhi. It is evident that the consumers need to take further steps for electricity conservation. The households are also required to reduce electricity consumption by judicious use of electricity. The lifestyle of households is as such that all the modern appliances are fitted or owned by the households. This makes it convenient for the family members to consume electricity at the flick of a switch.

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