

HARNESSING BEHAVIOUR CHANGE FOR PROMOTING ENERGY EFFICIENCY

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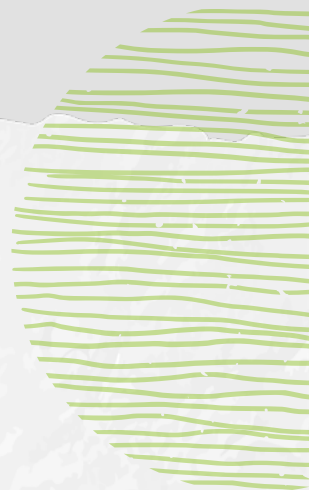


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Abbreviations

AC	Air-conditioner
AEED	Alliance for an Energy Efficient Economy
ATC	Adaptive Thermal Comfort
BCC	Behaviour Change Communication
BEE	Bureau of Energy Efficiency
CIFF	Children's Investment Fund Foundation
DR	Demand Response
HER	Home Energy Report
ICAP	India Cooling Action Plan
ICT	Information and Communication Technology
kWh	Kilowatt-Hour
ToU	Time of Use
TWh	Terawatt-Hour



1

Introduction

A peek into India's sector-wise energy consumption informs that residential and commercial sectors account for one-third of total energy use [1]. With rising incomes and aspirations, energy consumption in residential buildings is predicted to increase by eight times by 2050 under a business-as-usual scenario [2]. Managing the country's escalating energy demand in a sustainable manner requires strategic energy efficiency measures to be developed and implemented. In leveraging different policy tools for fostering sustainable and efficient energy consumption in the residential and commercial sector, individuals' choices and behaviour are vital factors to consider along with the technical efficiency of the products and infrastructure used.

Human behaviour has a critical role to play in fostering deeper energy savings. Decisions relating to energy use, including indoor temperature settings, adoption of star-labelled appliances, or participation in demand-response programs, are all intricately linked with human behaviour. The actions and attitudes of individuals play a key role in cumulative energy consumption. The rationale for leveraging behavioral tools for the promotion of energy efficiency comes from the realization that humans are the center of energy efficiency action and that barriers preventing the adoption of energy-efficient practices are not entirely technical in nature. Rather such barriers also tend to have a strong sociological and behavioral underpinning. Behaviour change can, thus, a vital force to generate and sustain energy efficient action.

Energy use, in general, has low visibility and generally an obscure concept. Given the complexity of energy consumption figures as well as the routine nature of the process of energy consumption, the extent to which it can be expected out of individuals to consciously optimize their energy use is constrained. Indeed, lack of knowledge and awareness is a key factor driving unsustainable use of energy [3]. Providing more information and facts about the benefits about energy efficiency prompts individuals to take responsible action. Energy labels, smart meters, real-time electricity mechanisms are all mechanisms to enhance the awareness levels of consumers. Information policies provide people with a fuller picture of the economic

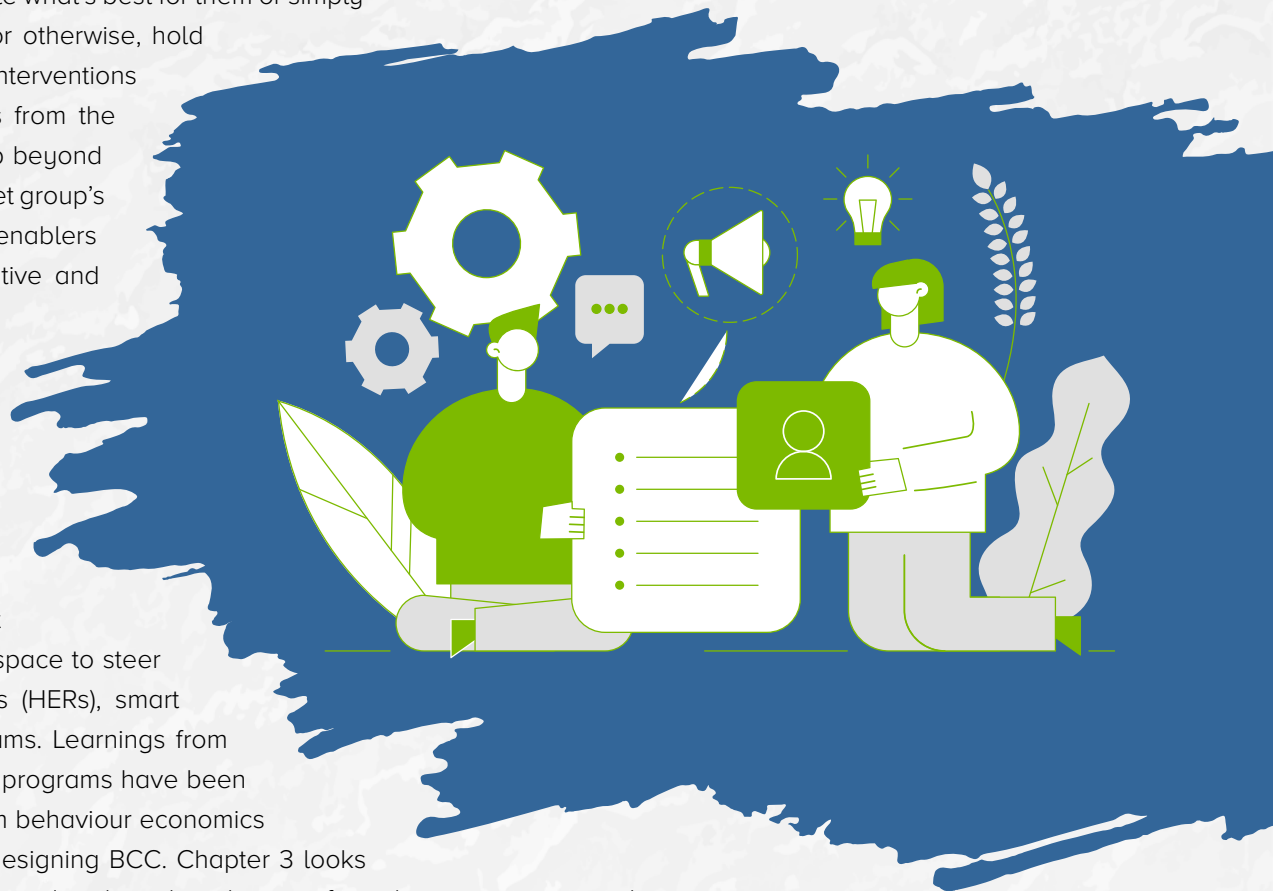
Behaviour change involves going a step beyond information dissemination. It involves understanding the target group's motivations, attitudes and practices to identify the real enablers of change.



as well as environmental consequences of their choices and actions. Information provision as an intervention strategy thus has strong potential to elicit energy savings.

However, from a behavioral perspective, lack of information is often not the sole factor that drives over-consumption of energy and as a corollary, information dissemination should not be the singular behavioral strategy for driving energy efficiency. Attempts of steering behaviour by informing people what's best for them or simply emphasizing the benefits of energy efficiency, economic or otherwise, hold potential for only limited success. For designing behavioral interventions for energy conservation, it is imperative to look at things from the lens of individuals. Behaviour change involves going a step beyond information dissemination. It involves understanding the target group's motivations, attitudes and practices to identify the real enablers of change that can make the desired change easy, intuitive and instinctive.

The purpose of this report is to underscore the factors that influence consumer decision making and behaviour that have important implications for the design of behavioural interventions. The report provides energy practitioners with an overview of the cognitive biases that come into play with respect to energy behaviour. It also provides the readers an overview of the behavioural interventions that have been successfully deployed in the energy efficiency space to steer consumer behaviour. These include home energy reports (HERs), smart meters with real-time display and social interaction programs. Learnings from these interventions that can inform the design of behaviour programs have been explored in the report. Chapter 2 looks at the learnings from behaviour economics on understanding consumer behaviour and the stages in designing BCC. Chapter 3 looks at real world examples from behavioural energy efficiency and outlines how lessons from these practices can be integrated for effective design of behavioural interventions. Chapter 4 explores the potential and need for behaviour change with respect to adaptive thermal comfort. Chapter 5 concludes and provides a way forward.



2

Methodology, Objectives and Scope of the Report

The central purpose of this report is to provide an overview of the ecosystem of behaviour change by outlining the relevant behaviour theories. In tandem, it also outlines common behavioural initiatives deployed in energy efficiency and extracts key learnings from these initiatives which can in turn inform the future design of behavioural interventions. A thorough understanding of general consumer behavioral tendencies and commonly deployed consumer behaviour change approaches is essential for launching successful behaviour change interventions. An assessment of the tried-and-tested consumer behaviour theories and behaviour interventions is also crucial for maximizing participation as well as the overall impact. The report summarizes key behavioral theories pertinent to energy efficiency, outlines the steps in developing behaviour change communications, and analyses international best practices and key lessons and provides an overview of the potential for behavioral change in promoting energy efficient actions.

The specific objectives of the report are:

- i Review the theoretical underpinnings from behavioral research and identify recommendations for designing interventions for promoting energy efficiency
- ii Analyze and summarize best practices and key lessons from international initiatives, studies, pilot programs on behavioral energy efficiency

The report has been prepared solely based on exhaustive review of secondary research exploring the principles of behaviour change pioneered by social science and tested through rigorous testing. The report shall be further strengthened by conducting primary research to cull out recommendations and strategies for promoting adaptive thermal comfort in the Indian context.

3

Learnings from Behaviour Economics

3.1 Understanding how people think and make decisions

Consumers usually tend to have interests that are well aligned with the socially desirable behavioural outcomes being promoted. For example, consumers generally would want to reduce their energy consumption, opt for cleaner fuels or use efficient technologies as it is also in their personal best interest. However, despite best intentions, they may fail to follow through for a variety of reasons. This gap between people's self-professed intentions and their observed actions, famously termed as the '*value-action gap*' [4] [5], can be explained by insights from behavioural research.

There are a variety of cognitive biases and motivational factors that come into play when we look at energy use and purchase behaviour. People's conscious and unconscious decisions are influenced by a number of these biases that make them behave in a predictably irrational manner. An understanding of these biases provides an explanation of why user awareness alone proves to be an effective measure for behaviour change. To be able to design effective behavioural interventions, it is important to identify how behaviours are formed and how they can be influenced through various levers.

This section looks at insights from behavioural economics and social sciences that are of critical importance for designing behavioural strategies for promoting energy efficiency. These insights have been delineated into three broad themes of cognitive biases: inertia and procrastination, heuristics and risk perceptions, and social norms.

Developing an understanding of what motivates people and what factors influence their behaviour is imperative for effective design of behavioural interventions.



3.1.1 Inertia and procrastination

People have a general tendency to avoid the hassle associated with changing and stick to the default settings as much as possible. Keeping the **status quo** involves little or no cognitive effort and hence eases the way of doing things. A large body of research shows that people tend to resist change even if it is in their personal interest and might lead to better outcomes [6] [7]. As a result, people might defer decision making and stick to the same choices they made previously, leading to inertia. The status quo bias itself is driven by a multiplicity of underlying cognitive biases.

Conservatism bias implies that people are more likely to disregard and question new information that dismisses their original belief systems. It takes considerable effort for people to revise their existing beliefs, resulting in suboptimal decision-making [8].

Present bias means that immediate gains are valued higher than future gains. There is subconscious temporal discounting of benefits that will occur in the future [9]. For instance, economic appraisal of investment in energy-efficient appliances providing evidence for cost savings might still not increase its uptake as the benefits of appliances are realized over the years while the total cost is accrued upfront.

Sunk cost effect explains that people try to get the most of the time, effort and money spent on investment and tend to be fixated on recovering losses already recovered. Having purchased an appliance after putting in the required time, effort and money, for instance, a consumer may tend to use it more, even when not necessarily required [10]. The phenomena of sunk cost effect, also underlines the lock-in of relatively inefficient appliances for a long time once purchased.

Box 1: Behavioural levers - Inertia and procrastination



(A) USE OF DEFAULTS

Energy efficient behaviour can be made easy for people by presenting the energy-efficient option as the default. Defaults, as a policy tool, can create a great impact in contexts where people show resistance to change [11]. An example of such intervention is a change to the default settings of air-conditioners to foster energy savings.



(B) OPT FOR OPT-OUT

If the behaviour being promoted is in the interest of the most people, opt-out systems can be used to increase participation. Participation in an opt-out programme where people are automatically enrolled in a scheme/programme tends to be higher than opt-in programmes where people have to make an active choice to participate [12]. This has been evident from significant increases in organ donor rates and contributions to retirement saving plans when opt-outs systems are used instead of opt-ins [13] [14]. Opt-out defaults make a decision easy for people, while preserving their choice to withdraw.



(C) CONTEXT IS KEY

Contextual factors can be made to be conducive to bring about the required change. The physical environment can substantially affect consumer behaviour, especially when choices are made spontaneously. For instance, the 'Eco' button on AC remotes can be intuitively positioned to ensure higher compliance.



(D) MAKE IT EASY

The cognitive burden associated with change can be minimized by providing a clear, explicit action plan on how to act in accordance with the energy efficient behaviour [15]. Inaction is often driven by complexity or ambiguity of information presented about costs and benefits of actions.

3.1.2 Heuristics and risk perception

Humans are not rational decision-makers, as assumed in traditional economic models. Rather as postulated by Daniel Kahneman [16], the founder of behavioral economics, humans rely on a number of mental shortcuts or systems of thinking to arrive at conclusions or make decisions. People simplify information, take reflexive decisions, and take shortcuts based on earlier decisions, behaviour or habits.

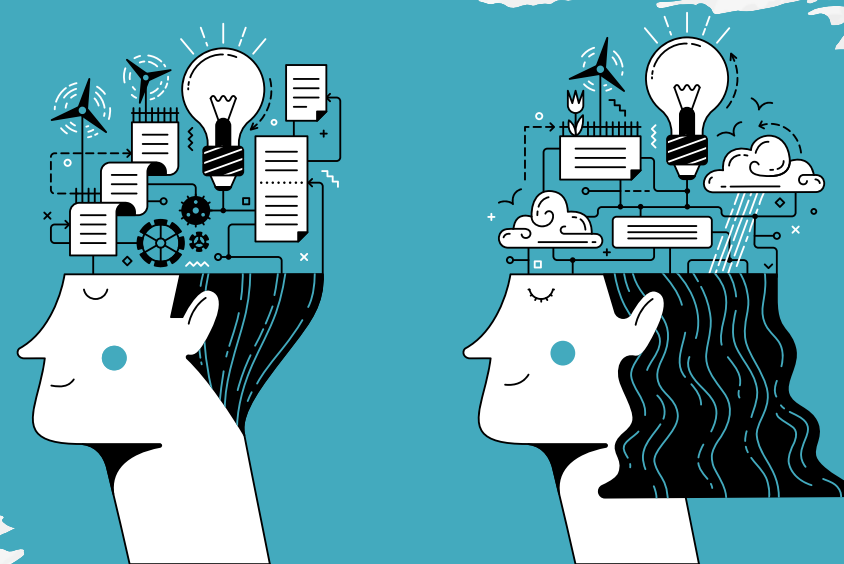
The following predictable tendencies cannot be termed to be irrational, rather they are rules-of-thumb that simplify and hasten the speed of problem-solving, especially when decisions are characterized by high levels of complexity, risk and uncertainty.

Anchoring is consumers' over-reliance on a single trait/characteristic or piece of information while deciding between different alternatives [8]. There is a tendency to compare the options on a single yardstick, rather than taking a systematic assessment of all the trade-offs between the product/service characteristics.

Satisficing is the tendency to process only so much information and employ efforts that are enough to arrive at satisfactory rather than most optimal results. The phenomenon of satisficing facilitates quicker and less burdensome problem-solving and decision-making. In other words, rather than targeting the 'best' option, people often settle with 'good enough' option or solution, one that satisfies the minimum requirements [17].

Cognitive dissonance is the discomfort that people feel when there is an inconsistency or conflict between two or more attitudes, beliefs or systems. When faced with such a conflict people tend to either add new attitudes to create a consistent belief system or reduce this discomfort by altering existing attitudes or beliefs [18].

Loss avverse nature of people implies that people tend to weigh the disutility of losing something far greater than the utility of gaining something [4]. This tendency of weighing losses more than equal-sized gains intensifies particularly as the stakes rise. An example that demonstrates the display of loss aversion can be found in the fact that a product labelled '90 percent fat-free' would garner more appeal than one that is labelled as '10 percent fat' [15].



Box 2: Behavioural levers - Heuristics and risk perception**(A) UNDERLINE WHAT IS BEING LOST**

The uptake of energy-efficient products, for instance, can be influenced by informing consumers about the loss being accrued with the use of energy-inefficient products rather than highlighting the gain of a certain amount of money by using energy-efficient products.

**(B) REDUCE THE COGNITIVE BURDEN**

Identification of the salient features of behavioral intervention is crucial for creating impact. Rather than providing information that is statistical and abstract in nature, it is more beneficial to provide information that is vivid and salient.

**(C) SALIENCY**

Simple, personalized, striking, and non-technical messages would be more effective in reducing the cognitive burden associated with making a choice and help avoid information overload.

**(D) TAILOR THE INFORMATION**

The anchoring bias highlights the fact that interventions should be tailored to the specific target audience. Everybody's behaviour is not motivated by the same guiding principles and different categories of people might be sensitive to different frames of information. While pro-environment behaviour may be guided by financial incentives for some, it might be best leveraged through altruism and ethical values for others. An assessment of cultural, structural, economic and psychological motivators (or barriers) for the target audience can guide the design of behavioral interventions [19].

**(E) CAPTURE FOCUS**

Feedback mechanisms can be a useful policy tool to bring attention to traits associated with energy consumption that might otherwise be ignored. The idea is to alter the anchor for consumers and bring more attention towards energy use. Regular feedback through home energy reports, informative billing, real-time in-home display devices have proven to be quite successful in bringing greater transparency and increasing consumer awareness.

3.1.3 Social norms

People tend to compare their behaviour to those around them and conform to the behaviours that are primarily perceived as norms in their immediate environment. Dawney and Shah [20] explain four concepts with relation to how much of people's behaviour is influenced by other people's behaviour

Social learning, a process by which people subconsciously take in the behaviour of others to learn how to behave

Social proof, a process whereby people, in complex situations of unfamiliarity, consciously watch and learn from the behaviour of others

Social identity, refers to observing and inculcating how other people in the group behave in a particular situation

Social capital, is the strong networks and mutual trust that people share amongst themselves

The significant influence of others on individual behaviour and choice has been evidently observed with respect to littering, recycling, obesity, smoking, vaccination and so on [15]. In addition, the following biases and theories also provide an insight into how societal contexts guide consumer behaviour.

The bandwagon effect implies that people are more likely to adopt those behaviours, attitudes or trends that they hear more often, even more so, if they are advocated by people they like or respect [8].

Box 3: Behavioural levers - Social norms



HIGHLIGHT THE GOOD ACTIONS OF THE PEERS

People's tendency to abide by social norms can be leveraged to influence individual decisions and bring behaviour change. For instance, comparative informational intervention by informing people about how their energy use compares with their neighbours can have a significant effect on behaviour.



BUILD COMMUNITY ENGAGEMENT

Active community engagement and public support can be built upon to ensure high accordance with behavioral programs/intervention, especially when they are voluntary in nature.



CHOOSE THE CORRECT MESSENGER

Messengers have an important role to play in strengthening social norms and ensuring high participation. Choosing an ideal communicator whose identity, values and affiliations conform with the target groups beliefs and ideas is crucial. The messenger has to be a person or organization that enjoys a good reputation and credibility with the audience.

3.2 Stages in designing Behaviour Change interventions

The rich literature available on behaviour change theories has led to the evolution of comprehensive communication strategies and programs for steering consumer behaviour. BCC is a community interactive process of developing tailored messages and approaches which helps to promote and sustain behaviour change by targeting people's knowledge, attitudes, norms, beliefs and behaviours [21]. In the realm of energy conservation, effective

BCC can enhance audience awareness and knowledge, stimulate community dialogue, foster essential attitude change and spruce up a demand for efficient technologies and services.

Based on the research and review of various case studies, the stages in designing behaviour change communications can be broadly divided into four steps:

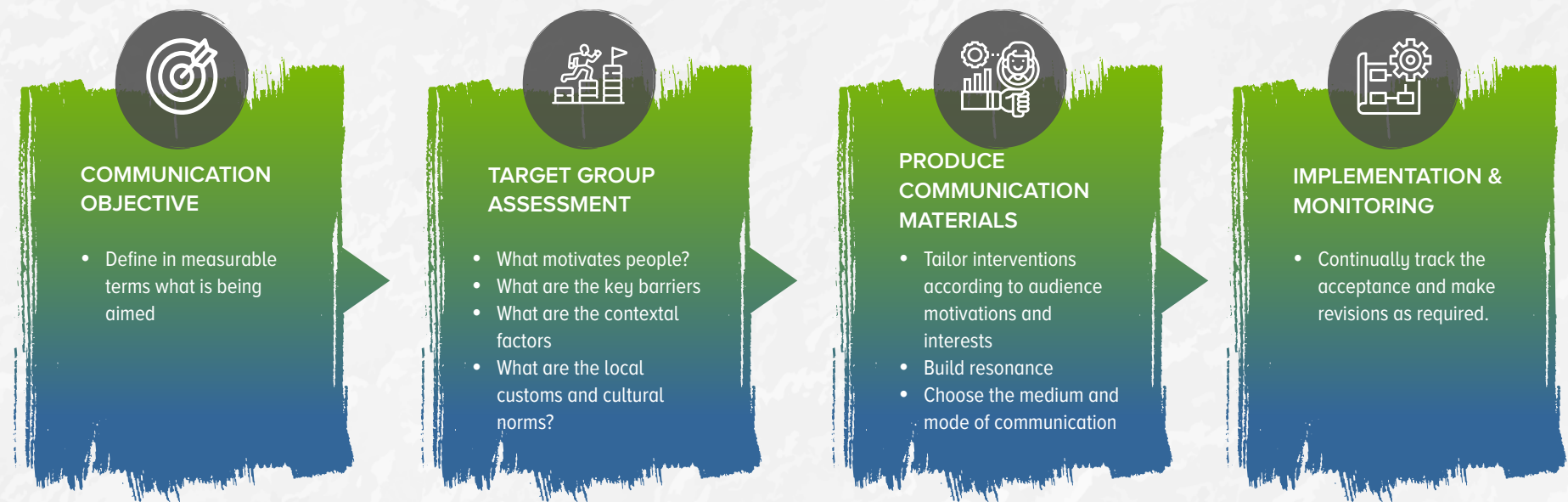


Figure 1: Stages in Behaviour Change Communications

3.2.1 Setting the communication objective

Any BCC starts with explicitly defining the communication objective. Based on the issue at hand and the change being strived for, a behaviour statement is laid that defines in measurable terms the objective being aimed. As far as possible, it is important to ensure the change being promoted is measurable, observable and specific in terms of time, place, quantity, frequency or duration. Setting clear communication objectives also facilitates post-campaign assessment of BCC.

With a communication objective in place, the next step is to identify the focus group. Based on the communication objective, the focus group could be the group most receptive to change or the group who is the direct point of contact or decision maker in the desired behavioral intervention or the group whose involvement will result in the maximum impact. A preliminary investigation of the demographic features, common practices, level of existing awareness and readiness of the target audience to the new behaviour can be helpful in selection of the target group.

3.2.2 Target group assessment

BCC cannot be designed in isolation. Rather extensive interactions with the target audience are critical. BCC works best when the messages are tailored to the target audience's inherent needs, motivations and attitudes. In this context, it is imperative to conduct formative research to understand:

- Common desires and personal motivations of the focus group
- Common barriers preventing the adoption of behaviour
- Most significant determinants/fulcrums that would influence behaviour
- Enablers of behaviour change
- Communication priorities

The findings from formative research serve as the guiding principles for the design of the BCC. Formative research helps to closely analyse people's perception of the issue including their perceived self-efficacy skills, perceived positive consequences, perceived social norms, perceived negative consequences, perceived severity and so on, which are also significant determinants in explaining the gap between people's intentions and their actions. The formative research also provides insights into the right mix of interventions, best medium for BCC and the right messenger to promote the campaign.

3.2.3 Developing BCC Messaging

Based on the audiences' characteristics assessed under the formative research, the next step is to develop the communication strategy and produce communication materials. Messages are most impactful when they are articulated succinctly, appeal to the audience's inherent motivations, cognizant of the contextual and social factors, and delivered in a manner that is easy to remember. Leveraging synergies between different behavioral interventions maximizes impact. Once two or more treatment options or prototypes are developed, concept-testing should be done to appraise various alternatives in terms of impact. Depending on the heterogeneity in the characteristics of the target audience, it might be useful to design the message/appeal in a manner that resonates with the different motivations of different groups of individuals. For instance, some people could be more motivated by the values of altruism, while for others underscoring financial savings from energy efficiency could be a more powerful message.

3.2.4 Implementation and monitoring

An important consideration for the implementation of BCC is the channel of communication. Social media campaigns, in recent years, have become promising means for BCC as they offer the benefits of cost-effectiveness,

ease of trackability, and provision for customizing user experiences [22]. However, ultimately the best channel for BCC can be best determined based on the communication objective and the target audience. For instance, the best channel for BCC to promote the uptake of energy-efficient appliances could be through the retailer or on online shopping sites.

The benchmark and indicators of the assessment of BCC should be done right at the first stage, with the setting of the communication objective. Once the BCC is launched, it is necessary to track its acceptance and success. The results from campaign measurement can be integral for the long-term success of the campaign and guide scaling up of the program at a larger scale.

Box 4: Essentials for messaging

ESSENTIALS FOR MESSAGING



PERSONALIZED

Tailored and personalized information tends to be more effective than generic mass media campaigns that try to target as many people as possible.



ENGAGING

Messages should be simple, engaging and have an element of surprise to pique the audience's interest.



STRAIGHTFORWARD

Messages in BCC should target to utilize one core idea at a time. Addressing too many issues at one time is not advisable as it might add to the complexity and cognitive burden of the audience.



NON-TECHNICAL

The use of technical language, expert jargon should be completely avoided as it fails to build resonance with the audience. Energy use, in itself, is a complicated concept. To be able to get the message across to people, BCC should be able to present the technical concept of energy as a simpler concept.



UNIQUE

The message should make people see the issue from a different lens, one that makes them act.



MINDFUL

To make an impact, BCC should be cognizant of the social context of the behaviour being promoted.



Learnings from International Best Practices

An important step for steering consumer behaviour is communicating information about energy consumption to the users. Individuals are most receptive to committing to change when they have just received feedback, and thus, it is an essential element in not only effective learning but also change reinforcement [8]. The essence of information disclosure as a behavioral intervention lies in how the information is framed and conveyed. **The effectiveness of feedback mechanisms is based on three important factors:**

Firstly, for maximum impact, the information being communicated to users should be clear, simple, and meaningful. It isn't necessary or even useful to dump all information on consumers. There are constraints to the attention span of individuals, and too much information will only lead to cognitive overload as well as choice overload.

Secondly, the most salient or noticeable features being highlighted through feedback mechanisms should be mindful of the cognitive biases and mental heuristics of the target audience. It is critical to link people's intrinsic motivations and intentions with the saliency of the information or indicators being provided.

Thirdly, feedback treatments should be cognizant of the variations in people's financial motivations, environmental goals, and altruism values. Drawing from behavioral research on energy use, it is evident that interventions are most impactful when tailored to the characteristics and motivations of the target audience [24]. Feedback is most impactful when it is delivered clearly, frequently, timely, and on those specific actions which users can influence easily [25].

While the field of behavioral energy efficiency is of relatively recent origin, there is emerging evidence from several studies on the impact of behavioral interventions in reducing overall energy usage. A study reported a reduction of 7.4%, on average, in individual energy consumption, based on a comprehensive meta-analysis of 156 non-monetary, information-based experimental studies from 1975 and 2012 [23]. The variation in the range of savings can be attributed to factors including behaviour change strategy, program design, level of participation, implementation strategy and so on [24].

4.1 Capturing attention through visual aids

An adaptive metaphor-based visualization approach is often used to simplify abstract information and captivate users' attention. Various studies have investigated the effectiveness of real-time feedback provided with the aid of animations and visualizations. Assessing the impact of feedback on the target behaviour of showering, a study undertook the installation of a smart shower meter between the shower hose and the handheld showerhead for the treatment group [25]. The smart meter displayed real-time feedback on water use (in a tenth of litres) and energy consumption (in kWh), along with temperature and energy efficiency class. This information was accompanied by a four-stage animation of a polar bear standing on a gradually melting ice floe (see figure below).

Exhibiting average savings of 22% for the target behaviour, the study also indicated that effective visualization used in conjunction with information systems is able to induce persistent behaviour change over longer periods of time. A similar diminishing ice floe metaphor was also used in another natural experiment conducted at six Swiss hotels [26]. The context of the experiment was again showering; however, the impact was investigated in a hotel setting. A reduction of 11.4% in energy use was observed in the treatment group. The study reported an amortization time of 2.2 years when the energy savings are compared with the retail price of installing a shower head. Given that the experiment was conducted in Swiss hotels, the results from the study underscored that even in a setting where the user isn't directly responsible for the marginal cost of resource consumption, feedback mechanisms can be an effective strategy for energy conservation.



Figure 2: (a) Installation of smart shower meter between the shower head and the shower hose for real-time feedback on resource consumption (b) Two snapshots of the treatment groups' display (c) Control group's display [25]

4.2 Channels of feedback

4.2.1 Home energy reports (HERs)

HERs are the most widespread and successful form of behavioral intervention used in the field of energy efficiency, and Opower has been the most prolific implementer of HERs since 2007 [27]. Since Opower pioneered HERs in 2007 in the US, it has resulted in collective energy savings of more than 25 TWh, which is roughly equivalent to the energy required to power all the households in Dallas, Texas [28].

HERs are summary documents sent intermittently to residential customers, separately from their utility bills. (Figure 2) The reports succinctly provide feedback to customers on their historical and recent energy use, a normative comparison of their energy consumption with their neighbours, tips for achieving energy efficiency, and occasionally also provide rewards or incentives for reducing energy consumption. HERs intend to target the small, repeated actions that impact energy use and thereby embedding persistent habitual changes.

The factors that have been the contributing factors to the success of HERs have been the fact that HERs motivate change by leveraging the insights from behavioral science on the power of social norms; providing frequent, personalized, salient, and actionable tips as well as; setting a strong anchor for consumers through comparison with their historical energy consumption.

Various studies have reported that HERs can bring about utility-wide energy savings between the range of 1-3% [29] [30] [31]. Compared with the operational price of HERs, the reported energy savings are reasonably attractive, especially when compared with the cost of setting up 2% additional generation capacity [30].

HERs demonstrate that how people feel they compare with their peers is a strong determinant of their feelings and actions. Most HERs characterize the energy usage of a home relative to homes that share approximate size and location. A comparison with the average power use in such homes provides an indication to a customer of its own standing in energy usage terms.

HERs also highlight the power use in the highest performing homes to set a realistic and achievable goal to consumers. In addition to fine-grained information and goal-setting, a vital element in the HERs is the actionable advice and tips that provide guidance on how customers can start catching up to their more efficient peers. However, it is important to consider that providing a normative comparison to customers and grading their energy use can prove counterproductive if not done strategically. For the good performers, such feedback may result in a 'boomerang effect' wherein social norms can cause relatively low consumption households to increase energy consumption [27]. Alternatively, lower than average performers might perceive such comparisons as 'energy shaming', which could potentially lead them to opt-out of such programs. Understanding the customer base's underlying perceptions and effectively framing feedback in a way that does not prove counterintuitive is crucial. HERs tend to employ a positive frame and use of emoticons while appraising customer energy performance. Rolling out HERs on an opt-out basis can help foster greater participation than an opt-in basis. Typically, HERs are delivered by post; however, electronic HERs which can be administered at an even lower cost, can be as effective as reports delivered by post [32].

UtilityCo

Home Energy Report

March 1, 2020
Account 1234567890

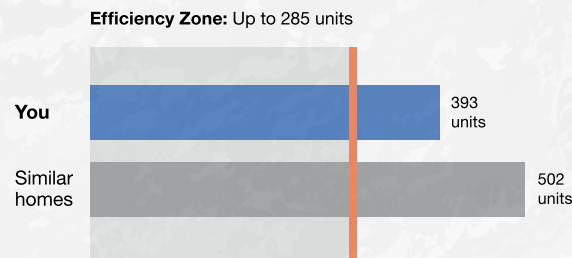
Service address:
12345 Main Street
San Francisco, CA 94111

Your energy use at a glance



This benchmark is an easy indicator that lets you know how you're doing each period.

Let's take a look at your energy use February 1–29, 2020



The **Efficiency Zone** is a goal we set that you can work toward. It represents the 20% of homes in your comparison group that used the least energy this period.

How do we define similar homes?

To make this comparison, we use your home profile to find 100 similar homes based on:



Size
similar square footage:
1,200 sq. ft.



Location
near your home:
within 4 miles



Heating source
similar fuel type:
gas



You used

23%
less energy
than similar homes.

Your energy use was not in the Efficiency Zone.

Don't miss out on saving \$40 each year! Turn over for tips that can help you save. →

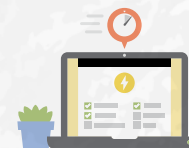
Figure 3: Sample Home Energy Report - Front [33]

This period, you used

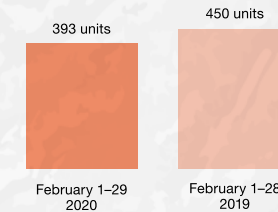
15%
less energy
than during the same
time last year

These tips were
selected for you
based on your

house
information
and
time of year



Compare energy use, year to year



What could have caused your energy use to decrease?

Changes in your household this period, like less appliance use or fewer people at home, may have lowered your energy use.



Heating

Run ceiling fans in reverse during the winter to circulate warm air.



Save up to \$22/year



Clothes Dryer

Use a moisture sensor on your dryer to avoid over-drying.



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Figure 4: Sample Home Energy Report - Back [33]

Opower HERs have demonstrated positive behavioral effects both in the short run as well as long-run [34]. It has been typically observed that with the receipt of HERs, there is an immediate reduction in energy consumption of households as it serves as a reminder for households to save energy through changes in behaviour such as adjusting thermostats, unplugging electronics, and so on. In addition to short-term effects, continued effects on energy savings were also recorded even after households stopped receiving reports. With rapid advances in technology, there is further potential to utilize HERs in implementing time-of-use (TOU) pricing and demand response (DR) strategies. For instance, HERs can provide the average number of times a consumer participated in DR events and compare it with the average number of times their neighbours participated. Such normative comparison can push consumer participation in DR events. Further innovations in the dynamics of HERs hinge on data availability and disaggregation into more granular parts to capture most energy-consuming activities [30].

4.2.2 Smart meters with real-time displays

The role that Information and Communications Technologies (ICTs) in energy systems and in influencing user behaviour has led to the advent of real-time feedback through smart meters. Direct feedback through in-home displays is a promising means to enhance the 'visibility' of energy consumption and track the cost of energy use. With real-time feedback, users are informed about their energy usage, energy costs, most energy-guzzling appliances as well as how energy use can be optimized through set budgets. Instantaneous information thus acts as a self-teaching tool for the users of smart meters. It may facilitate energy conservation behaviour by allowing users to be directly able to see the impact of their actions, such as taking a shower instead of a bath, using air-conditioners at 25 degrees Celsius instead of 20 degrees Celsius, using LED bulbs instead of regular incandescent and so on. By demonstrating direct links between people's actions and electricity consumption, real-time feedback generates awareness about the difference that can be made by altering day-to-day behaviour. It thus makes users more amenable to making small changes in actions, which often otherwise tend to be characterized by routine behaviour. In contrast to HERs, where users' energy consumption is assessed in comparison to their peers, real-time feedback hinges on the comparison of user's energy consumption to their goals, thereby leveraging the goal-setting or goal-directed behavioral lever for motivating desired behaviour.

Various studies, experiments, and pilot studies have investigated the impact of real-time feedback, and there is generally positive consensus on energy savings from real-time feedback. An essential criterion for the success of real-time feedback is clarity and concision of information being provided and, more importantly, it being user-specific

By demonstrating direct links between people's actions and electricity consumption, real-time feedback generates awareness about the difference that can be made by altering day-to-day behaviour.



and user-friendly. The effectiveness of real-time feedback primarily relies on two factors - the saliency of the information and the level of user engagement with the device. The maximum impact of real-time feedback is achieved by making the feedback appealing, intuitive and simple. Strategic positioning of the display device that ensures active user engagement is also crucial. People's interactions with the device can also be enhanced by including features such as a clock, or travel information [35]

The spill over behavioral effects of real-time feedback have also been observed. Real-time feedback has been observed to encourage replacing of high consuming appliances with new ones. Enhancing the visibility of energy-use associated with different appliances facilitates consumer learning in the process. This learning could elicit a behavioural response from the consumers, prompting them to look for, as well as better comprehend, the energy efficiency labelling on appliances. Hence, real-time feedback is also known to affect not just daily consumption habits but also people's investments in energy-saving measures [36].



Figure 5: Smart meter showing energy costs

Despite general positive evaluation, it is important to note that the feasibility of real-time feedback may be hampered by certain factors.

Firstly, the potential for achieving the benefits of real-time feedback might be hampered by restricted access to new technology, know-how, and resources.

Secondly, low or high consumption households are likely to be less responsive to feedback than middle-consumption households. The underlying reasons behind this could be that for the high consuming households, electricity costs constitute only a small part of the household income, and for the low consumption households already have a low potential for further savings [37]

Thirdly, there might be a tendency among users to interact less with the devices over time as the devices could be shifted to less prominent locations or could even run out of charge.

Despite the limitations, it is postulated that in-home displays are likely to be a more effective channel of real-time feedback than app-based mechanisms [38]. The most prominent advantage of in-home display devices in comparison to apps is the always-on feature, which acts as a constant reminder and prompt. In comparison, app-based mechanisms require proactive participation at the user end to download and use the app regularly to track the energy use. In addition, in-home displays tend to be more effective by being accessible to multiple members of a household. While mobile-apps are comparatively cost-effective, the limitation is that interaction with apps might tend to dwindle down after a while. This limiting factor associated with app-based mechanism may become even more significant while ensuring participation during the introduction of smart meters. Nevertheless, consumer engagement with apps can be sustained in the future as ICT technologies develop more sophistication. For instance, the push notifications feature can encourage higher user interaction over time.

4.3.3 Social interaction programs

Another channel for promoting energy-efficient behaviour is leveraging the shared group identity for fostering energy conservation. Social interaction programs, facilitated either through competition, games, or collaboration, are more personalized and engaging than HERs and real-time feedback and trigger an emotional connection for behaviour change. Social interaction programs can also serve as a good starting point for inducing larger behaviour change as they can initiate discussions among peers and subsequently snowball to increase participation beyond the targeted group. The success of social interaction programs hinges on how inclusive and engaging the programs can be. Participation in such programs can be encouraged by ensuring that games and competitions are engaging and rewarding for everyone, not just the winners of the programs [39]. Thus, it becomes crucial to offer recognition to all participants during the course of the programs. In addition, such programs have to be designed in a way that simply competing, and not solely winning, is exciting for the participants. Making the process fun and challenging can motivate sustained participation [40]. Social interaction programs also allow to bring together and build relationships among diverse stakeholders such as municipalities, non-profits, utilities and so on for facilitating the program [40].

Energy savings amounting to 4-15% from social interaction programs have been reported by various review studies [41]. However, it remains contentious whether the change in behaviours as a result of competitions or games persists in the longer run, beyond the duration of the program. Sustenance of the new behaviours or habits primarily depends on the type of rewards that motivated the change in the first place. The rewards that motivate change in participants can broadly be divided into two categories: extrinsic rewards, which might be offered to solicit greater participation and engagement in the program, including money or other tangible prizes, and intrinsic rewards consisting of praise, approval, sense of accomplishment. The probability of changing behaviour patterns persisting for longer periods of time is higher when intrinsic rewards are more powerful than extrinsic rewards in steering participant behaviour [41].

Social interaction programs leverage the power of social norms for inducing behaviour change as well as the public acknowledgment lever for inculcating a sense of social inclusion and engagement in the participants. Usually, such competitions take place within the same community or groups, including competitions between residential buildings, office floors, neighbourhoods, municipalities, or cities. With the advancement of information and communication technologies, the use of social media and mobile game apps can also be aligned for maximizing impact. A study compared the impact of the competitive gamified structure where different groups of households competed against

Social interaction programs can also serve as a good starting point for inducing larger behaviour change as they can initiate discussions among peers and subsequently snowball to increase participation beyond the targeted group.



each other to save as much electricity as possible, and a collaborative gamified structure wherein households collectively tried to reach a 10% electricity goal [25]. The findings from the study did not report a statistically significant difference between the two different gamified approaches in the long term and short term. However, a relapse effect of the positive impacts was observed one year after the intervention.

Hence, while there is evidence to believe that both collaborative and competitive strategies can prove effective in bringing desired change, the design of the social interaction behaviour change programs should be cognizant of a few other factors. Firstly, ensuring individual accountability in community participation can be tricky as there might be a tendency to free-ride others' efforts to achieve the desired goal. Secondly, whether the approach undertaken is competitive or collaborative in nature, setting an ambitious goal is crucial for maximizing efforts and bringing change. Thirdly, the design of the intervention should try, as much as possible, to leverage the intrinsic motivations of the participants and rely on the extrinsic and tangible rewards to the minimum.



5

Behavioural Energy Efficiency in India: Adaptive Thermal Comfort

The need for a shift in the behavioral as well as psychological attitudes towards adaptive thermal comfort practices to reduce cooling requirements and promote a healthy living/working environment has been underscored in the India Cooling Action Plan [42]. Findings from a recent nation-wide residential energy survey reported that 60 percent of the surveyed households run their ACs at a temperature setting of 23 degree Celsius or less [43]. Studies have also shown that compared to using only AC, using a fan along with at a higher temperature has similar implications for thermal comfort and can help bring down energy consumption [44]. However, it was observed from the nation-wide residential energy survey that only 20 percent of the households always use a ceiling fan with AC [43]. Clearly, therein lies the potential for leveraging behaviour change for promoting adaptive thermal comfort practices for energy conservation. In order to foster energy savings through optimum temperature settings, BEE in 2020 mandated the default temperature settings for all new ACs to be set at 24 degrees Celsius [45]. BEE's campaign for the default temperature settings was motivated by the observation that large establishments, hotels and offices in the country tend to maintain a temperature in the range of 18-21 degree Celsius, thereby prompting people to wear warm clothing or use blankets.

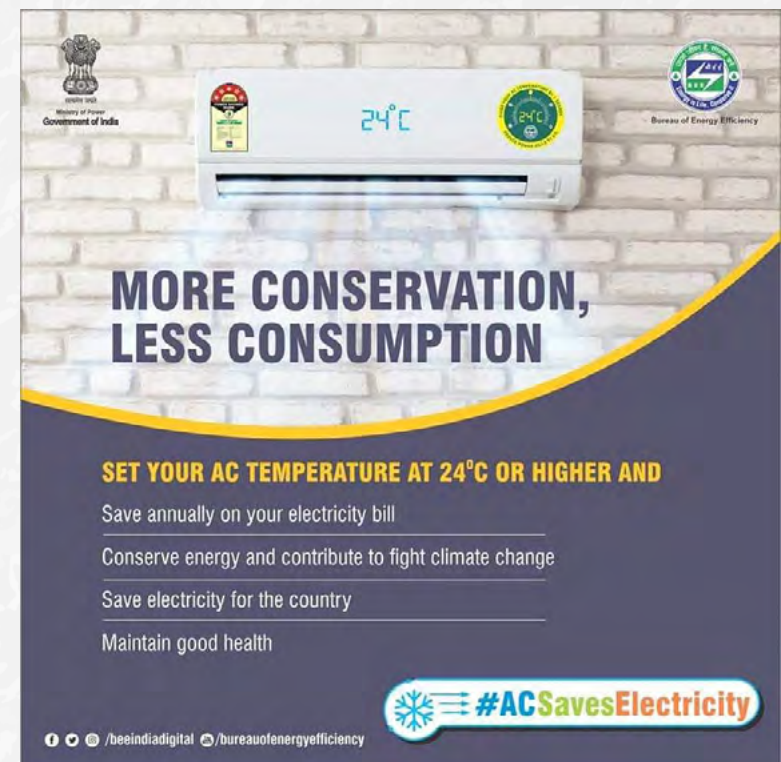


Figure 6: BEE's social media campaign on 24 degree Celsius. Posted on June 20, 2020 (Retrieved from twitter/beeindiadigital)

An energy-saving campaign on similar grounds, known as Cool Biz, was also launched in Japan in 2005 by the Ministry of Environment [46]. The campaign, by introducing a simpler, more casual summer dress code for employees, encouraged offices to set AC temperatures to no less than 28 degree Celsius. The Cool Biz programme for adaptive thermal comfort thus achieves the twin objectives of energy savings and higher worker productivity.

Rise in the penetration of ACs in India, projected to increase by eight-fold in the next three decades, will have significant implications for the cooling energy demand of the country [47]. Promoting optimum temperature settings of ACs will be an effective strategy to sustainably manage the rising cooling demand and ensure thermal comfort for all. Given the user interactive nature of optimum set-point temperature settings, the role of behavioral interventions is of paramount importance. The analysis shows that adopting adaptive thermal comfort practices holds the potential for nation-wide energy savings of 8-13% of the total air-conditioning energy consumption of the building sector [47]. Fostering user awareness and promoting the concept of comfort temperature range would be one of the crucial means to achieving the goals set under the India Cooling Action Plan to sustainably address India's rising cooling demands. The previous sections discussed and demonstrated how feedback measures, use of defaults and social comparison have been effective in promoting behaviour change in various dimensions of energy conservation. It would be interesting to test out how and which interventions can be contextualized in the Indian context and leveraged to promote the occupant behaviour towards adaptive thermal comfort practices.



6

Conclusion and Way Forward

Understanding how to shift consumer behaviour, attitude and practices towards a desired energy efficiency goal has been the focus of this report. The report highlighted that developing an understanding of what motivates people and what factors influences their behaviour is essential for successful policymaking.

The design of behavioural interventions hinges on understanding the target audience. The approach consists of identifying the behaviour to promote, diagnosing the bottlenecks that keep the individuals from switching to the desired behaviour and then strategizing the design and implementation of interventions that best fit the social and cultural context.

Well-designed behavioural interventions hold the potential to significantly reduce or avoid energy consumption. Theoretical underpinnings from years of behavioral research as well as learnings from international best practices provide strong foundational guidance for the design of behavioral interventions. However, these biases are not natural laws. Rather, these are broad human tendencies, which are not uniformly shared by everyone. It would be risky to assume that these behavioural tendencies apply unconditionally. It would be equally risky to overgeneralize learnings from international best practices covered in this report from one context to another. Local factors, customs, culture must be analyzed before scaling up behavioural campaigns.



The key learnings from the report can be summarized as follows:

- There are a variety of cognitive biases and motivational factors that come into play when we look at energy use and purchase behaviour. Developing an understanding of what motivates people and what factors influence their behaviour is imperative for effective design of behavioural interventions.
- People tend to stick to the default settings as much as possible, they are loss averse and risk averse, they tend to rely on a single trait/characteristic or piece of information while deciding between different alternatives and are majorly influenced by the behaviour of their peers.
- The effectiveness of feedback mechanisms can be pushed by ensuring that the information being communicated to users should be clear, simple, and meaningful. An adaptive metaphor-based visualization approach can assist in simplifying abstract information and captivate users' attention.
- *HERs* have been able to pioneer behavioural energy conservation measures by leveraging the insights from behavioral science on the power of social norms; providing frequent, personalized, salient, and actionable tips as well as; and setting a strong anchor for consumers through comparison with their historical energy consumption.
- *Real-time feedback* can be an effective tool for behaviour change. Its effectiveness primarily relies on two factors - the saliency of the information and the level of user engagement with the device. Strategic positioning of the display device that ensures active user engagement is crucial.
- *Social interaction programs* can be useful inducing larger behaviour change as they can initiate discussions among peers. The success of social interaction programs hinges on how inclusive and engaging the programs can be. However, it is important to ensure that change in behaviours as a result of social interaction programs persists in the longer run, beyond the duration of the program.

Designing behaviour change interventions for promoting adaptive thermal comfort practices

The work undertaken in the preparation of this report shall be taken forward and further strengthened by undertaking formative research to design culturally appropriate BCC for promoting adaptive thermal comfort practices in India.

Personal factors and occupant behaviour are some of the key characteristics in promoting the adoption of adaptive thermal comfort in India. Deploying a consumer-focused campaign to drive the adoption of and gain benefits from adaptive thermal comfort practices is important to achieve cooling energy reductions. Deciphering human behaviour is an inherently complex phenomenon marked by an interplay of psychological, sociological, and contextual factors. For designing behavioral interventions, it is important to look at things from the consumer perspective. As a next step, it would thus be important to understand the Indian audience and conduct research to understand the motivations, attitudes, and behaviours of the consumers. The primary research should be undertaken with the objective of evaluating consumer behavioral tendencies and key areas of intervention. The research will help to identify the most significant cognitive biases and heuristics in play with relation to thermal comfort practices, which can subsequently help identify the appeals the consumers will best respond to. A comparison between the attitudes and practices of individuals that practice adaptive thermal comfort (doers) and those that do not (non-doers) would help ascertain the main barriers preventing the adoption of adaptive thermal comfort practices. It would also help to identify the most important fulcrums/motivators around which the agenda of adaptive thermal comfort should be promoted.

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