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"Household Electricity Consumption Behaviour of Ranchi"

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Abstract: The Indian economy has hit a snag because of the country's ongoing energy problems. Higher disposable incomes and new patterns of work, play, and behaviour are spurring rapid alterations in way of life. Being the state capital, Ranchi city's residential sector uses a considerable amount of electricity. This study delves to gain an understanding of the relationship between energy consumption in urban households and the various factors that influence it. A strong link exists between the amount of energy used and the number of appliances a household owns. The number of people living in a home has a direct correlation to the number of appliances, rooms, windows, and doors that are owned by that family. Increased needs, appliance running times, and high heat gain and loss through openings may be to blame for this trend. In light of the rapid increase in the population and high standard of living in the Indian community, more energy consumption is expected in the near future. It was found that energy use is influenced by a household's population size as well as its socioeconomic standing. Additionally, households with air conditioning use more energy overall than those without it, which may be related to their higher socioeconomic status. Season, neighbourhood, socioeconomic status, and type of residence all affect peak demand and electricity consumption differently.

Keywords: Consumption behaviour, Members of household, Appliances, Electricity, Household

I. INTRODUCTION

Since the year 2000, India's per capita electricity consumption has increased threefold. In 2001, 55% of households had access to electricity; in 2017, that figure has risen to more than 80%.The amount of electricity used in the homes of Assam, Bihar, Chhattisgarh, and Jharkhand residents increased rapidly between 2004 and 2015 (about 11 percent -16 percent). Since 2015, the percentage of rural Jharkhand households that use grid electricity as their primary light source has tripled, from 20% to 60%. In contrast, the rate of household electrification has risen from 64% to 83% over the same period. In other words, electricity supply has improved enough to meet the majority of

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domestic lighting needs. The use of kerosene has dramatically changed in the last three years. The percentage of households that use kerosene as their primary source of lighting has decreased from 76% in 2015 to 34% in 2018.

The people of Jharkhand face serious problems with the access and affordability of electricity and the available alternatives to coal. As of 2021, there has been a slight increase in access to electricity (whether from the grid, solar home system, diesel generator, or micro grid) from 87percent to 89 percent, but universal electrification is still a long way from being achieved. It is true that the amount of time that electricity is available for use has increased (from nine to twelve hours daily) as has the accuracy of the metres used to measure it (from 51% to 75%). Moreover, there has also been a decrease in the number of connections provided through SAUBHAGYA (a government programme aimed at providing last mile connectivity to households without electricity). A city's electricity development and management relies heavily on the demand for electricity. Many factors influence the amount of electricity needed. The primary goal of this investigation is to identify the variables that have an impact on Ranchi's domestic electricity supply. It is the goal of this research to find out how much of a difference households can make in terms of how much electricity they use.

LITERATURE REVIEW

Consumers' willingness to change their habits and save electricity is relevant to the current investigation. Attitudes toward electricity conservation have been linked in research, but the results of these psychological studies have been mixed. The findings of Collins (2010) investigation into consumer attitudes and behaviour are noteworthy. The study observed that reduced electricity consumption is more likely to be a goal for those who already use less electricity, women, and those with pro-environmental beliefs, attitudes, and past behaviours. People with more education were more likely to fall into one of two extremes when it came to their desire to cut back on their consumption: either very high or very low. The typical home user has become accustomed to passively consuming electricity. It is difficult for this consumer to connect their daily activities to specific amounts of electricity consumption because electricity has an invisible quality; it arrives in the household through hidden wires and is consumed as part of daily life and routine (Hargreaves et al., 2010). Darby et al., (2006) found that the vast majority of people in their homes have no idea how much electricity they actually use on a daily basis for various purposes. Lighting and other readily apparent, low-electricity uses are frequently overestimated, while the electricity consumption of less obvious, high-electricity uses is frequently underestimated (Attari et al., 2010).

In addition, the vast majority of residential

customers are charged a fixed rate for their electricity. It doesn't matter when a customer uses electricity; all of their kilowatt hours (kWh) are charged at the same fixed price, regardless of when they use it. However, the production costs of these two kWh are not the same. It is significantly more expensive to produce and distribute the kWh used at peak times (Faruqui, 2012). Comparing a single snapshot of electricity consumption with data on the size of the household, the number of electricity-consuming appliances owned and used, and consumption habits reveals a relationship betweenhousehold activities and electricity consumption (Misra, 1995). The weather is well-known to have a significant impact on how much electricity is used. Increase in the winter mean temperature will reduce the demand for heating electricity as a result of global warming. Evidence suggests that the number of hot spells is increasing. There will be an increase in cooling degree days and a decrease in heating degree days as a result (Reddy and Srinivas, 2009).

METHODOLOGY

A questionnaire with 42 questions was used to gather data on a variety of topics, including the size of the household, the resources available, the amount of energy consumed, the presence and use of electrical appliances, and other patterns of behaviour. The total number of urban households that were surveyed was 100. The survey was divided into four phases: spring (February–April), summer (May–June), monsoon (July–October), and winter (November–January). In this research, the participants were divided into groups based on their intended use – for example: artificial lighting or for food preparation or cooling or heating or for entertainment or for washing clothes. To get an idea of how much electricity was used, we multiplied the wattage by the time it was in use. The electricity consumption of these appliances was assumed to be constant throughout the operating period. Mean, standard deviation, and Pearson correlation coefficients were used to calculate the statistical data.

PATTERNS OF ELECTRICITY CONSUMPTION

An important target group for electricity conservation is households. The objective of the current study is to systematically investigate the relationship between various forms of electricity use and savings and various behavioural antecedents, with a focus on the relative significance of socio-demographic variables. These elements and their relative importance are covered in detail in the following subsections.

The Populace

It was found that household income, the size of the household, and the composition of the household all had an impact on how much electricity was consumed. Teenage families use more electricity, possibly because they have more appliances that use a lot of electricity. Additionally, elderly households

use less electricity than middle-aged couples, likely as a result of having less electricity-intensive appliances. Although it has been noted that newer homes have more electricity-efficient features, the consumption did not decrease because of the larger number of appliances. Houses use roughly 70% more electricity than residential apartments per square foot. Higher income households tend to have higher consumption levels and exhibit less demand elasticity. Additionally, it was found that households with rising incomes may becorrelated with the ownership of inelastic appliances. However, there is only a very weak correlation, if any, between income and ownership of energy-intensive appliances.

People of higher socioeconomic status were observed to own a greater number of electric appliances, some of which may have lower electricity requirements. On the other hand, the trend among people living in poverty was the exact opposite, with more people using older technology that had a lower rating for its electricity efficiency. In addition, the influence of the ages of the people living in the household is documented: families with teenagers have a higher rate of electricity consumption. The need for space heating and cooling for longer periods of time during the day in homes with very elderly or very young occupants is primarily driven by the need to address health concerns. It was also observed that younger women have a higher rate of electricity consumption compared to older women.

Societal Aspects

People's attitudes change depending on the type of energy they consume. After discussing with the consumers, it is believed that the addition of feedback on peer usage to the utility bills of customers (typically their neighbours) could have a positive impact on lowering overall consumption. It is also believed that frequent billing would reduce the amount of electricity that is consumed in comparison to bills that were based on readings taken from electricity metres at quarterly intervals. This can be done so that customers could validate their actions and optimise their consumption. It is also suggested that feedback should only be delivered to households that use a significant amount of electricity. Because of the income effect, one more interesting finding was that households with higher value homes had a tendency to save less money than those with lower value homes. The ability to regulate one's consumption can be greatly enhanced by receiving positive feedback from others and by receiving social praise and recognition. In addition, monetary rewards that are proportional to savings have a huge impact.

Qualitative Aspects

Electricity consumption behaviour can be characterised by careful resource use or an effort to make more efficient purchasing decisions, but it is difficult to determine which of these methods is more effective in reducing

domestic electricity consumption. Appliances purchased solely on the basis of the manufacturer's name have been reported. Behavioural demand responses to electricity prices support their claim that a large number of consumption decisions are made based on routines because of a limited capacity to process information. Consumers need to be educated and aware of the importance of conserving electricity, and this should be emphasised. In this study, the ability to make choices and their associated costs were found to be the most powerful internal and external determinants of behaviour. Consumer behaviour isfound to be influenced by a variety of social factors. Rather than being solely the responsibility of consumers, electricity-consuming equipment manufacturers and service providers have a hand in shaping their customers' expectations for comfort and convenience. It is also found that consumption is an expression and underscoring of social status.

Activity-Based Household Consumption (ABHC)

People were reluctant to lower their consumption below their normal level, according to the results of the study. When it came to their electricity usage, they felt powerless to make any changes because certain appliances were necessities that needed to be used no matter how much electricity they consumed. They were unwilling to give up any of their comforts or conveniences in order to save a few pennies on their electricity bill. People are reluctant to change the time of use of other activities, such as those relating to comfort or entertainment, according to the researchers. Smart metres that display electricity consumption in real-time can help consumers get the most out of their two-way communication capabilities. A device like this is essential for dynamic pricing tariffs because without it, consumers will not be able to make the necessary adjustments to their behaviour. Those who participated in the study stated that they preferred to be notified by colour and chimes of any drastic deviations in consumption habits. In addition, they requested that the monetary value of consumption be shown instead of electricity units. For this reason, it's understandable that monetary comparisons are more relatable for customers, but electricity unit comparisons may be more useful if prices have changed over different time periods.

CONCLUSIONS

For the development of a tailored policy interventions in Ranchi's urban homes, the study of end use monitoring provides deeper understanding of appliance ownership patterns and residential electricity consumption. At least 98 percent of households have one or more of these devices, including phone chargers, televisions, set-top boxes for streaming media, refrigerators, and ceiling fans. Customers are expected to increase their use of appliances such as washing machines

and air conditioners in the future. With the exception of cold climate zones, electricity consumption is higher in the summer than in the winter across all socioeconomic strata, dwelling types, and socio-climatic zones. Winter peak demand is driven by space and water heating appliances, while summer peak demand is driven by space cooling devices. The number of people in a household and their level of socioeconomic status both have an impact on electricity usage. In addition, AC households use more electricity throughout the year than non-AC households, which may be due to their higher socioeconomic status. Peak demand and electricity use vary by season, climatic zone, socioeconomic strata, and type of residence. Inthe development of targeted demand response strategies, these can be of benefit. It is possible to extrapolate future electricity demand by looking at appliance electricity consumption and growth patterns. It would be more accurate to analyze the impact of electricity efficiency policies if the study was conducted on a regular basis, allowing for a better understanding of usage patterns and trends over time. Considering the growth rate of the population and living standards of the Indian community, it is expected that more electricity will be consumed in the near future.

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