CAG
Citizen consumer and civic Action Group

DEVELOPING AN EVIDENCE-BASED AWARENESS CAMPAIGN TO REDUCE STANDBY POWER LOSS IN HOUSEHOLDS OF TAMIL NADU

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Developing an evidence-based awareness campaign to reduce standby power loss in households of Tamil Nadu

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About CAG

Citizen consumer and civic Action Group (CAG), formerly known as Consumer Action Group (CAG) came into existence on 7 October 1985 as a non-profit, non-political, non-religious, voluntary and professional citizens group based in Chennai, India. S. Govind Swaminadhan, legal practitioner and former Advocate General of the State of Tamil Nadu, was the founding trustee. Initial trustees included S. Guhan (former Finance Secretary, Government of Tamil Nadu), S.L.Rao (former Chairman, Central Electricity Regulatory Commission), Shyamala Nataraj (development journalist with the South India Aids Action Program) and Sriram Panchu (Senior Advocate).

CAG has over 25 staff working on energy and environment, consumer protection, urban governance, water, sanitation, solid waste management, and transport governance. CAG's strengths are in the areas of policy and action research, information dissemination, training and capacity building, data analysis and ICT tools, stakeholder engagement, network building, advocacy, and outreach programmes.

The group was responsible for the establishment of a fully functional Electricity Regulatory Commission in Tamil Nadu. Further, with regard to improving quality of consumer participation in the electricity sector in Tamil Nadu, CAG is the only organisation in Tamil Nadu engaged in promoting the quality and quantity of consumer participation in the electricity space in Tamil Nadu through a series of policy and research analysis, information dissemination, training and capacity building, stakeholder engagement, network building, advocacy and outreach programmes. The organisation has also made particular efforts on behalf of electricity consumers in the state, including partnering with national advocacy organisations to improve the governance of electricity in the state and to regulate thermal power plants. The group has been represented in the Tamil Nadu Electricity Regulatory Commission - State Advisory Committee between 2002 -2012. Since 2014, representatives of CAG have been members of the Consumer Grievance Redressal Forum (CGRF) set up by the Tamil Nadu Electricity Generation and Distribution Corporation (TANGEDCO).

Since CAG's inception, qualified legal professionals have provided free counseling to consumers seeking redress; CAG staff have organised and led seminars and workshops on consumer rights. For its efforts, the Ministry of Consumer Affairs awarded CAG the National Award for Consumer Protection in 1989 (Second Prize) and 1992 (First Prize).

The group is best known for important public interest litigations it filed in the Madras High Court and the Supreme Court, especially on issues affecting public health and the environment. For example, after founding the Joint Action Forum for Safety on Roads in 1989, CAG successfully filed a case against dangerous road obstructions. CAG also filed a number of seminal cases against environmental degradation in the city, including successful stay in preventing the construction of the Madras to Kanyakumari Highway (East Coast Road) till receipt of environmental clearance from the Ministry of Environment and Forest (MoEF); illegal construction in the delicate estuary of the Adyar River; protection of Chennai's wetland spread over 358 acres. Following a successful court intervention on the regularisation scheme of the government on building violations, the Madras High Court appointed CAG as a member of the Chennai Metropolitan Development Authority (CMDA) Monitoring Committee to monitor regularisation.

The group has also taken action on key urban planning issues in the city. It released studies on decentralisation, fire safety in cinemas, water management, and much more. The group trained councilors in master planning and submitted detailed critiques of Chennai's Second Master Plan. As a result, CAG was invited to serve on a government committee to analyse public comments received on development control rules. The organisation's focus on urban planning and governance has continued into today with improved capacities in data management and data-driven decision-making. CAG's extensive engagement with the city corporation for a zero waste policy was rewarded with the government introducing the single use plastic ban in the state. The group strives for the improvement of livelihoods of the informal workers in the solid waste management sector.

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Peer reviewers (listed below) patiently read through the draft analysis in depth, provided critical comments, and offered highly relevant suggestions. Heartfelt thanks to them for their contribution to upgrading the report's narrative and analysis.

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Our gratitude to Benedicta Isaac for her guidance on messaging and ensuring that the report meets CAG's quality standards.

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Acronyms

ADB: The Asian Development Bank

BEE: Bureau of energy efficiency

CAGR: Compound Annual Growth Rate

CO2: Carbon di-oxide

CEA: Central Energy Authority

Discom: Distribution companies

DSM: Demand side management

ECCs: Electricity Consumer Cells

ECBC: Energy Conservation Building Code

EESL: Energy Efficiency Services Limited

GHGs: Greenhouse gases

GoI: Government of India

HH: Households

IoT: Internet of Things

kWh: Kilowatt hours

MoP: Ministry of Power

MU: Million Units

S&L: standards & labelling

TANGEDCO: Tamil Nadu Generation and Distribution Corporation Limited

UJALA scheme: Unnat Jyoti by Affordable LEDs for All scheme

UNDP: The United Nations Development Programme

USAID: The United States Agency for International Development

W: Watts

wh: Watt hours

Executive Summary

Standby power is the electricity consumed by end-use electrical equipment when it is switched off or not performing its main function. I.e., electrical appliances consume power when they are in standby mode or switched off. This consumption is known as “leaking electricity” or “standby power loss” (Prayas (Energy Group), 2010).

Standby power consumption makes for a fraction of the total power consumption. But, long running hours in standby mode, and the high penetration rate of certain appliances can in-turn result in significant loss of energy. Given the potential energy loss from standby power, this study will focus on standby consumption practices and the impact that informed actions can have around energy consumption. The objective of the study is to develop a campaign strategy that:

i. targets a specific area which poses immense energy saving opportunity – standby power.
ii. customises actionable, evidence-based recommendations for every household (HH) consumer.
iii. enables increased HH energy and cost savings.

This study employs quantitative methods to estimate standby power loss, through HH consumer survey in Tamil Nadu. Based on the estimates, the study further develops an evidence-based energy awareness campaign strategy drawing from the Wogalter & Laughery (1996) human information processing model.

In early 2021, CAG surveyed 387 electricity consumers across seven districts of Tamil Nadu in order to capture standby power practices and to ascertain standby power loss in rural and urban HHs. The findings of the survey reveal the following: (i) Set-top boxes contribute to a huge share of HH standby power loss, (ii) There is a strong need to improve practices that reduce standby power loss, (iii) Reducing standby power loss can result in significant energy and cost savings.

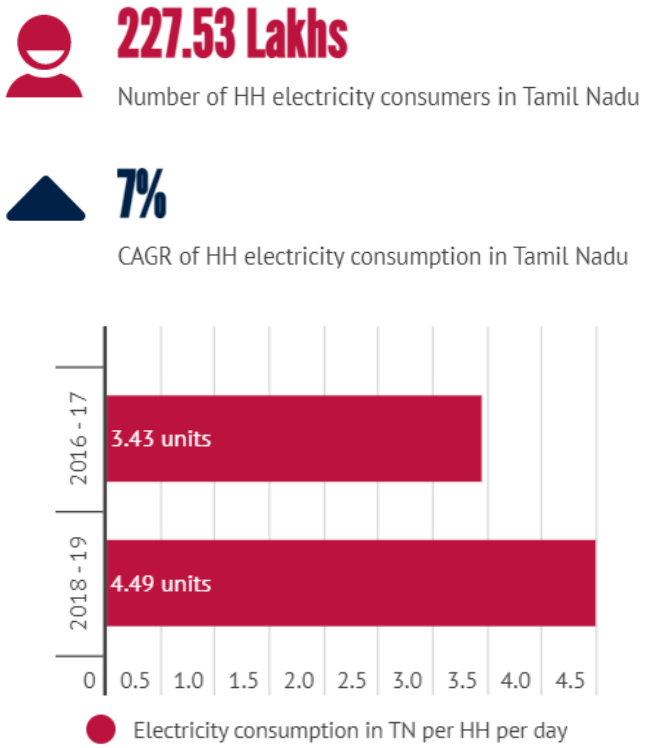
Drawing from the survey findings, the study builds a campaign strategy for awareness and outreach among HH electricity consumers. Overall, the need for a targeted, evidence-based approach with customised recommendations is established. In conclusion, the study highlights the significance of the following in tackling the problem of standby power loss: (i) awareness and outreach efforts, (ii) policy and regulatory framework, (iii) energy efficiency standards and labelling programme, (iv) international collaboration of energy agencies and manufacturers and (v) IoT solutions.

1. Introduction

Electricity consumption in Indian households (HHs) has tripled since 2000. HHs/domestic sector made up for the second largest share of the total electricity consumption in 2019 (Jaganmohan, 2020). This is further projected to rise more than eight times by 2050 (Dhingra, 2020). Such rapid growth can be attributed to several factors including increased focus on electrification, consistent addition of new HH connections, higher incomes, technological advances and more appliances at affordable prices.

Tamil Nadu context: Studies reveal that Tamil Nadu (TN) is among the top three states in the country, that rank high in terms of total electricity consumed at a HH level. It is further observed that the State's HH electricity consumption has been growing at a CAGR of 7% (Chunekar, Varshney, & Dixit, 2016). Based on recently published energy data, the State's electricity consumption per HH per day can be estimated at 3.43 units and 4.49 units, in 2016-17 and 2018-19 respectively. This suggests a 31% increase in the per day HH consumption, within a period of two years.

Figure 1: Tamil Nadu HH electricity consumption profile



Source: Authors' calculations based on data available in the Statistical Handbook of Tamil Nadu 2018 and the Policy note of Tamil Nadu Energy Department 2019-2020

The State's HH electricity consumption trend reflects a growing appetite for electricity. At present, the average power demand of Tamil Nadu is about 14,500 MW to 15,500 MW. In April 2019, power demand in the State had crossed 16,000MW for the first time and it was highlighted that the increased demand was mainly from HH electricity consumers (Tamil Nadu Energy Department, 2019). Given the steeply increasing consumption rate and growing demand for electricity, it must be recognised that HH choices and efforts to save energy will play a critical role in managing the demand and supply of electricity.

1.1. The need to promote energy savings at a HH level

One unit of energy saved at the end-use level reduces the need for fresh generation capacity by 2.5 to 3 times (International Energy Agency, 2021). It has been estimated that nearly 25,000 MW can be saved by implementing end-use energy conservation measures in HHs throughout India (Tripathi & Powell, 2020). Efforts to save energy would imply a reduced expense on electricity at a HH level and lower levels of fossil fuels burnt at regional and national levels. This translates to economic benefits in the HHs and a healthier environment for all. Thus, HH consumers need to develop a better understanding of their consumption behaviour and take concrete measures to promote energy savings.

Energy savings can be improved either by making behavioural changes without any cost implications or by adopting energy efficiency measures – i.e., replacing HH appliances with energy efficient alternatives. Considering the rapidly increasing demand for energy and the environmental concerns around conventional sources of energy, there is a strong need for HH electricity consumers to adopt a combination of the two energy saving methods.

1.2. Role of information and awareness

Socio-economic and demographic variables determine how a consumer uses energy. But, in order to effect a positive change in the way a consumer uses energy and instil energy saving goals, it is crucial to influence psychological variables such as attitude, habits, motivation, perceived behaviour control and energy knowledge (Razlin & Low, 2019). Information and awareness are key determinants that influence these psychological variables and result in cognitive efforts, particularly in HHs (Stern, 1992).

Wai et al. (2009) posit that changes in energy use can be brought about at a HH level by using motivation, raising awareness and developing skills among consumers. Further, successful information strategies, energy awareness programmes and experimental studies across the globe

have revealed that a behavioural approach can be highly effective in promoting energy conservation (Suryawanshi & Jumle, 2016).

Among various behavioural approaches, energy feedback has been widely recognised as the most pertinent aspect to incorporate whilst nudging a consumer to save energy. Energy feedback essentially directs the consumers' attention to specific energy goals, while identifying energy saving opportunities based on their own energy use (McCally, 2006). Learning about one's own electricity use could increase the sense of relevance in taking action towards conservation. But, if individuals perceive their own impact as negligible, they seldom make cognitive efforts to bring about change (Delmas, Fischlein, & Asensio, 2013). This study, therefore focuses on developing a strategic awareness campaign to highlight the impact of behavioural changes on HH electricity consumption. In order to do the same, the awareness campaign thus developed will focus on providing evidence-based energy feedback which (i) identifies an energy saving opportunity, (ii) defines a specific goal, and (iii) makes concrete recommendations for substantial energy savings.

1.3. Standby power consumption, an energy saving opportunity

Gram-Hassen (2004) cited that usage of electricity in identical houses can vary by as much as 300% or 400%. The variation has been attributed to individual consumer behaviours and everyday practices. Therefore, in order to ensure long-term behavioural changes and substantial energy savings, there is a need to target specific everyday practices that present a quantifiable energy saving opportunity. One such practice is turning off an appliance, when not in use (Gram-Hassen, 2009).

As early as 2010, Prayas (Energy Group) estimated that a simple, everyday practice of turning off an appliance, when not in use, can save 5500 million units (MU). Based on a HH consumer survey, it was identified that the amount of electricity consumed by appliances when not in active use – i.e., standby power consumption, is a rapidly rising concern with cost implications for HHs (Boegle, Singh, & Sant, 2010).

Table 1: Standby consumption

Appliance	Standby hrs/day	Day/year	Standby Watt	Standby kWh/year
Set-Top Box	16	365	10	58
TV	16	365	7	41
Computer	22	365	9	72
DVD Player	23.5	365	6	51

Source: (Boegle, Singh, & Sant, 2010)

Although there are no recent studies that quantify standby power consumption in Indian households, a 2010 report estimated the above standby consumption of common everyday appliances in Indian homes. According to the estimates, an average HH in 2010, could have wasted nearly 250 kWh of electricity every year, by way of standby consumption.

Standby power consumption makes for a fraction of the total power consumption. But, long running hours in standby mode, and the high penetration rate of certain appliances can in-turn result in significant loss of energy. Given the potential energy loss from standby power, this study will focus on standby consumption practices and the impact that informed actions can have around energy consumption. The objective of the study is to develop a campaign strategy that: (i) targets a specific area which poses immense energy saving opportunity – standby power, (ii) customises actionable, evidence-based recommendations for every HH consumer and (iii) enables increased HH energy and cost savings. The study also aims to address the lack of adequate and recent data around standby power consumption in Tamil Nadu.

The background and theoretical framework of the study is outlined in the next chapter. In Chapter 3, estimating standby power consumption for HH appliances is discussed in detail. The methodology adopted for the study is explained in Chapter 4. The survey findings in Chapter 5, capture consumers' standby power practices and ascertain the standby power loss in rural and urban HHs. In Chapter 6, based on survey findings and information processing theory, a campaign strategy developed to reduce standby power consumption. Chapter 7 summarises the takeaways of the study and makes concrete recommendations to tackle the problem of standby power loss.

2. Background & theoretical framework

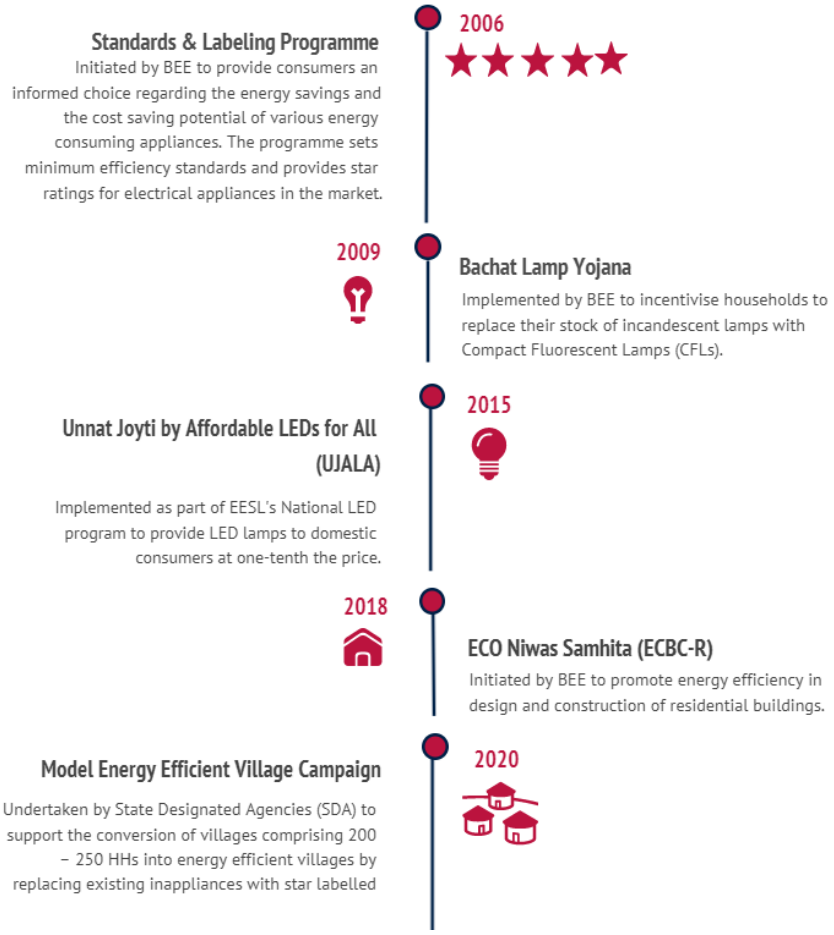
For the majority of its energy needs India is still dependent on coal, lignite, gas and diesel. 61.3% of India's electricity is sourced from these polluting sources (MoP, 2021). It is projected that India's CO2 emission per year will be around 4.8Gt (gigatonne) in 2050 in which 3.3 Gt comes from coal alone (Tripathi & Powell, 2020). As of today, India ranks third among the largest emitters of greenhouse gases (GHGs) with per capita CO2 emissions of 1.77 t per year from the burning of fossil fuels for energy (Ritchie & Roser, 2020). The need to reduce consumption of energy from fossil fuels has now become both relevant and urgent. Thus, making energy conservation an integral part of policy mechanisms outlined to meet energy goals of today.

2.1. HH energy conservation initiatives

India's earliest efforts to promote energy conservation began in the 1970s. Around the time, energy conservation initiatives were one of the many measures taken to address the crisis of energy access, amidst increased industrial production (Israni, 2021).

Over the decades, energy access has exponentially improved with 97.8 per cent of the Indian population having gained access to electricity (The World Bank, 2019). But it must be observed that along with improved access, environmental concerns around conventional sources of energy such as fossil fuels continue to grow. In light of the growing concerns, the Energy Conservation Act, 2001 was enacted to serve the efficient and effective use of energy and its conservation. Subsequently, in 2002, Bureau of Energy Efficiency (BEE) was formed as the statutory body for the enforcement of the Energy Conservation Act. Further, various bilateral bodies such as USAID, ADB, World Bank and UNDP have actively worked with the Ministry of Power and its nodal organisations to intensify national level energy conservation efforts.

Figure 2: Energy conservation initiatives that cater to HHs



Source: Authors' compilation from (BEE, 2020)

In addition to the BEE and EESL initiatives, there are a few home energy audit initiatives by NGOs, distribution companies (discoms) and think-tanks such as Vidyuth Rakshaka by TIDE,[1] Bangalaore, Minsarathai Semippom by CAG,[2] Chennai and the home energy reports initiative by BRPL,[3] Delhi. These energy audit initiatives largely involve presenting HH consumers with their electricity consumption patterns, along with comparisons against neighbours/benchmarks and in-turn making customised recommendations to save energy.

Each of these initiatives provide adequate scope to highlight the significance of standby power consumption and nudge electricity consumers to turn-off their appliances, when not in use. Yet, there is a strong need to create widespread awareness around the above listed initiatives and increase focus on energy saving tips pertaining to standby power loss.

2.2. Awareness and outreach

In order to enhance awareness level amongst the public on energy efficiency and inform them about the virtues of adopting energy conservation, BEE undertakes several awareness campaigns, workshops and outreach efforts. BEE takes a multi-media approach to creating awareness around conserving energy and using energy efficient appliances (BEE, 2020). Several advertisements in vernacular languages have been released in print media in addition to publications, promotional materials, magazines and books that focus on how to choose energy efficient appliances. Other BEE awareness programs and campaigns have been launched on electronic and social media. Few examples include video spots on business channels, video clips in cinema halls and radio spots in FM. While the videos focused on creating awareness around energy conservation, the radio episodes shared information around the standards & labelling programme.

Table 2: BEE awareness and outreach campaigns (2020)

BEE Campaigns 2020	
Bijli Bachayege to Roshan Hoga India	Video messages to promote energy conservation exhorting consumers across households, businesses and offices to save electricity
Button Dabao Bijli Bachao	Video and billboard messages on switching off appliances to conserve energy
Go Electric	Nationwide media campaign to educate the public about electric vehicles
Raise it by One Degree	Social media campaign to encourage air conditioner users to raise AC temperature by 1°C to save electricity

Source: Authors' compilation from (BEE, 2020)

[1] Technology Informatics Design Endeavour

[2] Citizen consumer and civic Action Group

[3] BSES Rajdhani Power Limited

The above table presents the various awareness and outreach campaigns launched by BEE in 2020. Between 'Bijli Bachayege to Roshan Hoga India' and 'Button Dabao Bijli Bachao'; the former simply stressed on the need to conserve energy and the latter emphasised on reducing energy consumption by switching off appliances, when it is not necessary. The 'Raise it by One Degree' campaign on the other hand, presented electricity consumers with a specific action item that they should adopt – raise their AC temperature by 1ºC to save electricity.

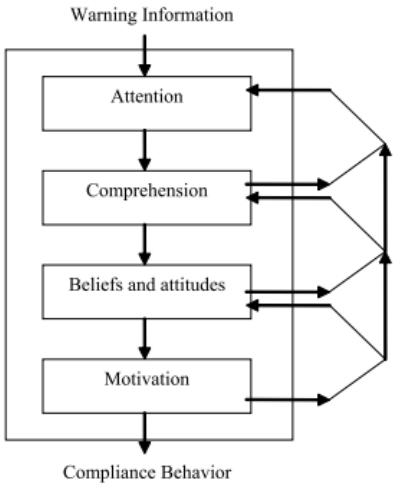
There is a need for more targeted campaigns such as 'Raise it by One Degree' to accelerate increased adoption of energy conservation measures at HH level. Further, since the most significant factor influencing HH energy consumption is human behaviour (D'Oca, Hong, & Langevin, 2018), it is crucial to develop awareness campaigns that build consumer understanding, trigger motivation and bring about long-term behavioural changes to ensure energy savings in the long run.

2.3. Information Processing Theory

In order to develop a sound strategy and framework for an awareness campaign that advances long-term behavioural changes and energy savings, this study draws its theoretical premise on 'Information Processing'. Information processing is one of the study areas of cognition psychology and can be used to understand how people achieve awareness. "It refers to the way people receive information from their environment, operate on it, integrate it with information available in memory and use the same as a basis for deciding how to perform" (Wai, Mohammed, & Alias, 2006).

Wogalter and Laughery (1996) summarise four important stages that will lead to an average person to receive an information, achieve awareness and eventually adopt behaviour that complies with the given information. This is highlighted in the figure below:

Figure 3: A human information processing model



Source: (Wogalter & Laughery, 1996; Wai, Mohammed, & Alias, 2006)

As outlined in Figure 3, the first stage is to attract the attention of people with information. Following this, in the second stage, a level of understanding – i.e., comprehension needs to build among the recipients. In the third stage, it is essential to fit the messaging with the recipients' mindset, beliefs and attitudes. Finally, in the fourth stage it is critical to motivate the recipients, either with social influence or by highlighting the expenditure of effort, time or money. Instilling motivation is the critical determinant that results in the recipients complying with the information/awareness materials.

This study will draw from the information processing model detailed above and develop an energy awareness campaign strategy to conserve energy in HHs by reducing standby power consumption.

3. Estimating standby power loss

Standby power is the electricity consumed by end-use electrical equipment when it is switched off or not performing its main function. I.e., electrical appliances consume power when they are in standby mode or switched off. This consumption is known as "leaking electricity" or "standby power loss" (Prayas (Energy Group), 2010). The functions which consume power even when not in use/switched off are charging of batteries, responding to remote controls, sensing the temperature, etc.

Standby power consumption was first identified as a challenge during the 1990s. Analysts highlighted that on an average, 20% of household electricity consumption comes from consumer electronics and information and communication technologies (ICTs)[4], and half of this is consumed when the equipment is in standby mode (Gram-Hanssen, 2004). Studies across various developed countries, such as the Netherlands, Germany, and the US have attempted to estimate standby power loss. Findings reveal that standby power accounts for as much as 10% of national residential electricity use and that the electricity loss for an appliance can range anywhere between 1 W and 30 W (Pano, 2017; Brahmanand, 2001). Information available around standby power loss trends indicate a global increase in standby power consumption since efficiency improvements in some equipment (e.g., TVs) are outweighed by the increase in the numbers of appliances that consume power in standby mode (Bertoldi, et al, 2002).

The growth in standby mode use reflects a significant shift in everyday HH consumer practices. As

[4]ICT is an umbrella term that includes any communication device, including radio, television, cell phones, computer and network hardware, satellite systems and so on, as well as the various services and appliances with them such as video conferencing and distance learning.

against turning the appliances either switched "on" or "off"; HHs now practice keeping their appliances "on" at all times, but in different modes (Raj, Sudhakaran, & Raj, 2009). Based on the operational status of domestic appliances four standby modes have been identified: (i) Passive standby mode, (ii) Active standby mode, (iii) Off standby mode, and (iv)Delay start standby mode (Yu, et al., 2017).

i. ***Passive standby mode***: When an appliance is waiting to be switched on or is in the state of performing secondary function. Example, when a television is connected to the main switch, but has been switched off by the remote control.
ii. ***Active standby mode***: When an appliance is on, but it is not performing its main function. Example, when a DVD player is ON but it is not playing.
iii. ***Off standby mode***: When an appliance is plugged in but not performing any function. Example, when a desktop computer is shut down, but still connected to power.
iv. ***Delay start (standby mode):*** When an appliance is scheduled for use in future. Example, when an air conditioner is set to be turned on after two hours.

Let us consider an example of a 24-inch TV of 50 W:

- If the time spent on watching TV is 4 hours per day, then energy consumed by TV on one day will be 70 W X 4 hrs = 280 wh
- If one measures the power consumed by the TV on standby mode, one may find that the power demand is 8 Watts (Bertoldi, et al., 2002)
- Now, if the TV is on standby mode for rest of the day (20 hours), then energy consumed would be = 8 W X 20 hrs = 160 wh

In the process, we end up using around 50% more energy compared to when TV is switched off.

Different electrical appliances and brands have varying levels of standby energy use. Therefore, it is important to engage with HH consumers, understand their standby power practices, develop their knowledge around it and further provide evidence-based energy saving solutions.

4. Methodology & Framework

This study employs quantitative methods to estimate standby power loss, through HH consumer survey in Tamil Nadu. Based on the estimates, the study further develops an evidence-based energy awareness campaign strategy drawing from the Wogalter & Laughery (1996) human information

processing model. The campaign thus developed will focus on reducing standby power consumption and enhancing energy savings for HHs.

4.1. Data collection, field site and respondents

This study analyses consumer survey data collected from 387 HH electricity in Tamil Nadu. The primary data collection exercise was undertaken in early 2021. A questionnaire with close-ended and open-ended questions, in English and Tamil languages, was designed to capture standby power practices in HHs and thereby estimate the energy loss thus incurred.

The respondents were identified using snowball sampling. CAG's Electricity Consumer Cells (ECC) helped identify respondents from urban, rural and semi urban areas of seven districts in Tamil Nadu including Tiruvannamalai, Salem, Trichy, Vellore, Cuddalore, Tirunelveli, and Tiruvallur. The below table provides details of the surveyed districts and the number of respondents reached from each district.

Table 3: Surveyed districts and respondents

District	Respondents
Tiruvallur	48
Cuddalore	71
Tirunelveli	56
Salem	53
Tiruvannamalai	60
Trichy	47
Vellore	52
Total	**387**

Source: Authors' compilation

Out of the 37 districts in Tamil Nadu, the districts chosen for the study cover 5 out of the 9 electricity distribution regions, provide for a sizable rural and urban representation and enjoy the presence of active consumer organisations, working in the electricity sector.

4.2. Questionnaire design and survey administration

The questionnaire was designed primarily to assess HH consumers' standby power practices. To achieve the same, following information was sought as part of the consumer survey:

- Socio-economic background
- Electricity consumption expenditure
- Number of electrical appliances and their usage hours

- HH energy consumption practices

CAG shared the questionnaire via email and WhatsApp across the seven districts with the support of ECCs. The consumers were asked to fill the online survey forms with on-call support from CAG researchers and ECC coordinators. Since the onus of filling the responses was mainly on the respondents, it was difficult to compel them to respond to all questions. Several respondents, who had submitted the incomplete forms, were later approached by researchers over the phone or in-person to obtain their responses to unanswered questions.
All the survey responses submitted were collected digitally via google forms and analysed using MS Excel.

Arriving at standby power loss

- The standby hours for each appliance per day was arrived at from consumer responses and further used to estimate standby power loss as follows:

Stand by power loss of an appliance (in kWh) =

Standard standby loss of the appliance[5] *X No. of hours kept in standby mode*

- The standby loss of each type of equipment in each sector was divided by the No. of households in the sector to get a ratio of loss per household per sector which was compared across sectors. Based on the analysis, various results were drawn from the data. These findings will give a basic understanding of the standby losses in the Tamil Nadu households.

4.3. Limitations

It must be recognised that there is a need for more recent and reliable data to accurately estimate standby power loss of electrical appliances. Although energy efficient appliances with minimal standby power loss are now available in the Indian market, we do not have adequate data to quantify it. Therefore, there is a strong need to bridge the data gap around standby generation, estimation, and standards.

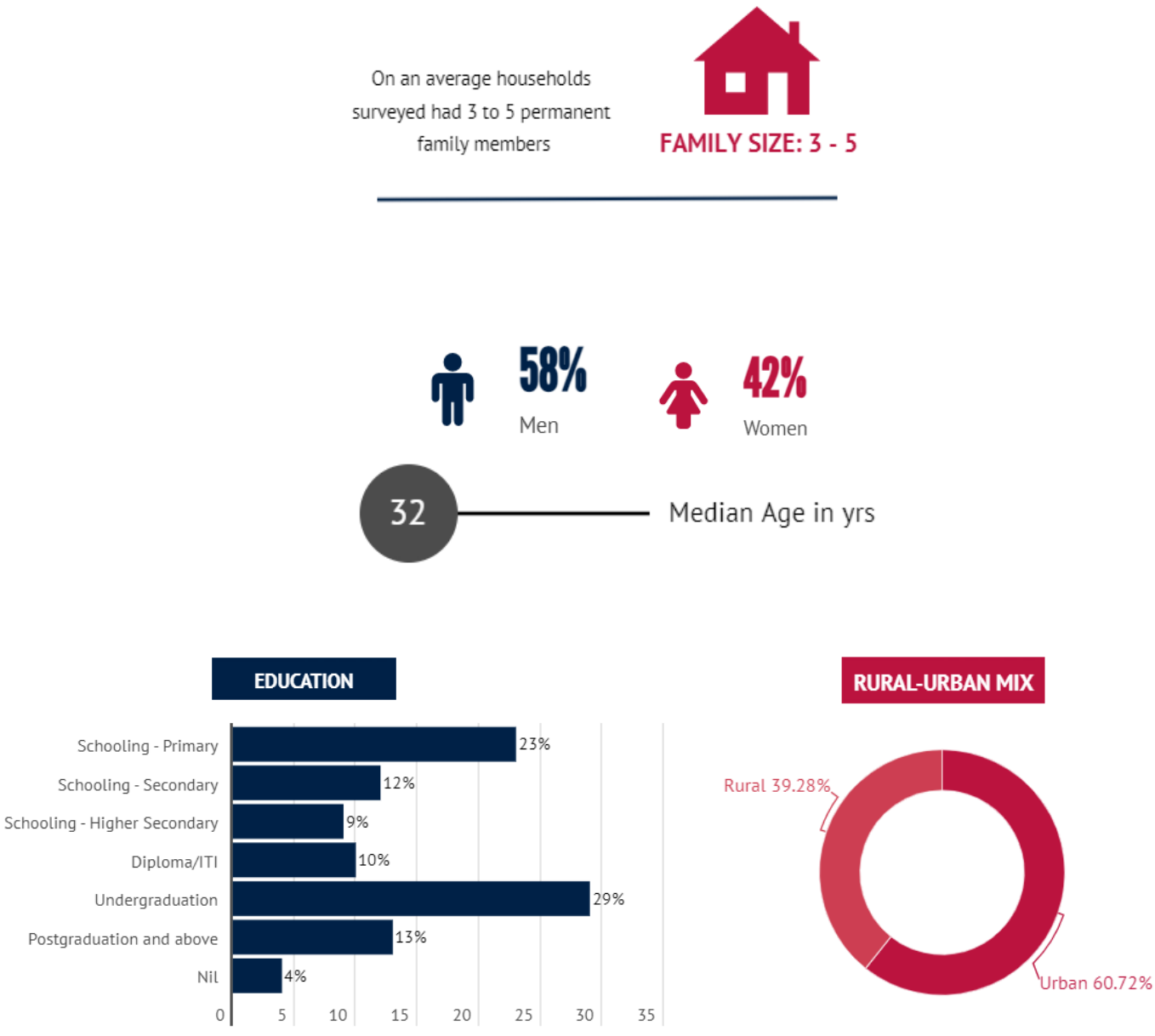
4.4. Sample characteristics

The sample predominantly consists of metered residential consumers and largely represents consumers from all age groups and across rural, and urban areas of the surveyed districts. On

[5] The standard standby loss of each appliance has been drawn from a study by Bijili Bachao and Prayas Energy Group (CAG, 2018)

average, respondents are from households with three to five permanent family members with diverse academic backgrounds. Private sector employees, self-employed people, and homemakers are prominent in the sample. Figure 4 depicts the characteristics of the participants based on gender, family size, age, education and rural mix.

Figure 4: Characteristics of the survey sample



Source: Authors' analysis

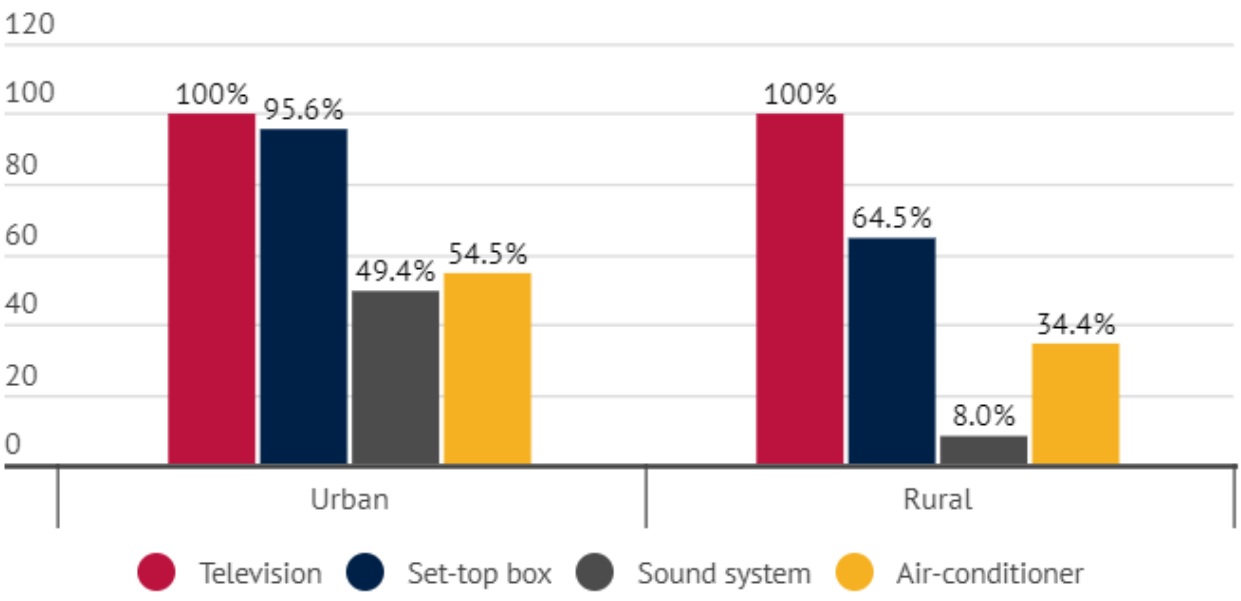
5. Findings from the Survey

The survey findings on consumers' standby power practices of select HHs in Tamil Nadu have been summarised in this section. Based on the analysis, the study aims to ascertain the overall magnitude of standby consumption and present customised recommendations to HH electricity consumers. The study further builds an awareness campaign strategy to present an evidence-based behavioural approach to reduce standby power loss and increase energy savings.

5.1. There is a need to improve practices that reduce standby power loss

This study focuses on four key appliances that are commonly found in HHs and are known to have a standby mode. The four appliances include television, set-top box, sound system and air-conditioner. The ownership of appliances across HHs has been captured below.

Figure 5: Ownership of HH appliances

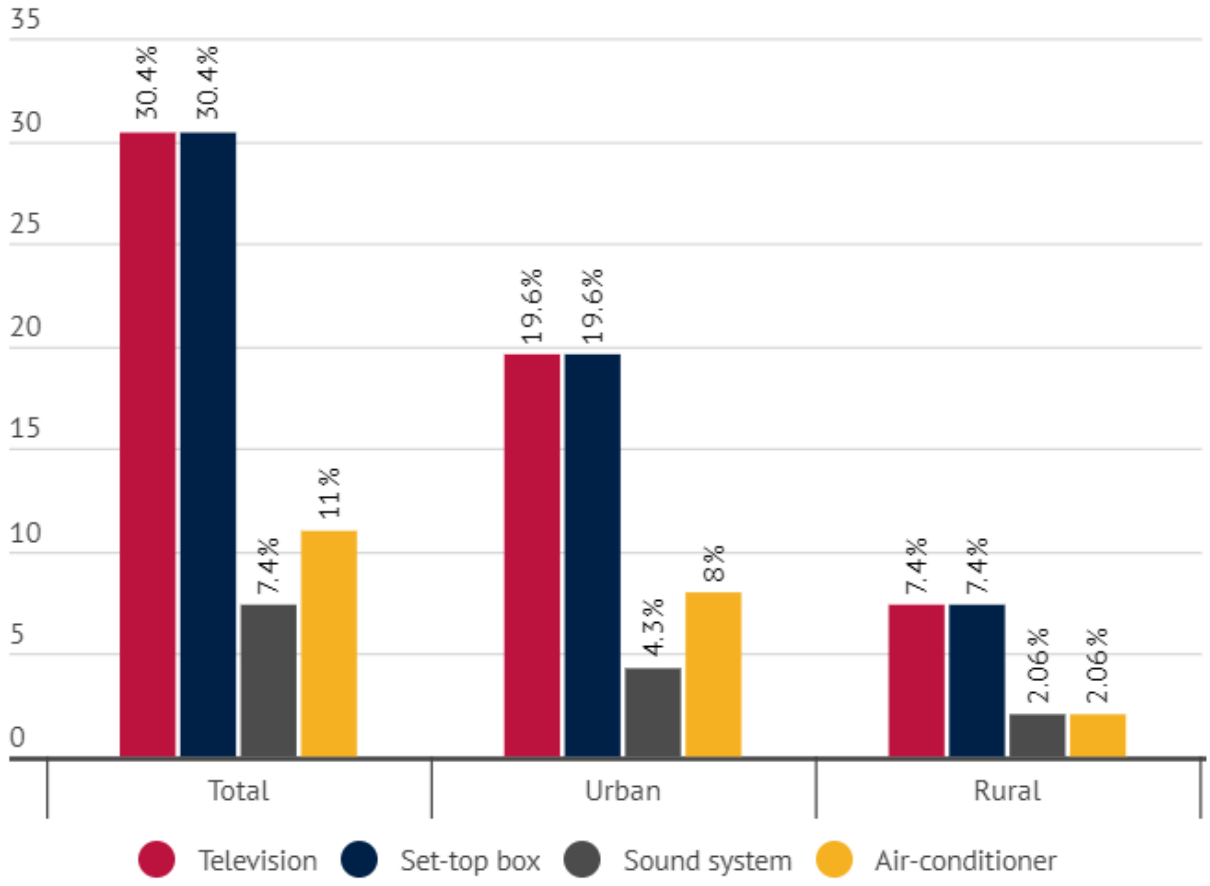


Source: Authors' analysis

Figure 5 suggests that amongst the surveyed HH, 100% HHs own televisions in both urban and rural areas. The ownership of appliances across urban and rural areas shows that sound systems and air-conditioners are owned by only 8% and 34% rural HHs, respectively. This implies that the two appliances are yet to penetrate the rural markets.

Respondents were further enquired if they turn off these appliances, when they are not in use. The responses indicate that a majority of the respondents do not turn off the appliances, when not in use; thus, incurring standby power loss.

Figure 6. Percentage of respondents who turn off appliances, when not in use



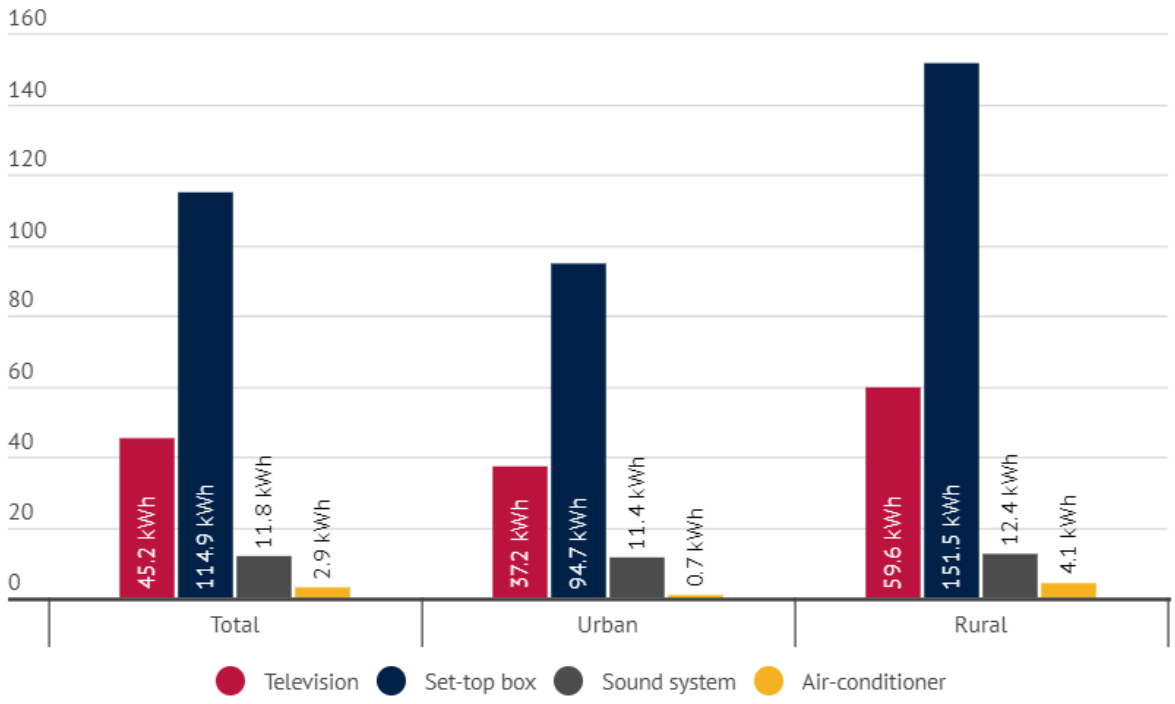
Source: Authors' analysis

Figure 6, reveals that only 30% of the respondents switch off their televisions and set-top boxes, after use. 7% of the respondents switch off their sound system after use. Whereas 11% of the respondents switch off their air-conditioner, after use. This implies that over 70% of the respondents run their appliances on standby mode, incurring expenditure for electricity that was not used. It can also be observed that more urban HHs follow the everyday practice of switching off the appliances, when not in use, as against rural HHs. Overall, this reflects a strong need to improve everyday practices that reduce standby power consumption and in-turn reduce energy and monetary costs.

5.2. Set-top boxes contribute to a huge share of HH standby power loss

Based on consumer responses, standby hours per appliance per household was arrived at and further standby power loss was estimated to reveal the below:

Figure 7: Standby power loss per household per annum



Source: Authors' analysis

As highlighted in figure 7, with 114.9 kWh of standby power loss, set-top boxes contribute to the highest share of total standby power loss per HH per annum. Further it must be observed that between rural and urban HHs, rural HHs appear to incur higher levels of standby power loss across appliances. Hence, there is a strong need to create awareness around standby power loss, with focus on set-top boxes and increased outreach to promote the same amongst rural HHs.

5.3. Reducing standby power loss can result in significant energy and cost savings

Responses suggest that every year, HHs incur about 174 kWh of standby power loss. This implies that by way of standby power loss, every HH surveyed pays an excess of INR 1,022.58[6] towards their electricity bill amount. Therefore, a simple everyday practice of turning off appliances, when not in use, can result in significant energy and cost savings.

[6] The price of per unit (kWh) of electricity has been assumed as Tamil Nadu's average cost of supply at 5.85 (TNERC, 2017)

6. CAG's awareness campaign strategy

This chapter builds a strategy for a campaign to create awareness amongst HH electricity consumers around standby power loss and promote long-term behavioural changes that result in energy and cost savings.

i. **Target audience:** In its first phase the campaign will target the 387 HH electricity consumers who were surveyed for this study across 7 ECC districts.
ii. **Area of focus:** Everyday electricity consumption practice that can reduce standby power loss and increase energy and cost savings.
iii. **Approach**: Present customised actionable, evidence-based recommendations to every HH consumer reached as part of the campaign and compliment the same through regular communication of key messages around 'turning off appliances, when not in use.'
iv. **Tactics based on research findings**:
    a. Improve knowledge and understanding of standby power mode among consumer groups so that they can take informed actions on a daily basis.
    b. Strengthen messaging around standby power consumption with focus on appliances that contribute to high standby power loss such as set-top box and television.
    c. Increased level of information and engagement at rural HHs who have been identified as incurring relatively higher levels of standby power loss.
    d. Incorporate the quantum of energy and cost savings such that consumers are motivated to make long-term behavioural changes around energy use.
v. **Duration:** One year - between the baseline study conducted in early 2021 to the impact evaluation to be performed in 2022.

Stages involved in rolling out the awareness campaign modelled around a human information processing model (Wai, Mohammed, & Alias, 2006; Wogalter & Laughery, 1996).

Stage 1. Attention: This stage acts as notice or mental focus, about how far the design of the stimulus can attract attention of people. During this stage, the campaign will focus on sharing knowledge products/awareness materials on a regular basis, explaining the concept of standby power loss and defining specific action items that can ensure reduced standby power consumption in HHs. Such materials will include posters, leaflets, SMS, social media posts, and videos.

Stage 2. Comprehension: This stage focuses on the level of understanding of the people have developed towards the issue. During this stage, the campaign will engage with the consumers to present customised reports of their electricity consumption patterns. These reports will highlight

and quantify the appliance wise standby power loss. It will further identify the everyday consumer practice and energy efficient solutions that can be adopted in order to reduce the extent of loss. In the process of engagement, consumers' level of understanding will also be gauged so that messaging can be further strengthened to instil motivation and change.

Stage 3. Beliefs and attitude: Largely defined by consumers' mindset. In this stage, it is crucial to ensure that the design and messaging of the awareness process is strong and concrete enough to influence consumers' actions and sway negative beliefs, if any. During this stage, the campaign will make recommendations to increase energy savings either by making behavioural changes without any cost implications or by adopting energy efficiency measures – i.e., replacing HH appliances with energy efficient alternatives. Based on factors such as the consumers' (i) energy use, (ii) extent of standby power loss incurred, and (iii) beliefs and attitude, the campaign will recommend either energy conservation measures or energy efficient solutions or a combination of the two.

Stage 4. Motivation: This is the most critical determinant that will influence the actions of the consumers and result in behaviour complying with the messaging of the awareness campaign. During this stage, consumers will be presented with the incentives of taking informed actions in terms of substantial energy and cost savings. In order to trigger motivation and result in positive behavioural change, the messaging in this stage will be customised to ensure that every HH is alerted of the quantum of excess electricity consumption and expenditure.

Way forward: This initiative treats the consumer survey held in early 2021 as the baseline study. The awareness campaign will be launched in early 2022 targeting the same set of 387 consumers, in order to influence their electricity use behaviour related to standby power consumption. Awareness and outreach efforts as part of the campaign will follow the above outlined stages and strategies. On completion, the impact of the campaign will be measured in relation with the energy and cost savings made by the consumer group.

7. Conclusion

The problem of standby power loss is real and significant. Therefore, essential steps must be taken in order to reduce standby power consumption in HHs and bring about energy and cost savings, in the long-run.

This study details the effects of everyday practices in HH energy use, presents insights for understanding the practice of standby consumption and thereby offers potentially useful background and approach to tackling the problem of standby power loss.

The consumer survey, conducted as part of the study reveals that there is a strong need to improve everyday practices that reduce standby power consumption and in-turn reduce energy and monetary costs. To achieve this, the study further develops a strategy for a targeted, evidence-based awareness campaign which focuses on standby power loss at HHs. CAG will launch this awareness campaign in early 2021 with the objective of promoting consumer understanding of energy use and instilling the importance of taking informed actions to increase energy and cost savings.

7.1. Recommendations

To envisage a sustainable energy saving solution, there is a need to scale actions beyond awareness and outreach efforts. Below highlighted are actions recommended at policy, regulatory, manufacturing and consumer level to further the efforts to reduce standby power consumption through energy conservation and energy efficiency.

i. There is a lack of adequate and recent data around standby power loss. MoP should initiate a detailed National level survey which will capture data around leakage loss better and further develop an understanding about consumer behaviour and awareness around standby practices.
ii. As of today, India does not have defined codes and standards for standby power loss generation. In order to bridge the gap and tap into the energy saving potential, the MoP should develop strict performance-based standards for standby generation.
iii. Regulations need to mandate labelling of all appliances with inclusion of annual standby power information (kWh) in the star label.
iv. Energy Efficiency Standards and Label programmes should support energy performance testing facilities in the country and further prohibit the manufacturing of appliances that consume standby power higher than the minimum standard.
v. Appliances are manufactured around the world and utilised across different nations. Focusing on region-specific solutions to tackling standby power can be challenging.

Therefore, it is crucial to promote international collaboration with major organisations such as International Energy Agency, International Energy Star and Asia Pacific Economic cooperation that are working in several countries to provide the legal frameworks for international co-operation and defining the limits of standby power use.

vi. Manufacturers should retrofit appliances with an alarm that would beep intermittently and prompt the user to switch off the appliance when it is not in active use.

vii. Technical collaborations of manufactures internationally should be promoted to overcome barriers such as unavailability of quality materials to produce efficient appliances.

viii. Energy awareness and power saving activities should be incorporated in school curriculum to inculcate the practice of energy saving and mould the thinking of students in terms of energy use.

ix. The MoP and BEE should launch an initiative targeting standby power consumption. The initiative thus launched should seek specific actions from HH electricity consumers, like it did with the 'Raise by One Degree' campaign.

x. BEE leads several energy conservation initiatives that cater to HHs. These initiatives such as standard & labelling programme and model energy efficient village campaign should increase its focus towards educating consumers about standby power loss.

xi. The State Designated Agencies in association with local utilities should lead campaigns to raise consumer awareness and encourage HH consumers to purchase equipment with reduced standby loss.

xii. In addition to making behavioural changes and purchasing energy efficient alternatives, consumers should adopt IoT solutions to ensure that all appliances in standby mode are switched off at the press of a button.

In conclusion, combined efforts and informed actions towards reducing standby power consumption can go a long way in managing demand and supply of electricity, and further result in economic and environmental benefits for communities.

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