

ELECTRICITY CONSUMPTION PATTERN OF THE ORDINARY HOUSEHOLDS IN KERALA

Dr Jojo K Joseph (M Com, B Ed, Ph D)

Associate Professor and Head, Research and Post Graduate Department of Commerce,
Marian College Kuttikkanam [Autonomous], 685 531, Kerala [India]

ABSTRACT

Kerala which is a state in the southern corner of India depends heavily on electricity for its energy needs. Earlier the Kerala was a supplier of electricity generated mainly through its hydro electric projects. But now the state has turned to be a borrower of electric power especially in summer. The state has been unsuccessful in matching the steep increase in electricity consumption with a corresponding increase in production. Since the availability of electricity from outside is scarce and expensive, an alternate option the state now trying is reducing the consumption by the stakeholders. This article is the result of a study done in this context, focusing on the consumer behaviour of the end users of electricity in the ordinary households of the state. The study take into account three major factors related to the issue viz. awareness of the consumers about the extent of their electricity consumption, consumer behaviour in electricity consumption and the usage pattern of the consumers in the case of electric gadgets which consume relatively more electricity. These factors of the study were analysed through the primary data collected on fifteen relevant variables from 207 sample respondents from different parts of the state. The study points out to the lack of consumer awareness regarding the need to reduce electricity consumption and practical ways of reducing consumption.

Keywords: Awareness, Consumer Behaviour, Consumption, Electricity, Kerala, Power, Usage Pattern

1. INTRODUCTION

The world can exist and progress only with sufficient quantum of energy. It is alarming that available energy sources are fast depleting in nature. Researches are going on round the globe to identify new sources of energy as well as to device ways and means to reduce energy consumption by mankind. Electricity is a major type of energy source. Reducing electricity consumption is equivalent to generating it. Behaviour of consumers using electricity decides whether they save it or waste it.

2. REVIEW OF LITERATURE

For the purpose of identifying the research gap, understanding the major factors and the variable of the study and to have an assessment of the earlier studies undertaken in this field, a detailed review of literature was conducted. The important ones from them pointing towards the research gap are discussed and listed here. "Household energy consumption in the UK" (Jackson, 2003) is a research paper which explores patterns of UK household energy use and associated carbon emissions at national level. The study found that the usage of refrigerators and air conditioners result in excessive emission of carbon dioxide compared to other appliances. "The effectiveness of feedback on energy consumption"(Darby S. , 2004) is a study about the domestic energy use which is invisible to the users most of the time. Most people have only a vague idea of how much energy they are using for different purposes and what sort of difference they could make by changing day-to-day behaviour or investing in efficiency measures. "The relation between energy consumption, energy prices and economic growth" (Adjaye, 2006), is a research paper which estimates the casual relationships between energy consumption and national income of India, using co-integration and error-correction modelling techniques. The paper shows how the electricity consumption contributes to the national growth."Saving earth" (Stone, 2008), studies the factors that increase the consumption of electricity in Canadian households. The author gives his views about how to reduce the use of such factors. The author points out that the climate of our planet earth is affected as a result of over consumption of electricity. The study concludes by suggesting ways to save electricity consumption."Effect of day light saving time on lighting energy use" (Newsham, 2008), is a study that presents a review concerning the effects of day light saving time on energy use in Malaysia. Simple estimates suggest a reduction in national electricity use of around 0.5% as a result of residential lighting reduction."Energy demand research project" (Darby, 2011), is a paper that provides a context for understanding the Energy Demand Research Project [EDRP] trials, by looking at the results of comparable experiments and trials around the world. It covers a broad range of trials, but emphasises those that have been carried out in the most 'real life' conditions."Electricity use and income" (Atamturk, 2012) reveals the relationship between residential electricity demand and income which helps in better understanding on welfare implications of various policies. According to the California Residential Appliance Saturation Study(California Energy Commission, 2017)there is a positive correlation between electricity use and income. "House hold energy consumption, conservation and efficiency" (Grantham, 2013), makes a basic overview of the Solar City in Alice Springs. This study examines socio-demographic correlations with energy use, methods for altering household energy consumption and attitude and behaviour of people in the consumption of electricity. "An econometric study of energy consumption" (Halicioglu, 2005)attempts to examine causal relationships between carbon emissions, energy consumption and income in the case of Turkey for the period 1960-2005.The study also examine the relationship between

electricity consumption and carbon emissions. It concludes that the variables examined are interrelated and any change in one variable will proportionately affect the other variables.

3. STATEMENT OF THE PROBLEM

Kerala is a state whose primary energy source is electricity generated from its hydro-electric projects. Till mid 1980's Kerala was a state with excess supply of electricity which it used to sell to its neighbouring states. But from 1985 onwards the trend started reversing mainly due to the unprecedented increase of household users basically due to the massive home electrification campaigns by the state government. Currently the state faces acute shortage of electricity in summer especially in the years of monsoon failures. Adding fuel to the fire misuse of electricity by the consumers, lack of awareness of the people regarding the need to save electricity, increased usage of modern electric gadgets and home appliances etc makes the crisis much worse. Many a times the government and Kerala State Electricity Board [KSEB] which is the monopoly electricity supplier in the state are forced to increase the tariff rates, impose power cuts and load shedding etc.

The total installed capacity of hydro-electricity of KSEB as on 31.10. 2016 was 2880.18 Mega Watt [MW] and the corresponding demand was 3860 MW (www.kseb.in, 2018). That means there is a shortage of 979.82 MW of power. The government is trying to combat this mismatch between demand and supply of electricity in several ways. One major initiative is persuading the end users in the households to reduce their electricity consumption, avoid wastages in its use and adopt alternate sources of energy.

The review of the available literature revealed that a research has not been conducted among the household electricity consumers of Kerala regarding their usage pattern so as to ascertain the possibility of power savings or reduction in consumption. It is in this context that this research is done to evaluate different dimensions of the consumer behaviour of end users of electricity in the ordinary households of Kerala. This paper is to fill the existing research gap by adding inputs to the growing body of knowledge.

4. OBJECTIVES OF THE STUDY

The main objective of the study is to identify and evaluate the electricity consumption pattern of the end users in the ordinary households of Kerala State. To achieve this main objective, the following specific objectives are identified and studied.

Specific Objectives

1. To ascertain the awareness of the consumers regarding different dimensions of their electricity consumption.

2. To understand the pattern of consumer behaviour of people in Kerala regarding their electricity consumption.
3. To identify consumer's usage pattern of various home appliances which consume relatively more electricity.

5. FACTORS AND VARIABLES INCLUDED IN THE STUDY

The consumer behaviour in any area is dependent on several aspects. The consumer behaviour in electricity consumption could be influenced by a number of factors. Out of such several factors this study deals with three major factors [F 1-3] which are constituted by 15 relevant variables [V 1-15]. Table 1 shows the details.

Table 1: Factors and variables included in the study

Name of the Factor	Variables Constituting the Factor
Awareness about the Extent of Electricity Consumption [F₁]	Monthly electricity consumption [V ₁]
	Number of light points in the house [V ₂]
	Main type of lights bulbs used [V ₃]
	Type of appliances used in the households[V ₄]
	Co-operation of the family members[V ₅]
Consumer Behaviour in Electricity Consumption[F₂]	Switching off lights when not in use [V ₆]
	Turning off equipment after use [V ₇]
	Switching off refrigerator during peak hours [V ₈]
	Occasional cleaning of light bulbs [V ₉]
	Use of solar energy [V ₁₀]
	Willingness to save energy [V ₁₁]
Usage Pattern of Gadgets which Consume More Electricity[F₃]	Usage of invertors [V ₁₂]
	Usage of motor pumps [V ₁₃]
	Usage of iron boxes [V ₁₄]
	Usage of induction cookers[V ₁₅]

Source: Compiled by the researcher

6. RESEARCH METHODOLOGY

This study is exploratory in nature and was conducted mostly based on primary data. It was conducted during the period of January to September 2017. The responses of the end users in the households of Kerala State who have electricity connection in their house serve as the source for primary data.

The data was collected from people living in the northern, central and southern parts of the state who were identified through stratified convenient sampling method. The responses of 207 sample respondents were collected by using a pre tested structured interview schedule. Before finalising the interview schedule a pilot study was conducted among 35 respondents. Based on the result of the pilot study the interview schedule was modified by including suitable questions and eliminating the unnecessary ones.

The collected primary data was fed into computer in Microsoft Excel. The data so entered was primarily subjected to percentage analysis by using Excel and outputs were extracted in the form of tables. From the many tables so derived only very few highly relevant tables are presented in this article. Inferences derived from the analysis are given below each variable.

7. ANALYSIS OF THE DATA, DISCUSSION AND INFERENCE

The following part presents the summary of the analysis of the collected primary data along with the discussions leading to the emergence of suitable inferences out of them.

Profile of the Respondents

Table number 2 shows the profile the sample respondents the study.

Table 2: Profile of the respondents of the study

Basis of classification	Category	No. of respondents	Percentage
Age	30- 50 years	114	55.1
	51-70 years	93	44.9
	Total	207	100.0
Gender	Male	108	52.2
	Female	99	47.8
	Total	207	100.0
Occupational status	Self employed	102	49.3
	Employed	105	50.7
	Total	207	100.0
Education level	Up to Plus Two	102	49.3

	Graduation and above	105	50.7
	Total	207	100.0
Monthly income	Rs. 30,000 and below	93	44.9
	Rs. 30,001 and above	114	55.1
	Total	207	100.0

Source: Compiled by the researcher from survey data

Discussion and Inference

From table 2 it can be seen that all the 207 respondents are matured persons whose age falls between 30 and 70 years. In the sample male and female respondents are more over equal in proportion. All of them are occupied through self-employment in business, agriculture etc or employed in government as well as private sector. In the case of education half of the respondents possess graduation or higher qualification. Regarding income 55 % of them have Rs.30,000 or more as earnings per month. All these attributes of the respondents contribute to the fact that the responses given by them would be relatively more accurate and dependable.

7.1 AWARENESS ABOUT THE EXTENT OF HOUSEHOLD ELECTRICITY CONSUMPTION [F₁]

This part of the articles deals with the variables which are indicative of the awareness level of the consumers regarding their electricity consumption.

Monthly Electricity Consumption [V₁]

Table3 shows the expenses incurred by the respondents in the form of their monthly electricity bill.

Table 3: Amount of monthly electricity bill for the respondents

Electricity bill [Rs]	No. of respondents	Percentage
Less than 500	54	26.1
501 to 1000	81	39.1
1001 to 1500	30	14.5
1501 to 2000	30	14.5
Above2001	12	5.8

Total	207	100.0
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Source: Survey data

Discussion and Inference

From table 3 it can be seen that 81 respondents whose monthly electricity bill falls between Rs. 501 and 1,000 forms the bigger category followed by the 54 respondents whose monthly electricity expenditure is less than Rs. 500. When these two classes of respondents are taken together [81+54=135] they become 65.2%. This leads to the inference that almost two-third majority of consumers in Kerala have a monthly electricity consumption of less than Rs. 1,000. The remaining 72 consumers who together form 34.8% are consuming relatively higher quantum of electricity.

Number of Light Points at Home [V₂]

The following table shows the number of light points in ordinary households of the State.

Table 4: Number of light points at home

Number of light points	No. of respondents	Percentage
1 to 5	3	1.4
6 to 10	33	15.9
11 to 15	69	33.3
16 to 20	60	29.0
Above 20	42	20.4
Total	207	100.0

Source: Survey data

Discussion and Inference

Table 4 indicates that only a very negligible part [1.4%] of respondent have less than 5 light points in their house and another 15.9% have light points between 6 and 10. Taking the cumulative total of these two groups, it comes to only 17.3% which is almost one-sixth of the total respondents. On the other hand the remaining respondent groups with more than 10 light points in their house comes to a highly significant figure of [33.3+29+20.4] 82.7%.

The inference emerging from the above analysis is that a very significant majority of the ordinary households in Kerala have considerable number of light points in their house. Hence only if these respondents show interest in reducing their electricity consumption there can be any notable electricity saving in the state. This points out to the need for suitable strategies to create awareness among customers having more light points in their houses to reduce their consumption.

Main Type of Lights Used [V₃]

The following table shows the particulars of the main type of lights used by the respondents in their houses.

Table 5: Different types of light used in households

Type of lights	Number of lights	Percentage
Incandescent	21	10.1
Tube Lights	45	21.7
CFL	123	59.4
LED	18	8.8
Total	207	100.0

Source: Survey data

Discussion and Inference

CFL bulbs consume less electricity when compared to other types of light bulbs except LED. From the above table it is clear that for majority of the households [59.4%] CFL is their main type of light bulbs. The indication is that people are aware of the impact of CFLs on reducing their electricity consumption and thereby getting savings on the electricity bill. One important reason for this awareness and consumer behaviour is the advertisements and other publicity campaigns organised by the manufacturers of CFLs and the state government. It is a welcome sign that 8.8% people have started using LED lights which are the most energy efficient light bulbs currently available in the market. At the same time there are another 10.1% people who are continuing with their incandescent bulbs which are very low in energy efficiency. This issue calls for special attention and appropriate action.

Type of Appliances Used in the Households [V₄]

The following table shows the common type of home appliances used in Kerala and the number of households having them.

Table 6: Commonly used home appliances and no. of houses having them

Type of appliances	No. of households	Percentage
Mixer Grinder [Mixy]	207	100
Refrigerator	207	100
Motor pump	204	98.6
Iron box	195	94.2
Washing machine	187	88.4
Induction cooker	145	70
Microwave oven	117	56.5
Inverter	93	44.9
Air conditioner	41	19.8

Source: Survey data

Discussion and Inference

From the above table it can be seen that more than three-fourth the houses have appliances like mixy [100%], refrigerator [100%], motor pump [98.6%], iron box [94.2%], and washing machine [88.4%]. More than half of them have induction cooker [70%] and microwave oven [56.5%]. Just less than half of the respondents have inverter. Air conditioner is the lone item that very few [19.8%] only have. The indication is that majority of the houses have a good number of electricity consuming appliances which calls for responsible usage of them.

Co-operation of the family members [V₅]

Electricity can be saved only with the cooperation of all the members of the family. This is especially so when most of the houses in the state have many electric gadgets and light points. The study revealed that only in 78 families [37.7%] all the members are co-operating very consciously in reducing electricity consumption. In the case of a majority of 105 families [50.7%] though there is the co-operation of family members, it is not very conscious, regular and earnest. In the case of the remaining 24 respondents [11.6%] there is no co-operation of the family members in this regard. This calls for the creation of awareness to all members of the family regarding their role in energy saving efforts.

7.2 CONSUMER BEHAVIOUR IN ELECTRICITY CONSUMPTION [F₂]

Under this factor the article deals with the variables which exhibit the consumer's behaviour regarding the pattern of their electricity consumption.

Switching off the lights when not in use [V6]

Table 7 shows the summary of responses given by the respondents regarding their usual behaviour regarding switching off lights which are on when they leave a room.

Table 7: Behaviour pattern of switching off the lights

Switching off lights after use	Number of respondents	Percentage
Always	78	37.7
Sometimes	117	56.5
Never	12	5.8
Total	207	100.0

Source: Survey data

Discussion and Inference

The table 7 shows that only 78 respondents [37.7%] have the practice of always switching off the lights when they leave the room. 117 respondents who form the majority [56.5%] resort to this practice only sometimes. The remaining 12 respondents [5.8%] never bother to have such a practice. Those who are not switching off the light may not be aware that they are wasting valuable energy through their behaviour. This clearly indicates the need for creating awareness among ordinary households of Kerala in switching off lights when not in need and there by save energy.

Turning off the electronic equipments after use [V7]

Turning off the electronic equipments like desk top computers, laptops, TV, music systems, game consoles etc after its use can result in reducing electricity consumption. The study revealed that 117 respondents who form the majority [56.5%] practise the habit of turning off their electronic equipments after use. For the remaining 90 persons [43.5%] this is not a regular practise. They sometimes switch off these devices or many a times leave them unattended after use. This gives scope for educating these respondents and thereby reducing electricity consumption to a greater extent.

Turning off refrigerators at peak hours [V8]

In Kerala 6pm to 10 pm is the peak hours of electricity consumption. In the case of refrigerators even if they are turned off for one or two hours in the evening it will not affect the materials kept

inside. Based on this fact the state electricity board had undertaken an awareness campaign in the past few years through the print and electronic media using celebrities from film and sports field. This study attempted to understand the consumer behaviour of families in this regard.

The analysis of the responses received showed that only 12 families [5.8%] are actually practicing the habit of switching off their refrigerators at peak consumption hours. 72 respondents [34.8%] revealed that they do it at times. A majority of 123 respondents [59.4%] opined that they never resort to this type of a practice and are unaware of such a practise and its impact on electricity savings. This leads to the inference that creation of consumer awareness is needed to reduce their electricity usage at the peak hours.

Occasional cleaning of light bulbs [V₉]

Keeping the light bulbs clean and tidy can result in better illumination which will then reduce the number of light points need to be used at a given time. The study revealed that most of the consumers do not know about this fact. It was found that only 9 respondents [4.3%] adopt the practise of regularly cleaning their light bulbs. Of the remaining respondents half of them [47.8%] resort to this practice at times and an equal number of respondents never have this custom. This points out to the need for creating awareness among the consumers in this regard.

Useof solar energy [V₁₀]

Usage of solar energy is assuming popularity as an alternate source for electricity. The state government has initiated several promotional measures and incentives for popularising the use of solar energy. From this study it was understood that only 27 families [13%] are making use of solar energy for lighting. Efforts shall be further strengthened to bring more and more families adopting the use of solar energy.

Willingness to save electricity [V₁₁]

One major problem in reducing energy consumption is the lack of awareness of the consumers regarding the various ways and means to do so without much disturbing their daily life. In this study as much as 156 respondents [75.4%] agreed that they would save electricity if they knew how to do it without much inconveniences to them. But at the same time the remaining 51 respondents [24.6%] were not willing to reduce their electricity consumption at any cost. These findings uphold the need for educating the customers regarding the ways and means of saving electricity as well as the necessity for it.

7.3 USAGE PATTERN OF GADGETS WHICH CONSUME MORE ELECTRICITY [F₃]

Since some of the home appliances consume reasonably good amount of power the pattern of consumer behaviour in the case of these gadgets assumes significance. This part deals with the

study of the factor and its variables which exhibit the usage pattern consumer behaviour in the case of those family gadgets which consume relatively more electricity. The important observations derived through studying the usage pattern of four such appliances are presented below.

Usage of inverters [V₁₂]

Inverters which are used for electricity backup when the normal power supply goes off consume more electricity to charge it. Therefore the use of inverters has a negative impact on energy conservation. The study showed that only a minority of 93 respondents [44.9%] have inverter and a majority of 114 families [55.1%] do not have it at home since it is expensive. This is a welcome trend which if sustained would contribute to energy savings indirectly.

Usage of motor pumps [V₁₃]

More than half [52.9%] of the households use their motor pumps once in a day. Of the remaining 41.4% use motor pumps twice a day and the balance 5.7% pump water thrice a day. This points out to the need for educating the people to be more conservative in using motor pump so as to save electricity.

Usage of iron boxes [V₁₄]

Iron boxes consume good amount of electric power. Ironing cloths which is a common activity in all households consumes a lot of electricity especially when it is done frequently. During the survey 62 families [30%] were found to observe a healthy habit of scheduling the use of iron box once in a week and save electricity. 7 respondents [3.4%] iron clothes twice a week and 10 of them [4.8%] thrice a week. But a larger number of 92 respondent families [44.4 %] were found using iron box several times daily. Hence the inference is that most of the people are either unaware of the fact that piecemeal ironing of clothes leads to increase in electricity consumption or they are not bothered about electricity consumption for the sake of their convenience.

Usage of induction cookers [V₁₅]

Of the 145 households having induction cooker 45% of them are frequently making use of it every day, 40% use it occasionally and the rest seldom use it. The use of induction cookers significantly add to household electricity bills which calls for suitable awareness creation.

8. SUGGESTIONS BASED ON THE FINDINGS OF THE STUDY

End users of electricity in the ordinary households of Kerala need better awareness in areas like the need for reducing electricity consumption, various practical ways of saving electricity, responsible usage pattern of home appliances etc. Since electricity saved is equal to electricity

generated incentives shall be offered to those consumers who reduce their electricity consumption. Suitable promotional strategies shall be adopted to replace the incandescent light bulbs at the houses with CFL's. The use of energy efficient star rated home appliance shall be promoted. The installation of mini biogas plants at home which produces energy by using household wastes shall be promoted as a substitute for induction cookers. The use of solar energy or wind energy shall be promoted as means of reducing the dependability on electricity. Solar panels shall be made advisable for houses above a particular square feet limit.

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