WaterSmart® SOFTWARE

Tapping into the Power of Behavioral Science

Insights & Opportunities for Water-Use Efficiency

Abstract

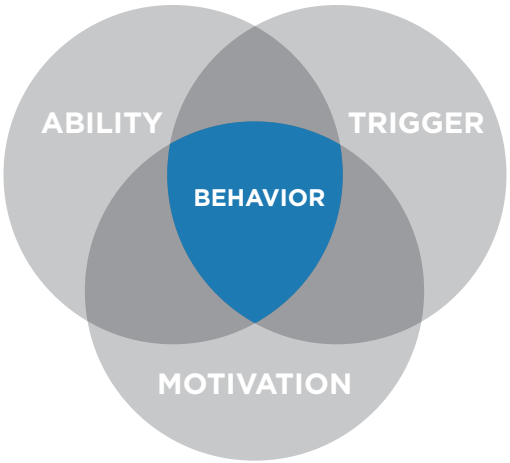
The water sector now employs behavioral science to persistently nudge residential customers to use water more efficiently. This paper begins with an in-depth analysis of how social norms, a key element of behavioral science, have been used effectively in other fields, and how they can drive gains in water efficiency. It also discusses how several other key principles of behavioral science—default options, feedback, goal setting, and public commitments—can be applied strategically in the water sector.

Background

The U.S. has made significant gains in natural resource conservation and efficiency over the past several decades. Yet many efforts to encourage consumers to persistently adopt the behaviors and products necessary to reduce resource use on a large scale have fallen short of expectations.[1,2]

Many conservation and efficiency efforts have focused on providing financial incentives for consumers to reduce their resource use. Despite the economic benefits associated with efficient resource management, consumers have not invested in efficiency-driving products and practices as widely as expected.[2,3]

FIGURE 1. **More than just financial motivation and knowledge drive behavior.**



Adapted from BJ Fogg's Behavior Model: www.behaviormodel.org

Other efforts, focused on providing consumers with information about steps they can take to reduce their resource use, have also failed to produce measurable behavior change.[4,5] Studies indicate that providing consumers with information alone can increase their knowledge of a topic, but rarely produces significant changes in behavior.[4,5] For example, one study showed that individuals who participated in a workshop on residential energy conservation showed changes in attitudes and knowledge, but no changes in behavior.[6] In another study, individuals who took a 10-week course about conserving water showed no subsequent changes in water consumption.[7]

Over the past decade, utilities, governments, businesses, and nonprofits have come to realize that more than just financial considerations and information drive behavior. Social and psychological factors also play a significant role in shaping consumers' decisions and behaviors around resource use.

Stakeholders have consequently turned their interest to behavioral science, a multidisciplinary field that draws from psychology, sociology, public health, and behavioral economics to explain the complex mechanisms that shape human behavior. When used strategically, behavioral science holds the potential to drive down resource use, drive up profits, and generate measurable gains in conservation and efficiency.

Early research on social influence

Perhaps one of the most well-known and widely applied areas of behavioral science centers on social influence and the related concept of social norms. Psychologists have understood for some time that people are profoundly influenced by those around them, often in ways that one might not expect. One of the earliest experiments in social influence research revealed that people would consistently change their judgments about something as seemingly concrete as the length of a line in order to match the judgments of those around them, even when the group's judgments were blatantly incorrect.[8]

Other experiments have shown that people mimic the behavior—such as facial expressions and mannerisms—of those around them, usually without realizing it.[9] In fact, people often mimic the behavior of those around them even when there is seemingly no reason to do so. In one study, 80% of passersby stopped on a busy street to gaze up at the sky when those around them were looking up, even when there was nothing noteworthy to look at.[10]

Some psychologists have speculated that our drive to conform to others' behaviors and beliefs is rooted in the evolutionary need to affiliate and build social bonds with others.[11] Other psychologists have speculated that following the lead of those around us can help us to maintain a positive self-image, which is a deep psychological need.[12] Another possible explanation is that mimicking the behavior of others provides a decision-making shortcut: if everyone else is doing something, it must be a sensible thing to do.[13]

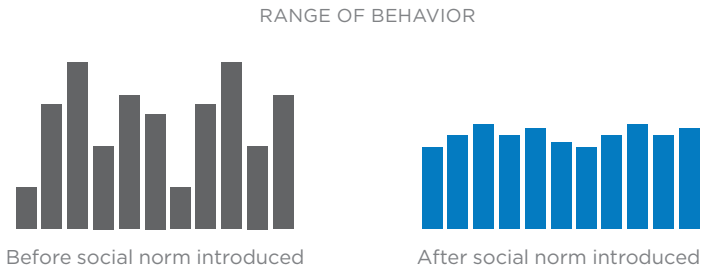
Leveraging social norms to change behavior

The power of social influence is particularly evident in individuals' tendency to adhere to social norms: beliefs about what other people are doing, and what they approve or disapprove of.[14] Social norms constitute a social standard from which people typically do not want to deviate.[15]

Social Norm
A social standard from which people typically do not want to deviate.

Ironically, people are often unaware of how social norms influence their behavior. In one experiment, participants rated the behavior of those around them as the least powerful reason behind their decisions to reduce their energy use, even though the experiment's results clearly demonstrated that participants' behavior was influenced by social norms more so than other factors.[16]

FIGURE 2. **Behavior will gravitate toward the perceived norm.**



Moreover, people often actively resist the idea of being influenced by social norms. Despite dramatic conformity in many experiments, participants often tell researchers that they came to their conclusions independently of the beliefs and behavior of those around them.[17] [18] [19] And a recent study found that consumers ranked "show me how much [energy] I used compared with households like mine" near the bottom of a list of possible features for an energy efficiency program.[20]

Of even greater interest is the fact that we often wrongly perceive what so-called "normal" behavior really is. In other words, we may think we know how the majority of those around us act or what they believe, but we may in fact be entirely incorrect. For example, a myriad of studies have shown that college students consistently overestimate how much those around them drink.[21] [22]

Interestingly, making people aware of norms, especially when these norms correct a misperception, can have an enormously powerful effect on behavior. This technique sits at the heart of a myriad of social norms based interventions. Numerous studies have shown that making people aware of

what is truly "normal" among their friends, peers, or neighbors can make them more likely to adjust their behavior to match that of those around them.[21]

The first social norms interventions focused on reducing alcohol use on college campuses in the 1980s.[22] Social norms interventions to reduce alcohol use—in which students are made aware of the typical alcohol use patterns of their peers—have been applied at more than half of U.S. colleges and universities since, according to a 2002 analysis by the Harvard School of Public Health.[23]

Social norms have successfully motivated behavior change in a range of other domains, including cigarette use,[24] voting,[25] retirement savings,[26] charitable giving,[27] seatbelt use,[28] drug use,[29] and food waste.[30] The social norms approach is used widely across the U.S.: According to a 2004 report, social norms interventions are currently being funded by more than five federal agencies and by dozens of state agencies, non-profit organizations, and consortia.[21]

Social norms have also been successful in altering individuals' environmental behavior. In one study, people who received normative information about their neighbors' recycling habits, as well as information about their own recycling habits, recycled significantly more than those who received information about how and why they should recycle.[5] In another study, hotel guests who received a message indicating that the majority of hotel guests reused their towels were more likely to reuse their towels than hotel guests who received information about the impact of towel use on the environment.[31]

Scaling up social norms

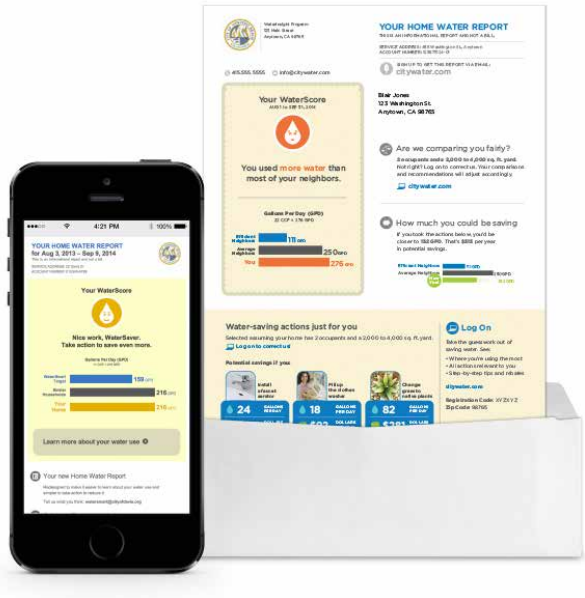
HOW BAR GRAPHS AND SMILEY FACES SAVE HUNDREDS OF MILLIONS OF GALLONS OF WATER EACH YEAR

Perhaps one of the best-known applications of social norms in the water sector has been by WaterSmart Software. WaterSmart's founders drew their inspiration in part from a 2007 study on social norms by Cal State University San Marcos psychology professor P. Wesley Schultz.[15] In the study, researchers distributed leaflets to suburban residents with information about their average energy use and their neighbors' average energy use. If the household used less energy than the average, researchers provided a smiley face on the leaflet. If the household used more than the average, researchers drew a sad face. Households that received this bundle of normative information showed significant reductions in energy use following the intervention and during a three-week follow-up. Importantly, savings were concentrated among households that initially used above-average amounts

of energy; those using less energy than average showed no significant changes in consumption.

WaterSmart Software has scaled up the methodology used in this study to reduce residential customers' water usage across the United States. Each month, WaterSmart sends "Home Water Reports" (Figure 3) to utility customers via direct mail or email that include information about the household's water usage, the usage of similar homes in the neighborhood, and the usage of "efficient" homes in the neighborhood. This information is paired with a smiley, neutral, or worried water droplet icon depending on the household's water usage relative to other homes. The reports also include personalized tips for reducing water use. Independent analyses indicate that WaterSmart's methodology reduces water consumption by up to 5%.[32]

FIGURE 3. **WaterSmart Home Water Reports**



WaterSmart isn't the only company that is using social norms to drive improvements in resource use-efficiency. Opower, a company that partners with energy utilities around the world to reduce residential customers' energy use, employs a methodology similar to that used by WaterSmart: Opower sends "Home Energy Reports" that provide customers with feedback about their monthly usage, the monthly usage of their average and efficient neighbors, and tips on how to reduce energy consumption. Independent analyses indicate that Opower's methodology reduces energy consumption by an average of 2%.[33]

Importantly, interest in social norms approaches to water and energy efficiency isn't attributable entirely to the fact that they decrease consumption. They also save money: efficiency and conservation are often less expensive than other mechanisms used to meet increasing water demand.[34] In addition, some behavioral programs, like those run through WaterSmart, have been shown to significantly increase customer satisfaction and incentivize program engagement.[32]

Maximizing the efficacy of social norms

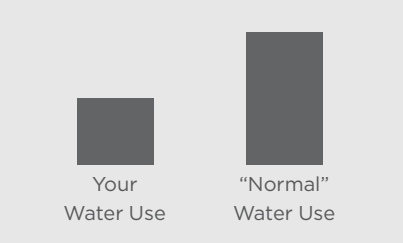
Though giving people information about social norms is a proven method for generating behavior change, social norms programs demand a sophisticated understanding of how a variety of psychological factors interact to produce meaningful behavior change. The effectiveness of social norms programs is dependent in part on the extent to which three key factors—injunctive norms, reference groups, and data credibility—are considered in the intervention.

COUPLING DESCRIPTIVE AND INJUNCTIVE NORMS

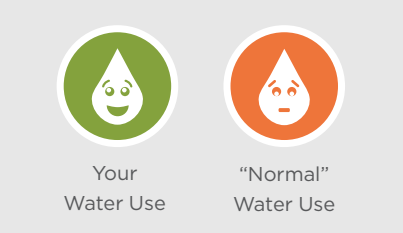
A critically important factor to consider in social norms interventions is the coupling of descriptive norms, which convey what is typical in a group (the is), with injunctive norms, which convey what is socially accepted in a group (the ought).

Injunctive norms—which communicate the social acceptability of a norm—are necessary to counteract an undesirable aspect of some social norms interventions: the boomerang effect (Figure 5). The boomerang effect refers to an inadvertent increase in socially undesirable behavior among those individuals who initially perform the behavior at rate below the norm.[15] For example, a social norms campaign to reduce water use may cause individuals

FIGURE 4. **Coupling norms**



Descriptive norms convey what is typical. In isolation, it may cause individuals who consume less water than the norm to start using more.



Injunctive norms convey what is socially accepted. They may be used to counteract descriptive norms.

FIGURE 5. **The Boomerang Effect**

Individual exhibits target behavior

e.g. low water use

Message encouraging normalized behavior moves individual back toward the "crowd."

e.g. "Most people use more water than you."

An injunctive norm is used to counteract this effect

e.g. "low water use is admirable"

who consume less water than the norm to start using more. Injunctive norms, however, can counteract this effect by showing this segment of people that their current behavior is commendable or socially accepted. In P. Wesley Schultz and colleagues' study, injunctive norms were communicated through smiley faces or sad faces on participating households' energy reports.[15] WaterSmart Software uses a similar strategy in its Home Water Reports.

Water managers should carefully consider the specific visual and written language used to convey these norms. Extensive A/B testing can help to fine-tune this language and thus maximize behavior change.

SOCIAL NORM CAMPAIGN BEST PRACTICES

Counteract the Boomerang Effect
Affirmative messages can keep already-compliant individuals focused on the target behavior.

Form relevant reference groups
Compare individuals to others that are as similar as possible.

Present credible data
Cite your data's source and collection methods.

Maintain a control group
Report statistically significant results from your campaign.

REFERENCE GROUPS

A second key factor to consider in the design of social norms interventions is reference groups. In psychology, a reference group refers to the group of people whose beliefs or behavior an individual is compared to. Social norms comparisons are most likely to change an individual's behavior when there is a high degree of perceived similarity or social identification between the individual and the reference group.[35] [36]

For example, a 2008 study on hotel towel use showed that guests were more likely to re-use towels when they were told that most people who had stayed in the same room reused their towels than when they were told that most people in the same hotel reused their towels. This is likely due to the study participants' greater perceived similarity to guests who stayed in the same hotel room than all guests in the hotel.[31]

One way of enhancing an audience's association with a reference group is to provide photographs of appropriate demographic groups in social norms messaging about water use. Ideally, these photos would be of real members who other members of the group might even recognize.[37] Social norms messaging about water use might thus include photos that match a community or region's demographic makeup. Another technique is to use the logos of relevant institutions (universities, cities, etc.), and photographs of local landmarks.[38]

The exact language used to describe reference groups can play a critical role in determining the success of social norms comparisons. WaterSmart, for example, has experienced challenges in communicating the reference group to which individual households are compared in its Home Water Reports. For example, some customers have taken the term "neighbors" to literally mean the household next door to theirs, which may or may not be representative of their reference group, and has led to confusion or frustration among customers. Using terminology like "similar households in

your neighborhood" may be a more effective way to elevate identification with the reference group and increase the likelihood of behavior change.

Equally important as the actual language used to describe reference groups are the analytics used to develop them. Evidence from WaterSmart suggests that reference groups are most effective when a variety of external variables are taken into account, such as the number of occupants, the size of a customer's home and yard, and local weather patterns. In addition, developing effective reference groups requires not only a large enough sample to allow for a control group and statistically significant results, but also a variety of data sources to ensure a reliable data model.

DATA CREDIBILITY

Data credibility is the third factor critical to consider in social norms interventions. Without credible data, social norms comparisons may fail to achieve intended outcomes.[37] For example, in one study, researchers identified the fact that close to half the students didn't believe social norms data as one of the primary reasons why a social norms experiment to curb alcohol consumption at a U.S. college failed to succeed.[39]

One way of ensuring the credibility of social norms data is to provide comprehensive information about statistics or data cited in social norms messaging. For example, messaging that compares households' residential water use may include information about the date data was collected and the size of the sample. Another technique is to provide individuals with the opportunity to access more detailed and comprehensive data, perhaps through a website.[37]

Beyond social norms: other behavioral principles

Water managers can harness the power of default options by **automatically enrolling** residents in programs to improve water-use efficiency.

Social norms are one of the most widely used behavioral tools to reduce resource use. Behavioral science, however, offers myriad other insights that can be applied in water efficiency and conservation programs. Default options, goal setting, public commitments, and choice overload are four additional principles that—when applied carefully and systematically—hold the potential to produce further gains in water-use efficiency in the residential sector.

DEFAULT OPTIONS

Psychological and economic research indicates that people are highly motivated to maintain the status quo. Thus, when presented with the choice of sticking with the default option or selecting a different option, people tend to stick with the default option.[40] This could be due to the fact that individuals weigh the potential losses of moving away from the status quo

more heavily than the potential gains of choosing an alternative option, a phenomenon known as the endowment effect.[41]

LEVERAGING BEHAVIORAL SCIENCE

Defaults
Whenever possible, opt your customers into your program automatically.

Feedback
Share data with your customers as soon as it is available to you.

Public commitments
Encourage water-saving pledges.

Goals
Use your customers' data to help them set realistic, personalized goals.

Choice overload
Target your messages so your customers are not overwhelmed.

Individuals' bias towards default options is so strong that countries with opt-out policies for organ donation have significantly higher rates of donation than countries with opt-in policies.[42] And policies that automatically enroll employees in 401(k) programs produce higher participation rates than policies that require employees to enroll themselves.[43] [44]

Water managers can harness the power of default options by automatically enrolling residents in programs to improve water-use efficiency, and giving them the option to leave the program if they choose. Some research indicates that relatively few people make the effort to opt out. In one instance, just 57 of 20,000 automatically enrolled households chose not to participate in an energy reduction program.[45]

FEEDBACK

Feedback is a common tool used to promote conservation. Like social norms interventions, feedback-based messaging generally provide households with more detailed and timely information about their usage than typical utility bills.[46] Feedback provided to residential energy customers has been shown to reduce energy usage from 2 to 20%.[47] [48] [50] Importantly, pairing feedback with other social science principles such as goal setting, commitments, and social norms can increase savings potential up to 35%.[48] Feedback may be especially fruitful in promoting water conservation given that on average, Americans underestimate their household water use by a factor of two.[49]

While the exact psychological mechanisms that underlie the effect of feedback on energy usage are not well-studied, feedback generally works by making people's resource use visible and thus easier to understand and control.[50] In addition, feedback can help people associate their behavior with certain outcomes (e.g. water and cost savings).[51] Feedback may also lead people to set explicit or implicit goals, or help people to achieve a goal they have already set.[56]

In general, research indicates that feedback tends to be more effective when it is provided more frequently. According to one meta-analysis, feedback given daily or weekly generates the highest savings per household.[50] Another analysis found that programs that give feedback daily or more-than-daily generally produce the best results.[49] In addition, consumers often value feedback that is delivered frequently.[49]

Feedback to households on resource use should correlate with the frequency of meter-read data collection. For example, if water utilities only generate meter reads on a semi-monthly basis, then providing feedback more frequently than that has the potential to undermine data credibility, as discussed above. When more frequent (i.e. hourly) data collection is available through Advanced Metering Infrastructure (AMI), programs can accommodate a more robust feedback schedule, which may in turn drive greater behavior change.

The effects of feedback on energy consumption are generally not uniform across all households: households that consume less energy than the norm sometimes increase their energy use as a result of feedback. [52] [53] [54] Water managers interested in feedback-based programs need to take care to manage these effects, through segmentation, injunctive norms, and other mechanisms.

According to one meta-analysis, feedback is most effective when it is presented clearly and simply, customized to the household, provided over an extended period of time, and is provided relative to a meaningful standard of comparison.[55] Feedback is also especially effective when it is presented immediately following consumers' actions.[56]

GOAL SETTING

Goal setting can be a powerful tool to increase motivation, overcome procrastination, and set reference points for progress.[57] Setting specific goals can be particularly effective in enhancing effort and persistence.[58]

Resource managers can utilize the power of **goal setting** by asking households to set a specific, realistic, and achievable—yet still difficult goal.

Goal setting has been used to successfully reduce energy use among residential customers in a number of different studies. For example, C3 Energy uses goal setting in combination with rewards through its customer engagement program C3 Residential™. An independent analysis of one of C3 Residential's™ programs in the Northeast reported an average of 5.7% energy savings.[59]

In another study of an energy efficiency program employing goal-setting, participating households saved an average of 4.4% in the first year of the program. Importantly, households that set realistic goals saved substantially more than those who chose the minimum goal possible or set unrealistically high goals.[60] Another study, however, found that households that were assigned a relatively difficult goal of a 20% reduction in energy use plus feedback on their progress saved significantly more energy than households that were assigned a relatively easy goal of a 2% reduction in energy use plus feedback on their progress.[61]

Resource managers can utilize the power of goal setting by asking households to set a specific, realistic, and achievable—yet still difficult goal. Managers may also consider giving households the option of setting their own goal or having a goal assigned to them. Goal setting can also be used in conjunction with feedback or commitments.

PUBLIC COMMITMENTS

Goal setting is often even more effective when individuals make their goals and commitments public.[62] As a rule, public commitments tend to be more persistent than commitments made privately.[63] The power of commitment may stem from individuals' core psychological need to see themselves and be seen by others as consistent.[64] Other researchers have suggested that the power of commitment lies in the fact that commitment can lead to the development of personal norms that further encourage a behavior.[65]

Water managers should identify the **specific outcomes** they hope to achieve and carefully select the strategies and insights that will generate these outcomes.

Several academic studies have shown that commitment can successfully reduce resource use. One study found that hotel guests who made a commitment at check-in to reuse their towels and who received a lapel pin symbolizing their commitment were 25% more likely to hang a towel for reuse.[31] In another study, individuals who signed a public commitment (that was later published in a leaflet) showed a smaller rate of increase in gas and electricity consumption than those in the control group and those who made a private commitment.[66]

Some evidence suggests that commitments are more effective when people are consistently reminded of them.[67] To that end, water managers might consider providing households with written instructions about target behavior to households and asking them to keep them visible.

Commitments to reduce resource use may be especially effective when people make them immediately after being made aware of their high resource use. In one study, participants who were reminded of times they had wasted water and who then made a commitment to take shorter showers saved more water than participants in a control condition. These participants also saved more water than participants who made the commitment without first recalling times they had wasted water.[68] Water managers may be able to leverage this phenomenon by strategically pairing the opportunity to make commitments with feedback about water usage.

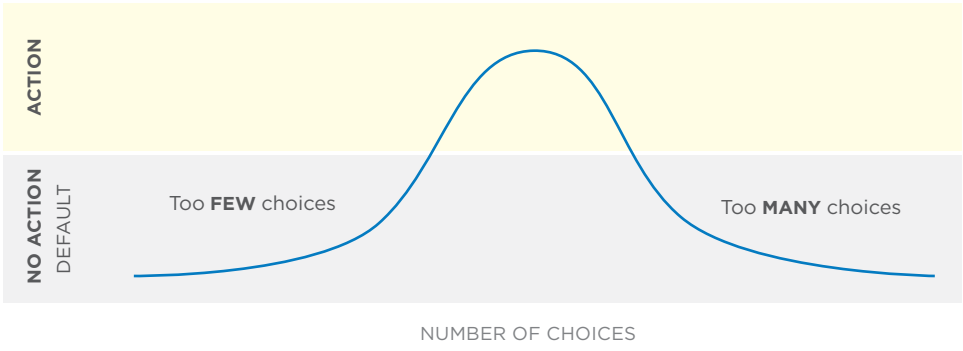
CHOICE OVERLOAD

A fifth behavioral principle to consider is a psychological phenomenon known as choice overload.[69] In the U.S., people commonly assume that more choice will lead to better outcomes. Yet recent psychological research

indicates quite the opposite—more choice, in fact, can be paralyzing and thus lead to worse outcomes (Figure 6).

In one study, people at a gourmet grocery store who were presented with 24 types of jam to taste were significantly less likely to stop at the booth or buy a jam than those who were presented with just six types of jam.[71] Another study found that 401(k) plans that offered more types of funds correlated with lower employee participation.[70]

FIGURE 6. **Presenting too many recommendations can overwhelm customers**



When applied to resource efficiency, this research suggests that program managers should caution against providing too many conservation and efficiency recommendations, as this can overwhelm customers and make them more likely to stick with the default option: doing nothing.[59] Resource managers may also consider providing households with packages of efficiency options rather than an item-by-item list of choices to reduce usage.[59,73] While utilities that provide both electricity and water services may consider bundling social-norms based information about both electricity and water, this decision needs to be carefully contemplated, as combined reports risk generating confusion and undermining the potential for behavior change.

Putting behavioral science into practice

Behavioral science offers a range of insights that, when applied appropriately, hold the potential to significantly reduce residential water use. Yet merely giving water managers information about behavioral science is unlikely to produce measurable change.[47] Some insights may have unintended effects when applied incorrectly,[47] and principles may interact with each other in complex or unexpected ways. To achieve intended outcomes, behavioral strategies must be applied with a sophisticated understanding of the theory that underlies them and the factors that drive how an insight translates from experiments to the real world.

Moreover, water managers need to go beyond simply incorporating behavioral science into program design. Water managers should also identify the specific outcomes they hope to achieve and carefully select the strategies and insights that will generate these outcomes.[38] They may also choose to employ experimental approaches to evaluate the specific language used to communicate households' consumption patterns, as well as recommendations for reducing resource use. Managers should, at minimum, use statistically valid control and test groups[71] and ideally, more sophisticated testing that can generate deeper insights about what elements of a program are effective and which are not.[38] Customer segmentation analyses can also help determine the optimal type and frequency of communications each household receives.

The need for water conservation and efficiency is huge. Americans' water footprint is twice the global average.[72] Climate change and growing populations threaten to exacerbate global water vulnerabilities.[73] By combining information and financial incentives with well-tested programs that take a range of social and psychological factors into account, stakeholders have the potential to make the progress necessary to help provide reliable access to water for all.

FOR MORE INFORMATION

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Endnotes

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