Techniques to Influence Corporate Water Behavior

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Introduction

The benefits of sustainable business practices are well-known. Reduced costs on utility bills allow the company's profit to increase. Serving the public good translates into greater social license to operate. Implementing sustainability practices can allow your company to get ahead of the regulatory curve so that when policies such as a carbon tax are implemented the company is well-prepared. Finally employee satisfaction is heightened and yields higher retention rates[1,2]. However, despite all the positive impacts, it is still only a fraction of businesses that fully embrace sustainable practices across the board. Obstacles include an absence of appropriate technology, excessive capital needed up front, and the fact it can be more complicated to be sustainable (too many thing to pay attention to). But even if all of these obstacles are overcome, there remains one huge hurdle – employee behavior. Without employee behavior that supports and embraces sustainable practices, all of the investment and technology in the world can fail.

In this paper we focus on cutting edge behavioral methodologies and studies of actual firms that have attempted to change to sustainable practices. We pay particular attention to nudge techniques[3], which have become so effective that experts in behavioral science have had high-

level positions as advisors to the British government and to the Executive Office of the President of the United States.

Often when implementing new technologies in the design of sustainable buildings, the behaviors of people who occupy office buildings daily are an overlooked factor in achieving sustainable performance goals and the conservation of resources. Building occupants are rarely trained or educated in how their behaviors impact environmental performance, be that in water, energy, or other resource use. Resource-saving technologies must therefore be accompanied by sustainable-use behaviors by operations and maintenance staff as well as by occupants[4].

This paper addresses how to get employees to change their habits, daily routines, or overall behavior relating to water use in a typical office setting. It will not address water usage related to industry-specific processes such as textile production or power generation. It draws from prior successes in water and energy reduction—both commercial and residential—to present behavioral change strategies that have proven to be effective.

While this is a complex issue with no simple answer, understanding behavior change in any field can be broken down into three steps: *information, control,* and *motivation.*

Overcoming the mindset that water is an inexhaustible, inexpensive resource

To many, water is considered to be a readily-available, inexpensive resource. Water is taken for granted. Yet data show otherwise. Water scarcity is increasing globally at an alarming rate. By 2025, an estimated 1.8 billion people will live in areas plagued by water scarcity[5].

Collectively office water consumption has a large footprint across the United States. In an analysis done by the US Energy Information Administration in 2012, 46,000 large commercial buildings (greater than 200,000 square feet) were examined and measured for their water usage. The results indicated shocking water use levels. The total amount about 359 billion gallons of water a year, which is 980 million gallons per day. This level is estimated to be 2.3% of the total public water supply in the United States. On a daily basis, they used an average of 22,000 gallons per building, 55.6 gallons per thousand square feet, and 50.1 gallons per worker[8].

a typical office setting water use is categorized in the following: domestic/indoor water use,

cooling and heating, and outdoor water use (see Table 1) [6]. Indoor water use can be described as water used in kitchens, restrooms, laundry and sanitation. Cooling and heating includes boilers and steam systems, cooling towers, and air conditioners. Outdoor water use primarily applies to irrigation.

Regardless of the difference services provided by companies in commercial and industrial sector, many have similar end uses for water. Domestic water use for plumbing fixtures such as toilets, faucets, shower heads, and urinals represents from one-quarter to one-half of all water use within most of these facilities[6]. They also utilize a significant portion of their water for irrigation and landscaping. Finally, at least half of the facilities use a significant amount of their water for heating and cooling purposes.

Table 1. Examples of Potential End Uses of Water in Commercial and Institutional Facilities[6]

Indoor/Domestic Water	

• Kitchens, cafeterias, staff rooms
  ○ Faucets
  ○ Distilled/drinking water
  ○ Dishwashing machines
  ○ Ice machines
  ○ Garbage disposal
  ○ Food preparation
• Restrooms and showers
  ○ Faucets
  ○ Toilets and urinals
  ○ Showers
	• Laundry
	  ○ Washing machines
	• Sanitation
	  ○ Facility cleaning
	  ○ Sterilizers/autoclaves
	  ○ Equipment washing
	  ○ Dust control
	  ○ Container washing
	• Process
	  ○ Photographic and x-ray processing

Cooling and Heating	***Outdoor Water Use***

• Cooling tower
• Evaporative coolers
• Broilers and steam systems
• Once-through cooling
  ○ Air conditioner
  ○ Air compressor
  ○ Hydraulic equipment
  ○ Degreasers
  ○ Rectifiers
  ○ Vacuum pumps
	• Irrigation
	• Pools and spas
	• Decorative water feature

Figure 1 demonstrates the breakdown of water use in the hospital, office, school, restaurant, and hospitality sectors specifically. The aforementioned categorization of water use stands. We see domestic/restroom, cooling and heating, and landscaping as representing the largest percentages

of water use throughout the sectors[7]. In offices more specifically the same usage trend occurs, with kitchen and dishwashing added as the fourth sector of major water use (see Figure 2).

The tables and figures in this section give a pointed list of appliances, machines, and sectors that utilize a lot of water, therefore providing a roadmap of where to target behavior change in an office environment. Some companies are recognizing that their reliance on water may pose a risk for their business and that they need to adjust their patterns of water usage. But how can they enact this change? Behaviors are a major underlying factor that contribute to the water savings achieved. In order to capitalize on water savings, behavior change needs to occur within business frameworks and individual mindsets. People are heavily influenced by what others around them are doing. Green behaviors can grow exponentially when social norms are changed. If businesses are changing the default way of thinking or behaving, employees will follow suit. The following sections discuss strategies of implementing behavior change in order to reduce water usage in the business sector.

Figure 1.

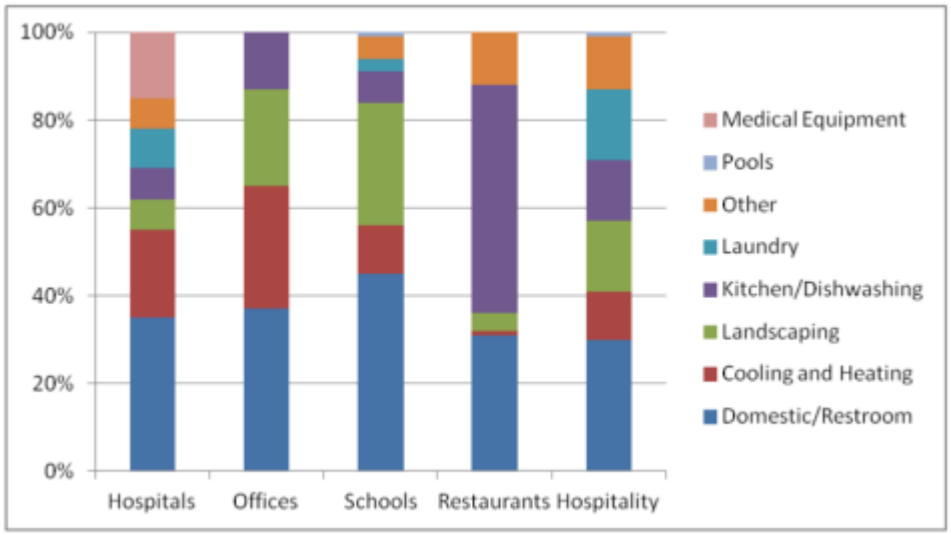
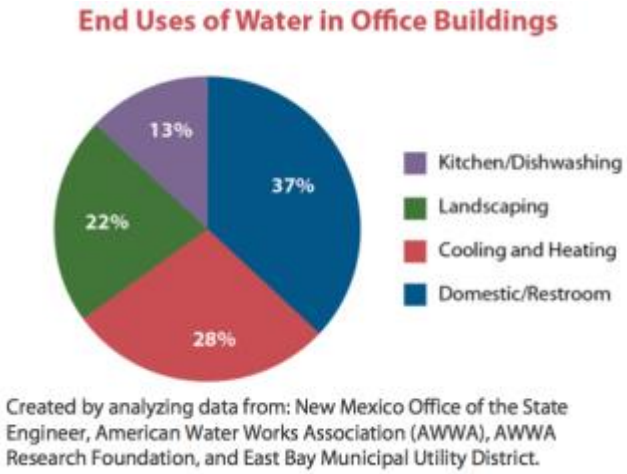


Figure 2.



Section 1. A portfolio of approaches for achieving behavioral and institutional change

Behavior change is the transformation or modification of human behavior focusing on individual, community, and environmental influences[9]. In the workplace, it is a method for encouraging employees to behave in ways that is considered desirable, in this case using less water. Several behavioral change methodologies can be used to guide employees to make both short-term and long-term sustainability changes. Evidence has suggested that using more than one behavior change method can greatly increase the effectiveness of intervention programs[10]. Behavior change methodologies and techniques that can be applied to workplace water use reduction are outlined below. In Section 2 we will explore case studies in which these frameworks have been used in sustainability initiatives.

All behavior change requires an initial diagnosis of who, what, why and how

Who will be the subject of the communication effort? In employee water use reduction will it be the facilities department, research and development, or all employees? Understanding which employee subgroups can aid in tailoring messaging. It is also important to take into consideration job category, education level, and age. Top management needs have strong buy-in to water conservation program to engage employees as they will likely be the messenger. Research has shown that employees look to managers to provide cues as to how to behave in relation to environmental issues.

What is the type of ideal water use reduction behavior? Understanding the results wanted from the change initiative can inform an effective communication program. Is it a reduction in total facility water use by a certain percent? A campaign to get employees to identify leaky faucets? Clear objectives are essential. Water reduction objectives should be specific, measurable, achievable, relevant and time-based. This technique for objective setting is known as SMART[11].

Specific: concrete, detailed, and well defined
Measurable: allow measurement of the outcomes and progress toward their achievement
Achievable: attainable within a reasonable amount of effort and resources
Relevant: lead to a desired goal, either on its own or in combination with other objectives
Time-based: indicate specific time frames and deadlines

Why is the change important? Developing a good 'why' means tapping into purpose and meaning. When individuals believe in the overall purpose of an organization, they will be happy to change their individual behavior to serve that purpose[12].

How can a behavior change program be implemented? It is important to keep change programs simple, practical, and relevant to employee work and life. Thinking long term can inform how projects and programs can lead to greater impact over time. Programs should be relevant, fun and have identified champions in the workplace[13]. In addition to implementation is how employees can be motivated to play a part in the process. Employees must both understand the role of their actions in relation to the purpose and how they can contribute. A change program must be able to tell a compelling story to get employees engaged in making the change happen[12]. Effective communication will address both the issue and potential solutions[46]. Its success is dependent on a dual focus of changing attitudes or values and behavior.

A suite of tools exists to help with implementation including peer to peer learning, competition, information display, recognition, incentives, training, and technology. Research has shown that feedback is one of the most effective ways to change behavior if it is displayed in a meaningful way to the individual and when a comparable referent is provided[10]. *In Section 2 we will focus predominantly on the how.*

Methods and approaches for understanding behavior change

Applied behavior analysis

Applied behavior analysis is the application of the science of behavior change to real world problems[14]. This involves studying and modifying behavior to produce socially significant improvement in human behavior. Key drivers for this method includes various forms of reinforcement. Most applicable to water use reduction in the workplace is positive reinforcement[15]. Positive reinforcement is the practice of following behavior with desirable consequence in order to increase the future likelihood of that behavior. For example, if a manager praises an employee for pointing out a leaky faucet, he/she increases the frequency of doing that task again. Positive reinforcement should be provided as soon as possible after the behavior occurs. This reduces the delay between behavior and the reinforcer making it more likely the behavior will occur again. The earliest application of applied behavior science in the workplace tended to concern behavior related to employee safety[16]. Recently, there has been a recognition that the same approaches that have been effective for safety protocols could also be effective for sustainability goals.

Organizational behavior

Organizational behavior is the study of the way people interact within groups in the workplace. It is the study of human behavior, the interface between human behavior and the organization, and the organization itself[17]. Organizational behavior is used often to create more efficient business organizations and is applied to the management of workers[18]. Viewing organizations as social systems allows management to understand the complex set of forces that affects the nature of business.

The main objective of organizational behavior is use interdisciplinary approaches to describe, predict, understand, and maintain human behavior. Research has identified organizational leadership and supervisory support as a key determinant of success of organizational environmental initiatives[19]. Convenience, intuitiveness, and resource availability were identified as key themes for successfully engaging employees in desired environmental behavior[20]. For example the positioning of recycle bins influences the likelihood of employees recycling[21]. SC Johnson had waste baskets removed from offices, and recycling bins placed down the hall. This

resulted in increase in recycling and reduction in waste sent to landfills. An individual's waste reduction was reinforced by the nuisance of the physical act of discarding it[45].

Social norms

Social norms are how individuals behave according to the rules of society. Norms are the beliefs that people often share about what others are doing and what other people may approve or disapprove. For example when individuals assume that "everyone recycles" or "everyone brings reusable water bottles to work" they are relying on norms.

Avoiding actions such as leaving water running while washing dishes at work because peers may disapprove is also an example of conforming to normative behaviors[50]. When utilizing social norms as a mechanism for change, it is important to consider how employees feel about what they are being encouraged to do, and what their peers are doing and thinking related to the behavior as well[51]. Social norms should build on the assets already in the workplace, through participation by employees, and by highlighting those who make environmentally friendly choices. This can be done through positive reinforcement of the desired sustainability practice.

For example one particular strategy could be to put emphasis on employees who are doing a positive action, such as an employee who turns off the water while lathering during hand washing, this will increase the likelihood that peers will adopt or change a particular behavior.

Section 2. Using applied behavioral methods to inform, control, and motivate

In the previous section we introduced several general methods to achieving behavioral change through an overarching framework of applied behavioral science. Now we will focus on the practicalities of this applied behavioral methodologies using the three steps of behavior change mentioned in the introduction: *information, control, and motivation*[52,53,54]. The application of this framework is demonstrated through case studies.

We will draw on prior successes in water and energy reduction—both commercial and residential— that have applied behavioral change methodologies. Studies on energy usage both residentially and commercially provide a useful parallel to water management and consumption, because in the U.S., 40% of water use is related to the production of energy. A crucial portion of

our nation's energy needs are related to the transportation, treatment, and heating of water. According to the U.S. Department of Energy, water heating is the second largest energy user in the home, accounting for 17% of a household's energy expenditure and 4% of the total energy budget of the U.S.[22]. In California, residential water usage is the largest consumer of energy in the state. One largely unexplored channel by which to reduce energy usage is through water conservation[23]. Reducing water usage helps conserve energy, save money, and protects valuable resources.

Helping employees to reduce water consumption through better information and awareness

Engaging employees can help change behavior in the workplace to reduce unnecessary water consumption and cut organization water costs. Simply presenting people with information is not always conducive to prompting a response in behavior[25]. Meaning that providing information does not necessarily encourage people to change their behavior but there are effective ways to convey information to employees that may enable them to reduce water use.

Successful engagement strategies can be achieved by investing in educating employees about water issues as well as to creating systems and processes that make it easier for employees to integrate water use reduction into their daily decisions. For this to occur employees must be aware of a problem and/or the opportunity for action before any engagement can occur.

Employers and management must provide accessible and credible information that will help avoid dismissal or skepticism, and ensure understanding of the issue[26,27]. As important as providing information regarding the issue is the presentation or display. One approach is identifying it as central to the company's ethic of corporate social responsibility; another is making the employee feel that is a personal issue and link it to their connection with the environment. Information sharing should also include where the biggest impacts and costs of water use are in the company.

The following case studies focus on information and awareness around water use reduction from an operations standpoint and from engaging reduction in employee at-home water use.

Linking information to existing practices: Arla Foods

Arla Foods is the UK's largest dairy company. It's a farmer-owned cooperative that processes over three billion liters of milk per year across 14 manufacturing sites. In 2013 Arla used 3.8 million liters of water in its operations. As part of an ambitious sustainability strategy, they committed to reduce water use by 20% by 2020 (from a 2005 baseline).

Arla produced a series of posters to encourage employees to reduce water across its operations. Using the methodology of organizational behavior, posters were designed to link into the company's existing lean manufacturing and continuous improvement activities[55]*. Poster topics included the water savings that the company as a whole needed to achieve to meet their target and expressing the target as equivalent savings that was required per employee. Linking their water reduction goals to their current existing practices allowed convenience in the adoption of the sustainability measures. The posters were engaging and demonstrated the change each employee needed to make to have an impact. Information was provided in the form of concrete goals that the organization needed to meet*[28,29]*.*

Information awareness and tools: VMware

VMware is a subsidiary of Dell Technologies that provides cloud and virtualization software and services. In 2015, they launched an aggressive water conservation campaign partnering with WaterGenius (a free online water use tool). Using the WaterGenius application motivated employees to decrease water use and enabled them to receive feedback and information on their water goals. VMware employees were encouraged to extend the water reduction goals trumpeted in their office locations out into their communities, to their own homes. The program was successful due to water reduction awareness becoming a social norm around the office. Hundreds of employees signed with the goal of saving at least 1 million gallons outside their workplace. While encouraging water reduction in employee homes VMware's Palo Alto office also saved over 13 million gallons of water, a 35% reduction of their water consumption. Information was not only provided to employees but active tools to make the change happen was also essential to the success of this program[30]*.*

Integrating information and other tools: Durham, Ontario

A community based social marketing campaign in Durham, Ontario was developed to decrease summer outdoor water use. The aim was to get homeowners to only water their

lawns a max of 1" per week including rainfall. Households visited by college students who explained educational brochures that explained that lawns only need 1" water per week had reductions of water use by 26%. Households that signed commitments to only water 1" water per week had water use reductions by 32%. Households that received only information packets on efficient water use had the least amount of water use reduction at only 15%. The awareness and information provided to the homeowners was essential but reinforcement and measureable goals were key to homeowner behavior change[31].

Helping employees to reduce water consumption through decision latitude and control

Providing employees with information brings awareness to the issue, but often an additional step is needed to affect change. Employees need to know that they can have an impact in reducing water use in their office and business and that it is their choice. This concept is called decision latitude and has been shown to increase motivation and performance[32].

Employee participation in decisions can lead to increased job satisfaction, organizational commitment, individual motivation, and job performance[33]. Studies have shown that sustainability practices can increase employee retention, productivity, and overall engagement[34]. A call to action can elicit a positive response from employees if they have the capacity and permission to engage.

Employee Driven Initiatives: Caesars Entertainment and USPS

Caesars Entertainment

The employees of the Caesars Entertainment group developed the CodeGreen strategy in 2008 to reduce overall resource usage and take aggressive measures to preserve the environment. Each property has a CodeGreen team made up of employees from different departments and job functions, such as facilities, food service, and housekeeping, who take ownership over the environmental initiatives. This program offers leadership roles for employees, who have the opportunity to become a CodeGreen Ambassador to lead and implement a portion of the enterprise-wide strategy each month.

The program focuses on many aspects of conservation including water. The water programs emphasize measuring, monitoring, and continuously improving (i.e. reducing) how much water is used. With 2008 as a baseline, the CodeGreen program set intensity-based reduction goals for water use of 10 percent by 2015 and 15 percent by 2020 for the domestic portfolio

of properties. Through 2013, as a result of this program, Caesars has reduced water use intensity by 18 percent, while increasing its physical footprint by 11 percent[35].

USPS Lean Green Teams

U.S. Postal Service (USPS) has five over-arching sustainability goals in waste reduction, energy conservation, fleet fuel reduction, recycling, water use and consumables spending. To reach these goals USPS employees are encouraged to form Lean Green Teams across their 1,400 facilities and develop low-and no-cost projects for implementation. Progress of each team is tracked and monitored with USPS reporting more than $52 million in savings in 2015 due largely to the employee-led initiatives.

Lean Green Teams have been essential in the water use reduction by improving utility bill monitoring and identifying water leaks. While water is not a major input for USPS operations, commitment to improving sustainable operations is seen by the reduction in water consumption at facilities. As of 2016, their facilities had achieved a 50.8 percent reduction in water use per square foot relative to a 2007 baseline[36,37].

Both Caesars and USPS gave their employees a significant amount of control and decision latitude in the development and implementation of water reduction strategies. As described in organizational behavior theory, the created a company culture where initiative and employee-driven activities were central. Both companies made it known to employees that individual employee behavior was important to the whole company's success in sustainability efforts and utilized reinforcement, as seen in applied behavior analysis, as a motivator.

Helping employees to reduce water consumption through motivation

Building upon information and control, motivation is the last step in fully engaging employees in water conservation. Our research found that successful techniques fall primarily into two categories: financial incentive and competition.

In the both the commercial and residential sector, financial incentives have been a way to reduce energy and water use. For example Denver Water once offered business $21.50 for every thousand gallons of water they saved annually, up to $40,000. In California, Pacific Gas and Electric offers instant rebates for companies such as Cisco to replace urinals in multiple buildings with waterless versions, saving the company 29,000 gallons per day[38]. Financial

incentives for individual employee water use reduction can come in the form of gift cards, free lunch, or time off. Careful selection of items as incentives is necessary, as in some cases monetary incentives are not a large motivator. This is a form of positive reinforcement (applied behavior analysis strategy) previously discussed in section 1. Rewards and incentives, when connected to the culture and appropriate to the behavior change wanted, can be an important component of an effective office water use reduction program[4].

Feedback beyond rewards has comprehensive ties to behavior change as well. Employers can use data to inform employees about their progress and motivate change through praise of the high performers, also known as positive reinforcement. The company creates of culture or social norm of working together and striving to do as well as one's neighbors on conservation performance. In office buildings, continual or real-time feedback can now be provided in a variety of different ways. These include: through smartphone applications, equipment sensors, and computer- or lobby-based dashboards. Dashboards, for instance, can display graphs of current resource use of appliances, indicating immediate feedback, as well as trends over time, differences between groups, and other applicable data[4].

Other feedback strategies focus explicitly on simple triggers or warnings about usage, without interrupting ongoing activities in an office building. For example, a green light on one application indicates energy usage within the correct limits, while a red light indicates when usage is too high. This strategy maintains transparency of staying within the allotted limits of usage[4].

In the residential sector, feedback techniques have led to energy reductions of 5 to 12 percent depending upon the specific context and methods used. Local or federal governments, energy or water companies, and researchers have all used programs which notify consumers how much of a resource they are using. The consumer then is left to his or her own devices to determine which actions or behaviors they want to adjust, lessen, or expand upon. This flexibility of choice, or decision latitude as described previously, increases the impact and results in reduce usage rates. In the context of domestic energy use, providing consumers with feedback on how their energy use compares with similar households in their neighborhood has been consistently shown to reduce energy consumption in higher-than-average users.

Providing incentives and giveaways: Irvine Ranch Water District and Residential Study

Irvine Ranch Water District

Water Districts often used a scaled billing approach in which each household is given a water budget based on characteristics like number of residents and square footage of home and landscaped area. Higher prices are charged for water consumption above the 'efficient' allocation, creating an incentive for conservation. The Irvine Ranch Water District's water budget accounting has resulted in an allocation of 50 gallons per person per day, with each household's amount adjusted based on its characteristics such as income and size of household. Not only do households get charged a higher rate if they exceed these allocations but extra conservative households are rewarded with reduce water rates if they use less than 40 percent of their allocation. The District reports that in the 13 years following the introduction of water budgets, average per-acre outdoor water use declined by 61 percent. Using incentives that appeal to a community is an example of tapping into applied behavioral analysis and capitalizing on positive reinforcement as a mechanism for motivation[39,40].

Residential study

In a study undertaken by two researchers, a pamphlet on energy conservation was sent out to two groups of homeowners. One group in the study received a shower flow restrictor along with the pamphlet; the other group received just the pamphlet. Homeowners who received the shower flow restrictor were more likely to engage in the other conservation actions mentioned in the pamphlet (e.g., reducing the temperature on their hot water heaters, installing setback thermostats, and cleaning their furnaces). This applied behavior analysis strategy intersects social norms methodology as it hones in on a reciprocity principle: people who receive a favor or gift feel socially bound to reciprocate in some way. Thus, the free shower flow restrictor motivated people to use it solely because it was a gift[4].

<u>Feedback and competition: Opower, WaterSmart and 3M</u>

Opower

Opower provides consumers with a Home Energy Reporting Program, which includes comparative consumption information showing how your energy use compares with similar neighbors. It is accompanied by personalized feedback on how the household uses energy and tailored suggestions on how to use less energy and save money. This feedback is based on monthly and, increasingly, sub-monthly meter data, which enables Opower to provide

consumers with more fine-grained information. At least nine independent evaluations have demonstrated consistent average energy savings in the order of 2–3%[41].
Comparing energy use taps into social norms methodology. Users see that their peers are using less energy and feel inclined to do so themselves. The feedback provides the information they need to make the change and the comparison is the motivator.

Water Smart

A San Francisco startup, WaterSmart, creates a personalized report for each residential customer using historical records of water use paired with property characteristics (e.g., age of home, square footage, number of bathrooms), demographic and weather data. The report shows each household's water use compares with its neighbors, and includes water-saving tips. WaterSmart distributes the report every two months to each home, and residents who view their reports online will also find information about rebates offered by the utility district for buying water-efficient appliances, such as clothes washers and toilets. The motivation and control that comes from the feedback reports give households more of a desire to participate. The payoff has proven itself: in the East Bay Municipal Utility District, participants have reduced their water use by an average of 5 percent, or 3,300-6,200 gallons per household annually[42].

3M

3M's Employee Energy Initiatives Competition is an example of friendly workplace competition that can yield sustainability related savings. Each year 3M employees teams are challenged to decrease energy consumption at their facilities. At their annual Energy Recognition, the teams are recognized for their performance using on a four-level rating system ranging from Bronze to Platinum. Winning teams are rewarded with a variety of prizes including certificates and dinners with management. More than 1,900 employee-inspired projects were implement from 2005 to 2009; these projects have realized a 22 percent improvement in energy efficiency and yielded $100 million in energy savings[43]*. Ultimately, recognition can be a positive reinforcement for environmentally friendly behavior.*

Conclusion

Individuals can contribute significantly to water conservation by changing their behavior in the workplace. As demonstrated throughout this paper, it is not as simple as deciding to practice water management and conservation skills. Behavior change has to be a targeted objective practiced by businesses in order to bring about a reshaping of both water policy and water attitude. This will be specific to each company, utilizing the three psychological strategies of applied behavior analysis, organizational behavior, and social norms. Practically speaking, companies should aim to take these strategies and infuse them into the framework of information, control, and motivation. Changing the social norms around water conservation starts with the work environment that employees are situated in, and builds upon individual motivations to contribute to overall water saving tactics. Effective communication is critical to success and is dependent on a dual focus of changing attitudes or values *and* behavior.

The behavior change strategies we have discussed can be included in the planning process that businesses already undergo. Businesses have strategy documents and multi-year business plans for their overall operations. Water management and corresponding employee engagement is just an extension of this planning process. Setting up water conservation initiatives can be helpful in institutionalizing the culture of sustainability at your company that will then draw in and retain employees.

California is a great location to begin the movement towards behavior change around water usage. Due to the recent drought, attention is already raised around water awareness in people's home life, so it's a comparatively easy transition to get people to change at work. The massive media campaigns aimed to get people to change their lifestyles have worked—in May 2015, California residents cut their water use by 29%, an impressive and encouraging statistic[44]. If residential water use can decrease significantly from efforts by the general public, these strides can surely be taken in your business as well.

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