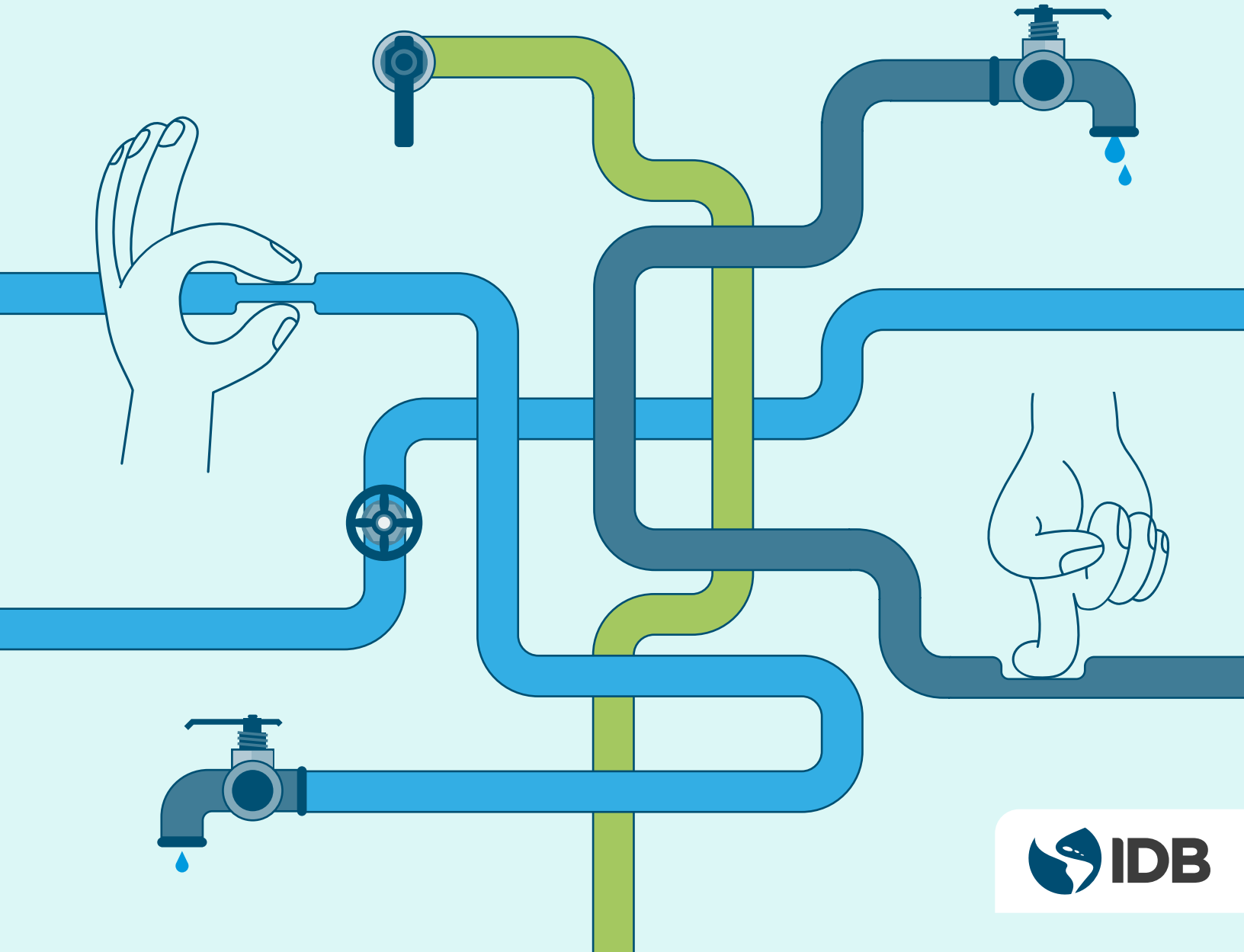
ADDRESSING WATER SUSTAINABILITY

Lessons from Behavioral Economics



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ABSTRACT

Unsustainable water consumption practices are a growing concern, especially as climate change threatens global water resources. Immediate action is needed to promote conservation and ensure long-term availability. **Addressing this challenge requires a broad understanding of structural and behavioral factors that influence water consumption.** This document examines how cognitive and behavioral biases affect water use, outlines key challenges, and summarizes approaches for promoting sustainable practices. **Moreover, it reviews global initiatives, with a focus on Latin America and the Caribbean, highlighting behaviorally informed interventions that contribute to enhancing water sustainability.**

1 Introduction

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Water availability is fundamental to daily life, yet significant differences in water access exist globally, ranging from easy access from taps to lengthy commutes to unreliable and unsafe sources. This disparity is particularly notable in Latin America and the Caribbean, which faces severe water vulnerability despite being one of the most water-abundant regions.

The region contains some of the world's largest rivers and river basins and holds approximately 35% of global renewable water resources (Rodríguez *et al.*, 2022). Furthermore, it accounts for 29% of global precipitation while supporting only 10% of the global population, resulting in per capita water availability four times the global average (World Bank, 2022).

Yet, amidst this abundance, water scarcity remains a pressing issue in Latin America and the Caribbean. Multiple droughts, coupled with unsustainable water consumption patterns, have increased water challenges in recent decades, underscoring the urgent need to raise awareness and promote sustainable usage. Since 1960, global water demand has doubled, and in the region, water demand is expected to grow at twice the global rate over the next 30 years (UNDP, 2024). Although water consumption has been minimally regulated in recent decades to avoid affecting people's lifestyles, the escalating pressures of climate change now demand more rigorous regulation of water usage.

In countries with extremely high water stress, over 80% of water resources are allocated to productive and domestic needs, making even short droughts a significant risk for water reserves (UNDP, 2024; WRI Aqueduct, 2023). **Currently, access to water is limited for 166 million people across Latin America and the Caribbean, with 24 million lacking basic water services and 150 million living in areas of extreme water scarcity (World Bank, 2023).**

SOME DEFINITIONS...

Water scarcity is the physical shortage of freshwater resources in a given area, determined by human water consumption relative to available water resources. It focuses on the availability of water, regardless of quality. An area with enough water resources but severe pollution may face quality issues without being classified as water-scarce.

Water stress is a comprehensive concept that includes human and ecological water needs, considering factors such as availability, quality, and accessibility. Different societies may have varying standards for water quality and environmental requirements, affecting their assessments of water stress levels.

UN Global Compact | Pacific Institute (2017)

FIGURE 1

Water Stress in Latin America and the Caribbean (1979-2019)

Source: Adapted from Aqueduct 4.0 by World Resources Institute (2023).

Challenges in the Region

Limited access to water poses direct health, safety, and economic challenges for people across Latin America and the Caribbean. Beyond hydration, water is crucial for maintaining households' health, hygiene, and living conditions. Unsafe or insufficient water access exposes households to significant health and economic risks.

Water-related diseases are a leading cause of death among children under five in Latin America, with 4.8 million children facing extreme water vulnerability (UNICEF, 2023).

These risks become more pressing during the region's hot, dry summers—when rainfall is low and water demand peaks—putting additional pressure on already strained resources.

Inequities further complicate this reality. Access to water in the region is unevenly distributed. Figure 1 illustrates water stress levels in Latin America and the Caribbean, highlighting Chile, Mexico, and Peru as the countries where it represents a significant challenge (WRI Aqueduct, 2023).[1] Differences in water access also exist at a more granular level. Rural, Indigenous, and Afro-descendent populations face persistent challenges in accessing proper water infrastructure.

Marginalized communities struggle with limited access to potable water and face higher costs to access clean water, which reflects longstanding inequalities (World Bank, 2023).

The region's water challenges are worsened by pollution from human and industrial activities. Rivers that serve as a vital source of drinking water and irrigation—such as the Medellín River in Colombia, the Guanabara Bay in Brazil and the Matanza-Riachuelo River in Argentina—are often contaminated by untreated sewage, agricultural runoff, and industrial waste. Industrial activities such as mining in Chile and Peru, or manufacturing in Mexico, introduce heavy metals and toxic chemicals into water supplies, rendering them unsafe for consumption and further depleting clean water resources. Much of this contamination stems from inadequate infrastructure for waste management and sewage treatment, which lead to high levels of pollutants, along with weak regulatory enforcement. The impact is twofold: it reduces the availability of clean water and poses significant health risks to local communities.

Impact on the Economy

On a macroeconomic level, the repercussions of water vulnerability in Latin America and the Caribbean are profound, underscoring the critical role of water in economic stability. Agriculture and energy, two of the region's most water-dependent sectors, highlight these challenges. As the world's largest net exporter of agricultural produce, which generates 15% of regional employment, the region relies heavily on irrigation. Water is also vital for energy generation, with hydroelectricity comprising 45% of the energy matrix (World Bank, 2022). Adequate and consistent access to water is thus essential for these and other crucial sectors, such as mining and tourism, which help fuel regional economic growth.

Reliable and consistent access to water is crucial for multiple sectors that drive regional economic growth.

[1] The data come from WRI Aqueduct 4.0, released in 2023, which relies on hydrological data from 1979 to 2019.

Insufficient access to water directly threatens these industries, constraining growth, employment, and economic resilience. To illustrate, over the past two decades, Latin America has experienced 74 droughts, causing approximately US$13 billion in losses. These droughts have significantly impacted agriculture and livestock, negatively affecting vulnerable small-scale farmers in regions like the Dry Corridor on the Central American Pacific coast (World Bank, 2023).

A clear example of these economic impacts is Colombia, where water scarcity is projected to reduce GDP by 1.56 to 2.31% due to decreased agricultural yields, employment losses, and reduced production caused by water rationing and lack of access to water supply, sanitation and hygiene (WASH) services (World Bank, 2022). Similarly, in 2024, Ecuador declared a state of emergency to address severe drought conditions and an energy crisis (The Guardian, 2024). These stringent measures are undertaken in conjunction with electricity rationing due to insufficient rainfall and the inability to generate hydroelectricity, negatively affecting key industries.

The significant impact of water scarcity on regional prosperity has prompted urgent discussions on the most effective strategies to address this critical issue. With climate change expected to increase the frequency of extreme hydrometeorological events such as droughts and heavy rainfall across Latin America and the Caribbean, traditional solutions like tiered pricing mechanisms to curb excessive water consumption and investments in climate-smart infrastructure are commonly proposed. While these approaches are necessary, they address only part of the challenge.

Behavioral interventions offer a complementary and potentially more adaptable solution by influencing how individuals and communities use water. Behavioral science, which draws on principles from psychology and economics, provides valuable insights into understanding and changing human behavior.

Behavioral science helps promote sustainable water use by addressing how individuals and communities manage water resources.

By leveraging these insights, it is possible to promote more sustainable water practices in the region. **Understanding the psychology of water users is crucial in the context of scarcity, making behavioral interventions an essential tool in addressing water conservation challenges across the region.**

2 Behavior and Water Sustainability

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Achieving water sustainability in Latin America and the Caribbean involves not only understanding the availability of water resources but also examining the behaviors that impact household water consumption. In this section, we explore several common practices that lead to excessive water use, emphasizing the importance of behavioral change alongside structural and policy interventions. By recognizing and changing these wasteful habits, we can make meaningful progress toward more sustainable water management.

Running water unnecessarily

Consider you are in the bathroom, brushing your teeth. The tap is running continuously, and you let the water flow. How much water do you think you waste if you leave the tap running for two minutes instead of turning it off while brushing? Most answers to this question reveal the misperception water users have surrounding how much water is used in daily activities. The actual number is staggering: **up to 15 liters of water can be wasted in just two minutes.** Despite knowing that water conservation is crucial, many people still let their taps run, often out of habit or convenience, and out of lack of awareness concerning the magnitude of the waste.

Taking long showers

People often lose track of time, enjoying the comfort of cold or hot water. Given that a typical shower consumes around 10 liters of water per minute, **reducing shower time by just one minute can save a substantial amount of water.** However, individuals often overlook the impact of such a small adjustment.

Washing dishes inefficiently

Another prevalent practice is washing dishes under running water, which many people believe is more effective than using a basin. This leads to significant water wastage, as **using a basin can cut water use by up to 50%.** This misconception is often reinforced by people's tendency to resist changing their habits.

Watering gardens during the hottest part of the day

Watering gardens or lawns during peak sunlight hours can lead to major water evaporation losses. Many people are unaware that **watering in the early morning or late evening is much more effective for keeping plants hydrated and conserving water.** This simple shift can make a big difference, especially in areas where every drop counts.

Unattended hose use for cleaning outdoor spaces

Leaving the hose running while cleaning driveways, patios, or sidewalks is another common practice that can waste a substantial amount of water. Many people use a constant flow of water to rinse off debris, leading to unnecessary overconsumption. Using a broom eliminates the need for water while cleaning those areas, and if water is needed, a bucket is a more efficient alternative than leaving the hose running unattended.

The behaviors described above challenge the rational decision-making assumptions of traditional economic models.

In reality, people are influenced by cognitive biases, ingrained habits, social influences, and emotional factors that lead to suboptimal water use choices.

Behavioral economics emerged to address these deviations, providing a complementary framework to traditional approaches by offering a more nuanced understanding of decision-making. By incorporating insights from this field, we gain valuable insights for areas such as resource conservation and sustainability.

Water conservation is a matter of not just knowledge but also behavior. By recognizing the cognitive biases and social influences that drive water use, we can develop more effective strategies to promote sustainable practices. As we face increasing water scarcity, particularly in our region, understanding and addressing these behavioral aspects is crucial for ensuring a sustainable future.

3 Cognitive and Behavioral Biases

3 Cognitive and Behavioral Biases

Cognitive and behavioral biases, often stemming from automatic mental shortcuts, habits, or emotional responses, play a crucial role in shaping how individuals approach water conservation. These biases create systematic deviations from rational decision-making, often driven by heuristics that simplify complex choices but can also mislead (Tversky and Kahneman, 1974).

Cognitive and behavioral biases lead people to undervalue conservation strategies or favor immediate convenience over sustainable choices, even when they are aware of potential benefits.

Below, we outline some of the most common behavioral biases impacting water conservation practices.

- **STATUS QUO BIAS** is the tendency of individuals to prefer things to stay the same or to maintain their current situation even if their actions are inefficient or wasteful. Some households resist changing their water habits just because they are attached to them, even when there are more sustainable options available and despite knowing the importance of water conservation. A household may be accustomed to watering their lawn every morning, using a sprinkler system that oversaturates the grass. In a scenario where there are drought conditions in their region, they may continue this routine because it is what they have always done and changing it feels disruptive.

- **OPTIMISM BIAS** is a cognitive bias in which individuals tend to underestimate the probability of negative events happening to them while simultaneously overestimating the probability of positive events occurring. In the context of water usage, many individuals believe that negative outcomes, such as water shortages, are less likely to affect them than others. For example, residents in regions with frequent rainfall may believe that their community is unlikely to face water scarcity. They underestimate the risk of drought affecting their local water supply and therefore do not prioritize water-saving practices.

- **PRESENT BIAS** refers to the tendency of individuals to overvalue immediate rewards at the expense of future gains. This bias leads people to favor short-term gratification over delayed advantages. For instance, individuals may take long showers or leave the tap running while washing dishes, prioritizing immediate comfort and convenience over the effort of turning the tap on and off, despite being aware of the long-term benefits of water conservation, such as lower bills and environmental sustainability. Similarly, businesses might consume excessive water to maintain the aesthetic appeal of their gardens during hot summer months, prioritizing the immediate visual appeal of their garden over considering the potential deficit of water resources in the future. By focusing on the benefits of present consumption, this bias often causes people to neglect the longer-term consequences of their actions.

- **AVAILABILITY HEURISTIC** refers to a mental shortcut that involves making judgments and decisions based on the ease with which relevant information comes to mind. Given the disparities in water access across the region, if people have not experienced water shortages or restrictions personally, they might underestimate the likelihood and impact of such events. People living in regions historically abundant in water resources may not perceive the importance of water conservation. Their attitudes are shaped by how easily water has always been available, without considering potential future scarcity or the impact of increased demand on local water supplies.

- **LOSS AVERSION** is the tendency of individuals to place more weight on losses than on equivalent gains. In relation to water usage, many households may perceive water conservation efforts as a loss of comfort or convenience. Given this perceived loss, individuals may resist the adoption of such measures.

- **AN ANCHORING EFFECT** occurs when individuals rely too heavily on the first piece of information they encounter (the "anchor") when making decisions, even if that information is irrelevant or arbitrary. For example, residents may continue to use more water than necessary because they are anchored to their earlier consumption levels registered during a time of abundant rainfall, which were appropriate given the conditions at that time. This reliance on previous guidelines can lead to continuous high water usage, even when new recommendations suggest lower consumption due to changing conditions, such as a drought.

- **NORMALCY BIAS** is the tendency to underestimate the likelihood of a severe event occurring because individuals have become accustomed to a long period of stability or normalcy. This bias leads people to believe that current conditions will persist, even in the face of significant changes or threats, such as droughts. For example, when facing a severe water shortage, individuals may still underestimate the urgency of reducing their water usage, clinging to the belief that things will remain as they have been. Consequently, someone might underestimate time spent in the shower, failing to recognize that continued excessive usage is no longer sustainable in the current context.

- **A STEREOTYPE** refers to a fixed and generalized belief about particular groups or actions that influence perceptions and interactions, including household water consumption. For instance, the belief that wealthy homeowners must maintain well-kept yards, even during droughts, may lead them to prioritize watering their gardens over conserving water. Similarly, the notion that only environmentally conscious individuals care about conservation can cause others to neglect water-saving practices.

- **SOCIAL NORMS** refer to the unwritten rules and expectations that guide behavior within a society or group. These norms significantly influence how individuals act and interact, as people tend to conform to societal standards. Failure to comply with these standards can lead to disapproval from peers. Social norms play a crucial role in shaping behaviors such as water consumption, reducing waste, or conserving energy. For instance, people often replicate common practices they observe in their environment or conform to behaviors they perceive as morally or socially obligatory. Social norms can be categorized into two types:

  - **Descriptive norms** — reflect what people typically do, focusing on behaviors that are perceived as common or frequent. For example, if individuals observe that most of their neighbors use water-efficient systems, they are more likely to adopt these practices, believing "this is what everyone does."

  - **Prescriptive norms** — highlight what people are expected to do based on shared values or societal expectations. These norms emphasize behaviors considered socially responsible or ethically correct within a specific context. For instance, there may be a general expectation to prioritize water conservation during a drought, with communities urging households to minimize non-essential water use as a socially responsible action.

- **THE ENDOWMENT EFFECT** refers to the psychological phenomenon where individuals assign a higher value to things merely because they own them. For example, a household may have used a large, water tank for several years. Even though it is becoming less efficient over time and requires frequent maintenance, the family continues to invest in repairs rather than considering a different water storage solution. They place greater value on it because it belongs to them.

→ **COGNITIVE OVERLOAD** occurs when the mental effort required to realize a task exceeds the cognitive capacity of an individual. For instance, while a person could intend to take a shower in less than 10 minutes to save water, during the shower there are probably more thoughts in their mind competing for attention. This causes them to lose track of time and unintentionally exceed the 10-minute limit, using more water than intended.

Recognizing these psychological barriers is key to developing targeted interventions aimed at promoting sustainable water practices. By identifying the specific biases at play, interventions can be tailored to align with individuals' perceptions and motivations, making them more effective in encouraging long-term behavioral change. Addressing these biases not only fosters a culture of water conservation within households but also leads to more impactful and sustainable water usage strategies.

Understanding cognitive biases is essential for addressing household water consumption, as these biases can hinder conservation efforts by influencing how individuals perceive the need for change and their willingness to take action.

Identifying and addressing cognitive and behavioral biases enables targeted interventions that align with perceptions and motivations, promoting sustainable water conservation.

4 Strategies to Enhance Water Sustainability

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Enhancing water sustainability requires a comprehensive approach integrating both behavioral and non-behavioral strategies for effective water resource management and conservation. Non-behavioral strategies are often the foundation of water conservation efforts, emphasizing technical solutions and regulatory policies. These strategies include improving water efficiency through pricing strategies, advanced technologies, and investing in infrastructure to minimize water loss.

Complementing these non-behavioral approaches, behavioral strategies target the psychological factors that influence individual and community water usage. Understanding cognitive biases and other psychological factors influencing water consumption can significantly enhance conservation efforts. Among these strategies are educational initiatives that increase public awareness, highlighting the positive impact of conservation behaviors to encourage more sustainable practices. Furthermore, showcasing the water-saving actions of neighbors or community members can foster a shared unwritten standard of sustainable behavior, encouraging others to adopt similar practices.

Combining non-behavioral and behavioral strategies allows societies to more effectively address the growing challenges of water scarcity.

This comprehensive approach promotes a culture of sustainability, enhancing water resource management and conservation while supporting a more sustainable future.

Non-Behavioral Approaches

Non-behavioral approaches address the structural and systemic factors underpinning water use. These approaches aim to create an environment conducive to sustainable water management through policy innovation, infrastructure development, and technology adoption. Regulatory frameworks play a critical role establishing clear standards and guidelines to ensure adherence to best practices by all stakeholders. By focusing on the systems that govern water distribution and usage, non-behavioral approaches seek to implement measures that facilitate sustainable water consumption at a community and institutional level.

Pricing Strategies

Price is a fundamental factor often considered when aiming to reduce consumption. Based on basic economic principles, increasing the price of any good typically reduces its demand. However, water is an inelastic good, meaning that its demand is less sensitive to changes in prices. This reduced sensitivity applies mainly to essential needs, while non-essential uses are more responsive to price adjustments. A tiered pricing system is a widely used strategy for reducing water consumption (Figure 2), as it takes advantage of this distinction of uses by keeping essential consumption affordable while increasing rates of excessive use. Establishing a pricing structure that varies based on consumption levels motivates individuals to conserve water to minimize their expenses. This strategy encourages more responsible usage without compromising access to basic water needs.

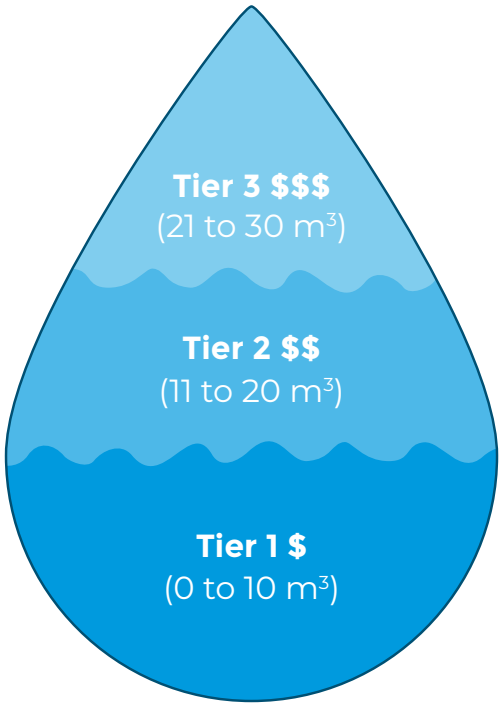
As individuals regulate their water usage to save money, they also become more conscious of its environmental and economic value as a limited resource. Through careful planning and implementation, this strategy achieves a balance

between affordability and conservation, ensuring access to the water needed while also safeguarding this vital resource for future generations.

An example of such a strategy is China's Pricing Strategy for Residential Water (PSRW), a model that dynamically adjusts water rates annually based on varying levels of water scarcity (Yu *et al.*, 2021). This pricing model raises rates for residential users during drought periods, reallocating water to sectors experiencing critical shortages, such as industry, while still ensuring that basic residential needs are met. It aims to enhance water conservation while maintaining residential affordability. According to Yu *et al.* (2021), PSRW effectively manages urban water resources in challenging contexts like Tianjin.

FIGURE 2

Tiered Water Pricing System



Another strategy employing pricing mechanisms is allocation-based rates, which adjusts the block rate price structure based on household-specific characteristics. In April 2009, Southern California transitioned from a uniform pricing model to this approach. In this context, Baerenklau *et al.* (2014) analyzed the observed household water demand under the new pricing system and compared it to the predicted demand if uniform rates remained in effect.[2] The results indicated that allocation-based rates successfully reduced water consumption by 10-15% over several years. This substantial conservation was achieved with a price increase of less than 4%, in contrast to the 30% increase that would have been necessary under uniform rates to attain similar reductions.

In addition to tiered pricing and allocation-based rates, financial incentives make adopting water-efficient technologies more appealing. Through subsidies or discounts, the installation cost of water-efficient appliances can be offset. By reducing financial barriers, people are more encouraged to adopt these solutions, making conservation a practical and accessible choice.

Alternatively, imposing penalties for exceeding specific water consumption limits works as an effective dissuasion tool, since penalties serve as clear signals to identify when unsustainable levels of water are being used. Over time, implementing such pricing schemes can lead to significant reductions in water use, especially in areas where overconsumption has been a persistent issue.

Pricing strategies have great potential to shape consumption and water use. However, their potential is even greater when they are combined with behavioral tools.

[2] To conduct the comparison, the researchers developed a statistical model of household demand using data from the uniform pricing period of 2003 to 2008. They predicted household demand as if uniform rates had continued and calculated average prices under allocation-based rates from 2009 to 2014. Finally, they compared these predictions to the actual demand under the allocation-based rates.

Combining pricing strategies with behavioral tools creates a more comprehensive strategy, generating a more impactful solution. Hernández *et al.* (2024) analyzed the effect of an increase in water tariffs, which resulted in an 11% reduction in water use. However, the reduction was largest when this strategy was combined with a campaign based on social norms, which provided households with personalized reports comparing their water usage to their neighbors' usage patterns.

Policy Strategies

Policy strategies provide a wide range of possibilities to address household water consumption and promote sustainability. These strategies often involve the implementation of infrastructure upgrades, urban planning initiatives and the adoption of innovative technologies. Other types of interventions, including regulatory and behavioral approaches, will be addressed later.

These infrastructure- and technology-based strategies are particularly effective because they make it easy to incorporate water-saving practices into daily routines. Several strategies that have been implemented include the installation of individual water meters, the renovation and maintenance of networks, the promotion of water-efficient devices and rapid leak detection systems. Evidence from residential water demand management policies in four European cities—Berlin, Copenhagen, Tallinn and Zaragoza—shows that water consumption decreased after the policies were enacted, regardless of the specific policy implemented. However, the most effective strategies were those that incorporated and promoted structural improvements (Stavenhagen *et al.*, 2018).

Once low-consumption technologies and infrastructures are implemented, they allow for the integration of behavioral components. For example, smart meters not only measure usage but also provide real-time feedback. These behavioral elements embedded in technology will be discussed in more detail in the following subsection.

Regulatory Strategies

Regulatory strategies are pivotal for reducing household water consumption, as they create a framework that guides and enforces conservation efforts. Laws and regulations, such as those requiring the installation of low-flow fixtures or water-efficient appliances, play a foundational role in driving a systemic shift toward more sustainable water use. These regulations establish minimum water efficiency standards, ensuring that new products comply with stricter water-use criteria and phase out less efficient technologies. By enhancing these regulations, the market is driven toward water-efficient options, contributing to significant reductions in overall water consumption.

Water use restrictions are another regulatory strategy, particularly during droughts or water shortages. These restrictions limit activities such as lawn watering, car washing, and filling pools, curbing excessive water use during critical times. Regulations during droughts may also include measures such as limiting water access or reducing water pressure in specific areas on designated days and times to conserve water (see Figure 3). **These regulations help manage water resources more effectively and encourage people to adopt more mindful water-saving habits.**

Regulations can be accompanied by behavioral tools to make them more effective, such as communication campaigns that inform the public about new regulations, conservation techniques, and the benefits of water-saving measures. These educational initiatives can foster a culture of conservation and help people understand and adopt new habits.

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FIGURE 3

Regulatory Policy for Water Conservation During Droughts

Source: Adapted from "Water Conservation Plan for Drought" by Nuevo Leon Government (2023).

Behavioral Approaches

Behavioral science offers effective and innovative tools to promote water sustainability. **By understanding human behavior and incorporating its insights, we can develop strategies that encourage habit formation, shift mindsets, and establish new benchmarks for water consumption.** These approaches go beyond traditional methods by addressing the psychological and social factors influencing water use. As a result, existing strategies can be enhanced, becoming more comprehensive and impactful in driving improvements in water conservation practices.

Several strategies have been implemented to harness the power of behavioral science in promoting water conservation. Among the strategies most widely used due to their effectiveness are i) increasing awareness of water issues, ii) providing information on habits to reduce water consumption, iii) leveraging social norms, and iv) nuding individuals toward more sustainable choices.

The success of these strategies relies heavily on tailoring them to the specific context and population they aim to reach. Moreover, it is crucial to understand and validate the underlying behavioral barriers and design appropriate interventions to address them.

Integrating behavioral insights into water sustainability initiatives has the potential to achieve a long-lasting reduction in water consumption.

Informational Strategies

By helping the public better understand environmental issues, **strategies focused on raising awareness through information can inspire behavioral change and encourage the adoption of sustainable, pro-environmental habits.** For example, disseminating messages highlighting the consequences of water overconsumption can effectively draw attention to critical issues such as droughts, water scarcity, and the depletion of freshwater resources. Similarly, providing clear insights into the water usage of everyday household activities can make individuals more aware of their actual consumption and the significant impact small changes can have on conservation. By making these connections clear, such messages can motivate individuals to reconsider their consumption patterns, adjust their daily behaviors, and adopt environmentally conscious practices, ultimately contributing to sustainable water consumption.

FIGURE 4

Informational Water Conservation Campaign

Source: Inspired by Target 140, Queensland Water Commission.

One such initiative is the Target 140 campaign developed by the Queensland Water Commission (QWC), which aimed to reduce water consumption in Australia during the worst drought on record (Walton and Hume, 2011). After two years of restrictions focused on reducing water consumption, which accomplished a 40% reduction in liters per person per day, it was necessary to reduce water usage even further. The analysis of the situation highlighted key barriers among residents of the area, mainly a lack of awareness and information. Target 140 used several methods to tackle the problem, including providing information through a booklet, websites presenting water-saving tips, and media coverage (radio, print media and television news), as shown in Figure 4. **By providing the public with necessary information on how to change their water consumption patterns, households were prepared to respond effectively to the perceived risk of water scarcity.**

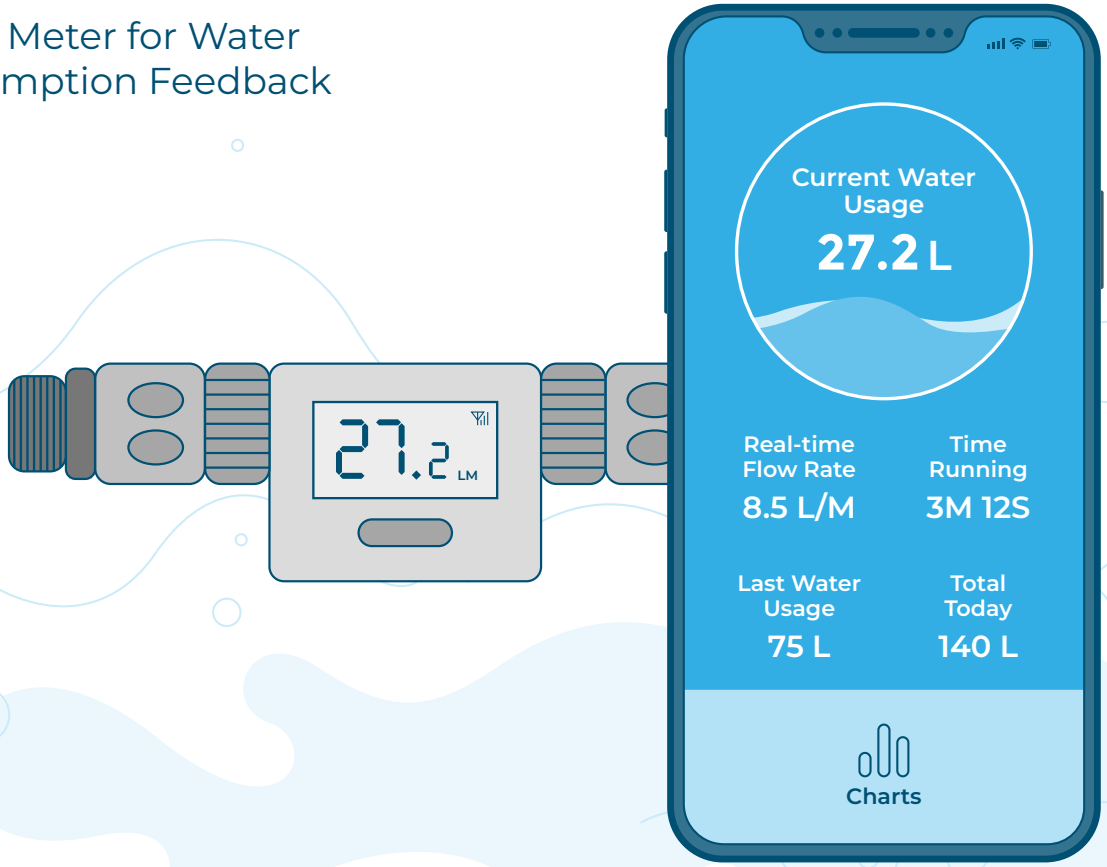
Providing Feedback

A highly effective strategy to reduce water overconsumption is providing feedback on household water use. This approach raises awareness of usage patterns and motivates individuals and families to take concrete actions toward more sustainable living. **Feedback through monthly reports, smart meters, or digital apps helps households recognize their habits' direct impact on water consumption** (see Figure 5).

Real-time, or near-real-time, feedback is a powerful tool for individuals to see the immediate consequences of their actions and make better decisions on resource conservation. Moreover, feedback mechanisms can highlight specific areas where water wastage is most prevalent, such as during showers, dishwashing, or lawn watering. By breaking down consumption information in this way, households can identify the most effective areas for improvement and take targeted steps to reduce their water usage.

FIGURE 5

Smart Meter for Water Consumption Feedback



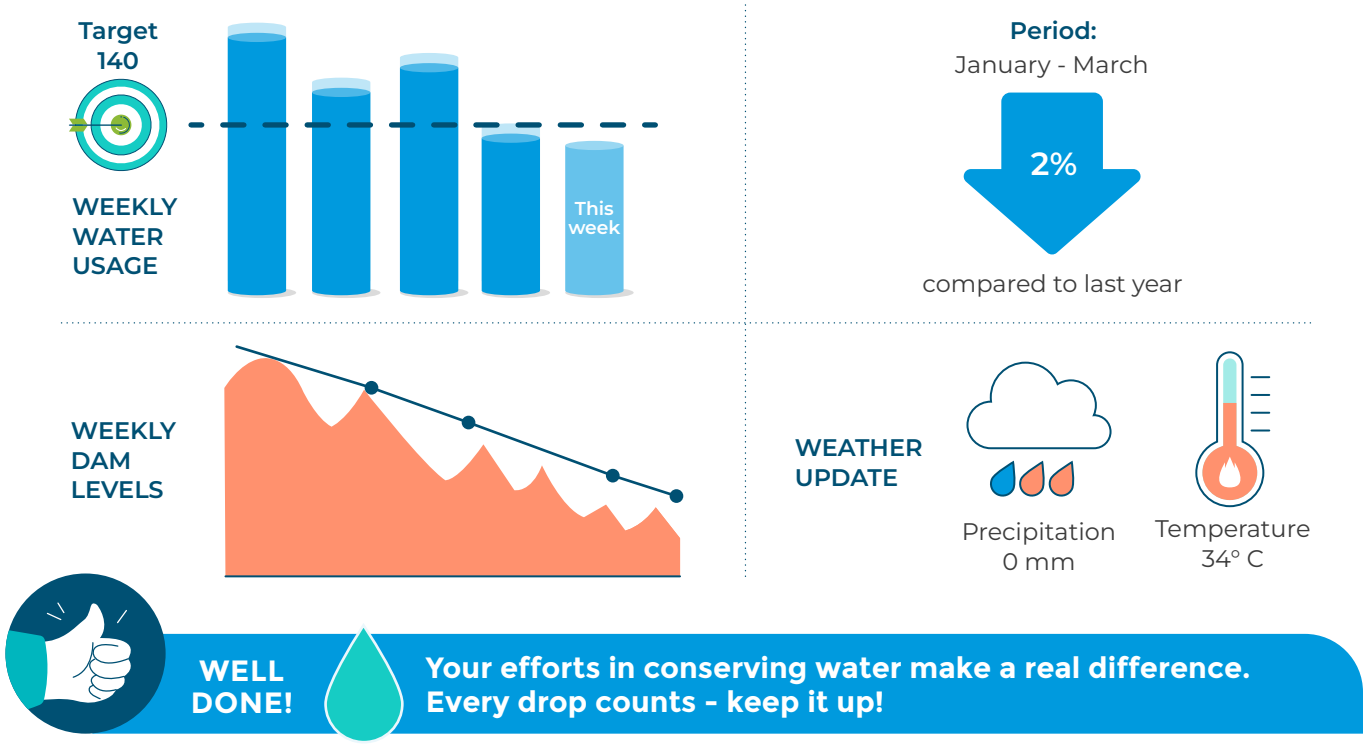
Receiving regular feedback—whether monthly or in real time—**encourages individuals to internalize conservation practices as part of their daily routines.** Moreover, noticing reductions in water usage relative to previous consumption motivates continued efforts. **By making water consumption visible and actionable, feedback transforms abstract environmental goals into achievable ones,** leading to substantial and sustained reductions.

An important feature of the campaign Target 140 in Australia was the inclusion of a feedback mechanism (Walton and Hume, 2011), which provided information on household consumption compared to the target goal of 140 liters per person per day. Simultaneously, it included a message either congratulating the household for their effort or encouraging them to keep trying. Feedback was provided in three main ways: weekly graphs showing water use and dam levels, daily updates in weather reports and newspapers, and quarterly bills comparing household water use to the previous year (see Figure 6). These regular updates from the QWC helped the community feel their efforts were making a difference, with extra support through community newsletters and detailed bills.

Fielding *et al.* (2012) conducted a subsequent study, also in Australia, to determine which type of campaign generates long-lasting effects on water conservation. They compared three interventions: a letter with an informational message, a letter with a descriptive norm, and a letter informing participants of water usage in different areas of their household along with water-saving tips (see Figure 7). The results showed that all interventions led to a reduction in water usage. However, the effects of the informational and normative letters faded over time, while the **feedback letter resulted in a slower but long-lasting reduction in water use, with long-term effectiveness measured six months after the intervention.**

FIGURE 6

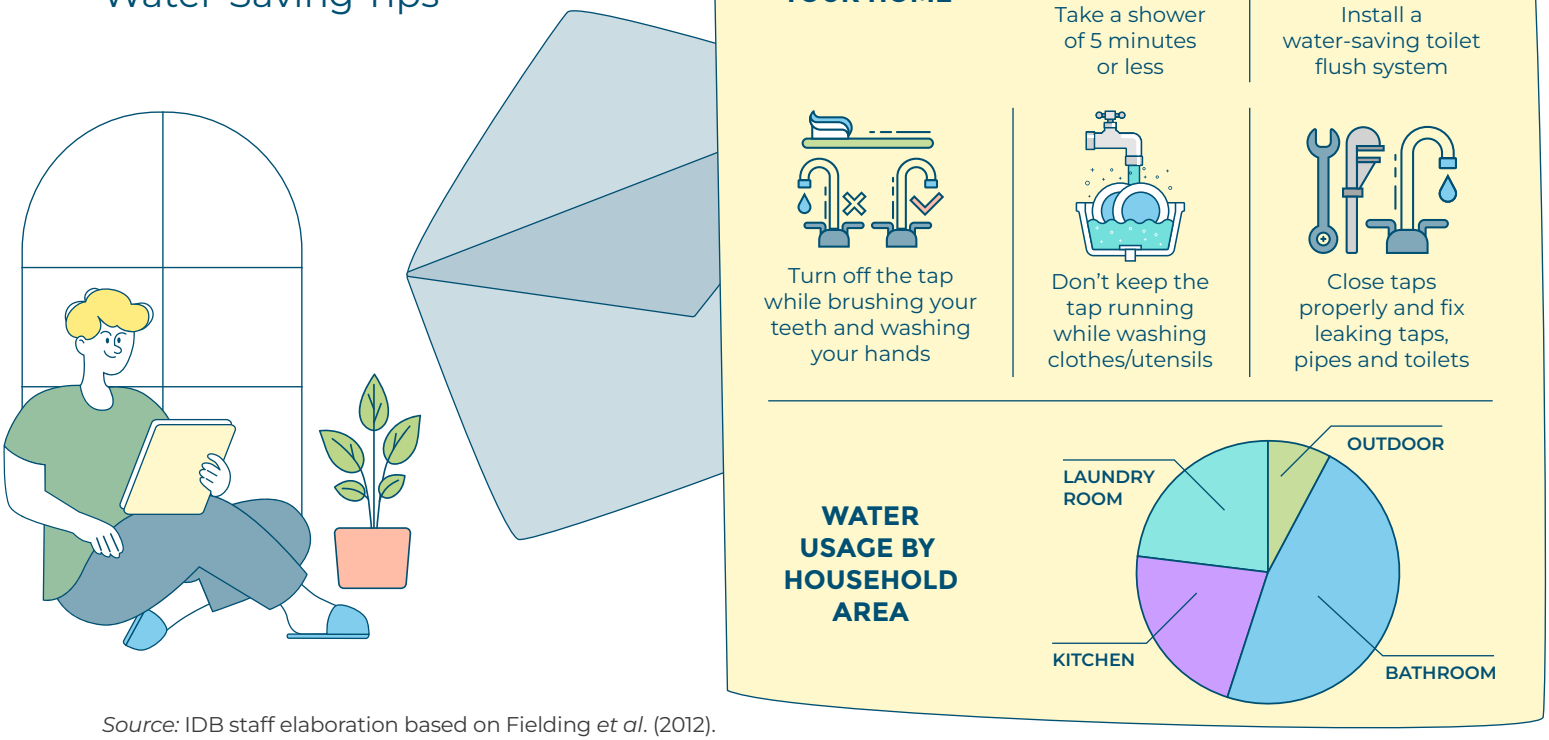
Water Consumption Feedback Mechanisms



Source: Inspired by Target 140, Queensland Water Commission.

FIGURE 7

Water Usage Feedback Letter with Water-Saving Tips



Source: IDB staff elaboration based on Fielding *et al*. (2012).

Social Norms

Social norms provide a powerful tool to tackle behavioral biases. **This technique tailors behaviors by showcasing the typical actions of the majority and leveraging the human desire to fit within a group.** Moreover, social norms guide behavior and inspire others, creating a positive ripple effect that encourages broader adoption of these norms.

In the context of water conservation, this strategy motivates individuals to reduce their water usage, helps them to identify the benefits of water-saving habits, and encourages them to replicate successful practices to align with community standards and avoid feeling out of place. An effective application of this is social comparison, which consists of showing individuals how their water consumption compares to their peers.

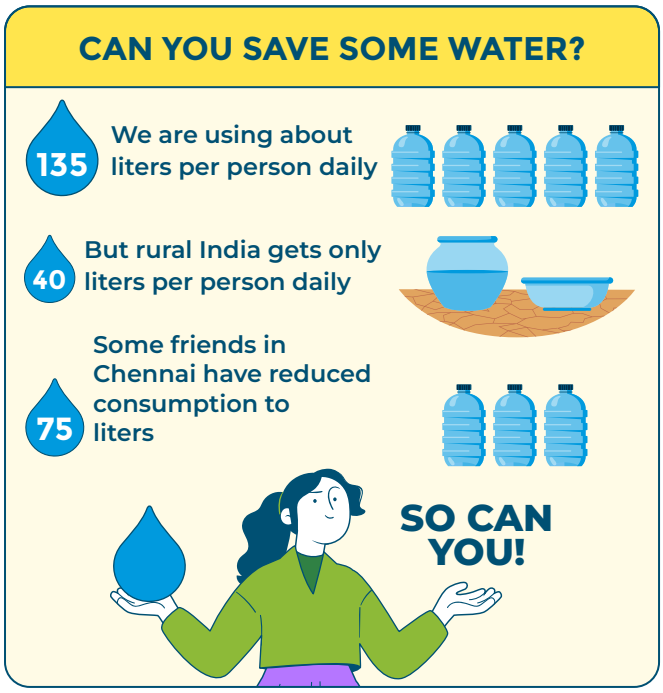
For example, **when people see that a significant portion of their community conserves water, they are more likely to adopt similar practices. Also, when people find out their water use is higher than their neighbors', they are often encouraged to reduce it.**

In India, users received an informational card highlighting limited water availability in rural areas, showcasing good water conservation behavior of their peers and providing actionable steps to reduce water overconsumption (see Figure 8). Additionally, users were contacted directly through a phone call to reinforce the goal, and they received stickers to place near high-water-use appliances. These strategies jointly generated a 10.3% reduction in monthly water consumption (Nayar and Kanaka, 2017).

By incorporating these insights into broader community efforts, such as public commitments and participatory planning, social dynamics can be leveraged to foster a supportive environment for water conservation.

FIGURE 8

Water Conservation Informational Card



Source: Adapted from Nayar and Kanaka (2017).

Public Commitments

Public commitments and pledges amplify the social norms effect. **When individuals make their intentions to save water publicly known, they create a personal and social obligation to stick to their promises. The desire to be consistent with their public commitments thus drives individuals to adopt water-saving practices more diligently.** In Lisbon, Barata *et al.* (2017) examined the impact of different types of commitments—public, private, or no commitment—on water conservation behaviors among students who received environmental education. The commitment consisted of conserving water and energy at home for a month. Those assigned to the public commitment group signed their pledge, which was then displayed on the classroom wall, while those in the private commitment group signed their pledge and kept it confidential. The study found that **students who made public commitments had a significant saving of 12.3m³ in water usage compared to those with private commitments.**

Furthermore, **community-based programs enhance this approach by involving residents in collective water conservation efforts.** When people work together on initiatives, they foster a shared sense of responsibility and create a supportive environment for change. Participatory planning also empowers community members to influence decisions about water management, increasing their investment in conservation outcomes.

The campaign Brown is the New Green, implemented by Santa Clara Valley in California, aimed to address local drought conditions by encouraging residents to temporarily suspend the use of water for lawn maintenance, allowing their lawns to turn brown (see Figure 9). This conservation program, along with other complementary efforts, led to savings of nearly 70,000 acre-feet of water (Santa Clara Valley Water District, 2017). Later, this campaign was adopted by California to encourage all its residents to save water. And to incentivize participation and foster community engagement, it included a recognition system where participants who adhered to the water conservation guidelines could print a sign and display it on their lawns. The campaign served as both a symbolic acknowledgment of their commitment to the campaign and a visible marker of their contribution to the collective effort.

By tailoring water conservation messages to fit cultural values and promoting broader lifestyle changes, these strategies ensure that conservation efforts resonate deeply with individuals' everyday lives. These social influence strategies create a powerful, integrated approach to reducing water consumption that is both personal and communal.

FIGURE 9

Brown is the New Green Campaign

Source: Based on the "Brown is the New Green" campaign in California (Santa Clara Valley Water District, 2017).

Messenger Effect

The sender of the message—whether a person or an institution—plays a crucial role in shaping people's behavior. This influence can be attributed to factors such as the messenger's expertise, fame, credibility, or role model status. In a study by Ho *et al.* (2022) on Vietnamese college students, an informational campaign promoting the reduction of single-use plastics was compared between messages with and without celebrity endorsement. The results show that a message endorsed by a celebrity had a significantly larger effect than one without the endorsement. Participants who received the celebrity-endorsed message showed a more than 20% reduction in the use of plastic straws and spoons. Furthermore, when single-use plastic usage was measured one month after the intervention, the effect remained significant and consistent in size.

This finding emphasizes the **potential of strategically selecting messengers to enhance the effectiveness of interventions.** Although this evidence focuses on single-use plastics, a similar approach could be applied in water conservation. For instance, **messages promoting water-saving practices or sustainability may have a greater impact when delivered by trusted local leaders, influential public figures, or relatable role models.** However, the role of such messengers in water management has not been extensively studied, offering potential for future research.

Nudging Techniques

A nudge is a subtle change in choice architecture that can alter people's behavior in a predictable way, without removing any option or making it more expensive. Nudges gently tailor decisions but do not force any particular action (Thaler and Sunstein, 2021). In the context of promoting more sustainable actions, nudges are highly effective tools for reducing household water consumption by subtly guiding individuals toward more sustainable behaviors.

A powerful nudge is setting water-saving options as the **default** in appliances, which can be leveraged to reduce household water usage. A default refers to the pre-set option automatically applied unless the individual actively chooses another. Behavioral science leverages defaults because of status quo bias, which explains the tendency of individuals to stick to the predetermined option even if there are better options. **By setting water-efficient options as predetermined, individuals are more likely to adopt them, as changing the default would require active effort.**

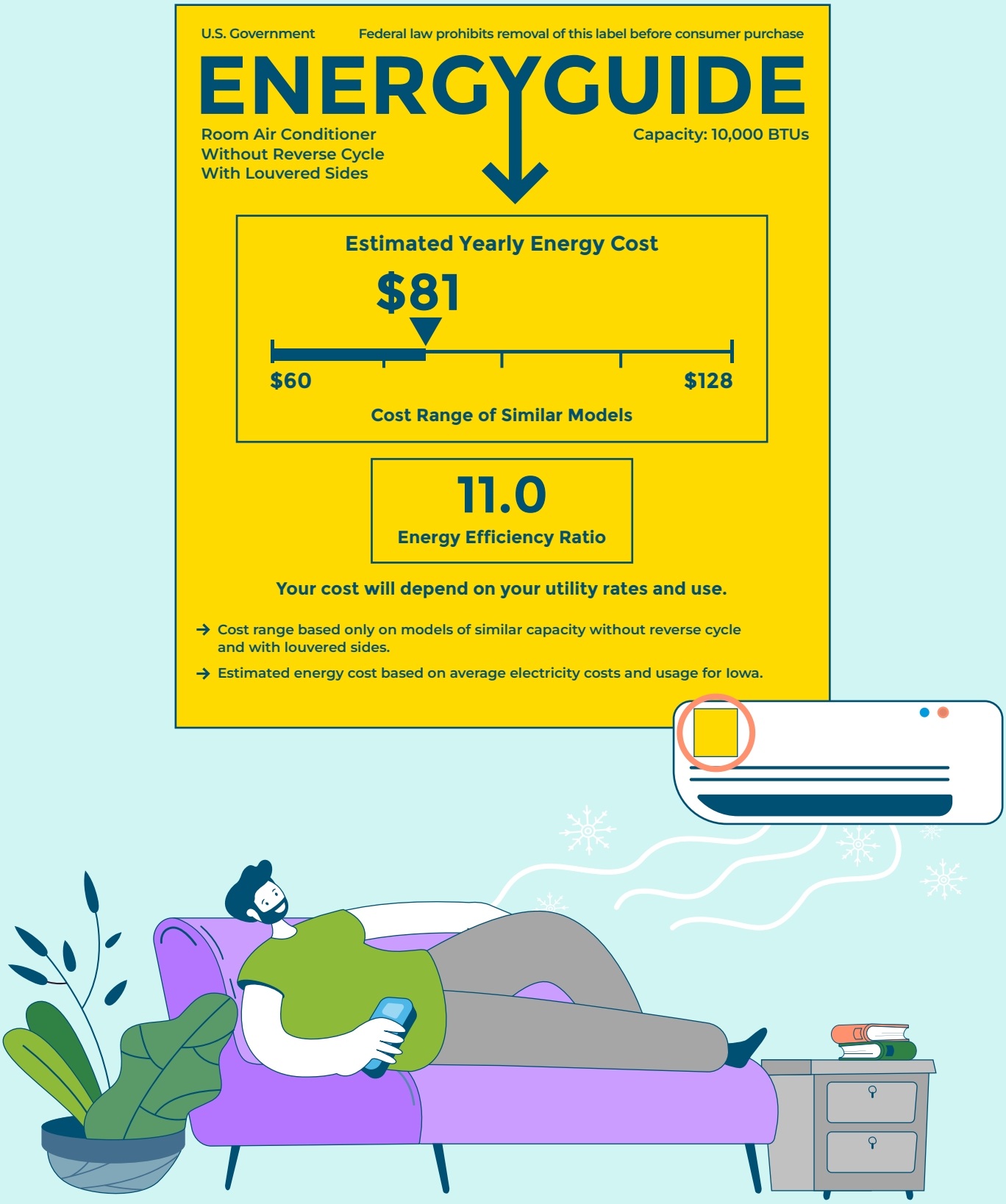
In France, an intervention aimed at adjusting the thermostat level—which controls the indoor temperature—before the individuals arrived at their work location was conducted to use energy more efficiently. The intervention involved lowering the thermostat weekly, with one group experiencing a 1°C reduction and another group a 2°C reduction. Findings showed that a smaller reduction (1°C) led to an average temperature decrease of 0.38°C, which helped to save energy (Brown *et al.*, 2013). However, when the thermostat had higher reductions (2°C), individuals noticed the change and responded by increasing the temperature, resulting in an overall rise above the original settings.

Framing choices emphasizing water conservation can effectively guide individuals toward more sustainable decisions. People's decisions are influenced by how information is framed, such as whether it has a gain or loss approach. It can simplify the decision-making process by emphasizing specific outcomes of water-efficient options, thereby increasing the likelihood of their adoption. In Sweden, Lövqvist (2021) conducted an online experiment to evaluate whether a positive or negative frame is more effective in promoting water conservation. The findings highlight the importance of how information is presented, revealing that **positively framed messages tend to elicit greater concern for water conservation.**

The way in which water-saving options are presented, known as **salience**, is crucial. Salience leverages the availability bias, which explains that people tend to choose an option that stands out. For instance, **placing water-efficient appliances in prominent positions and providing clear, accessible information about their benefits can nudge consumers toward selecting these products.** Davis and Metcalf (2016) found that the inclusion of a state-specific energy-guide yellow label (see Figure 10), which reports energy cost information based on usage and energy prices, led to more efficient decision-making in purchasing air conditioners.

FIGURE 10

Energy-Guide Yellow Label



Source: Adapted from Davis and Metcalf (2016).

FIGURE 11

Visual Cue for Water Conservation

Source: IDB staff elaboration based on Katz *et al.* (2016).

Visual cues serve as constant prompts to encourage water-saving behaviors. Placing signs or stickers near water fixtures with conservation messages or using smart home systems to issue **reminders** helps keep water conservation top-of-mind.

These **cues reinforce behavioral intentions and prompt individuals to make more conscious decisions regarding their water use.** For instance, Katz *et al.* (2016) conducted a study in Israel in which three mailings calling for water conservation were sent. These messages served mainly as a strategy to remind individuals of the goal of reducing water consumption. While these reminders could be presented in several ways, in this intervention the researchers opted for a postcard with a conservation message, a printed note on the water bill, and a magnet with the same content (see Figure 11). **After five weeks, daily water consumption decreased by 7.6%.**

FIGURE 12

Sticker Reminder in High-Water Usage Areas

Another example of visual cues is placing reminder stickers near areas with high water usage. **These can prompt users to adjust their habits by serving as constant reminders that water conservation is possible in everyday situations** (see Figure 12). In India, an intervention included providing users with stickers to place near areas prone to water overuse. Users additionally received a personal call to remind them of the goal and an informational card. Monthly water consumption decreased by 10.3% for those who participated in this initiative (Nayar and Kanaka, 2017).

Among other **interactive cues**, the **use of timers to measure the time taken during activities of high-water usage helps address cognitive overload by making individuals more aware of how much time they spend on such activities.** Doel (2021) carried out an intervention in seven tourism accommodations in Denmark, Spain, and the United Kingdom where smart shower-meter timers were installed to provide real-time feedback (see Figure 13). This feedback was accompanied by persuasive messages reflecting pro-environmental values (selfless/selfish) and different levels of effort (high/low). Results show that providing real-time feedback by using the timer led to a reduction of around 13.56%. Furthermore, when a selfless and high-effort persuasive message was included, the reduction was even greater, at 21.27%.

FIGURE 13

Real-Time Feedback through Smart Shower-Meter Timers

Source: Adapted from Doel (2021).

Anchoring is achieved by setting a reference point that influences future behaviors. For example, **establishing a target goal for water consumption alongside an individual's consumption on their water bill serves as a benchmark, encouraging them to match or stay below the goal.** This technique helps individuals align their behavior with a clear, desirable standard. The Australian Target 140 campaign leveraged this strategy by establishing 140 liters per person per day (l/p/d) as the objective for every household. This highly effective strategy reduced water consumption by 28.3% in the following 11 months. However, the most surprising effect was persistent lower levels of water consumption, less than the original goal, even when the goal increased to 200 l/p/d (Walton and Hume, 2011).

By integrating these diverse nudging techniques, households could be effectively guided toward reducing their water consumption. This approach leverages various psychological principles to drive significant and lasting changes in water use behaviors.

5 Behavioral Strategies Implemented in Latin America and the Caribbean

5 Behavioral Strategies Implemented in Latin America and the Caribbean

In recent years, several countries in Latin America and the Caribbean have experienced water stress due to climate change conditions, droughts, and water shortages, among others causes. Due to this situation, a variety of strategies have been implemented to address water conservation challenges across the region. **Some of those strategies incorporate behavioral insights into their design and implementation,** aiming to encourage sustainable water use in households, and they have proven to be highly effective and cost-efficient.

This subsection explores the range of approaches applied so far, highlighting their design and impact in enhancing more sustainable water behaviors in the region.

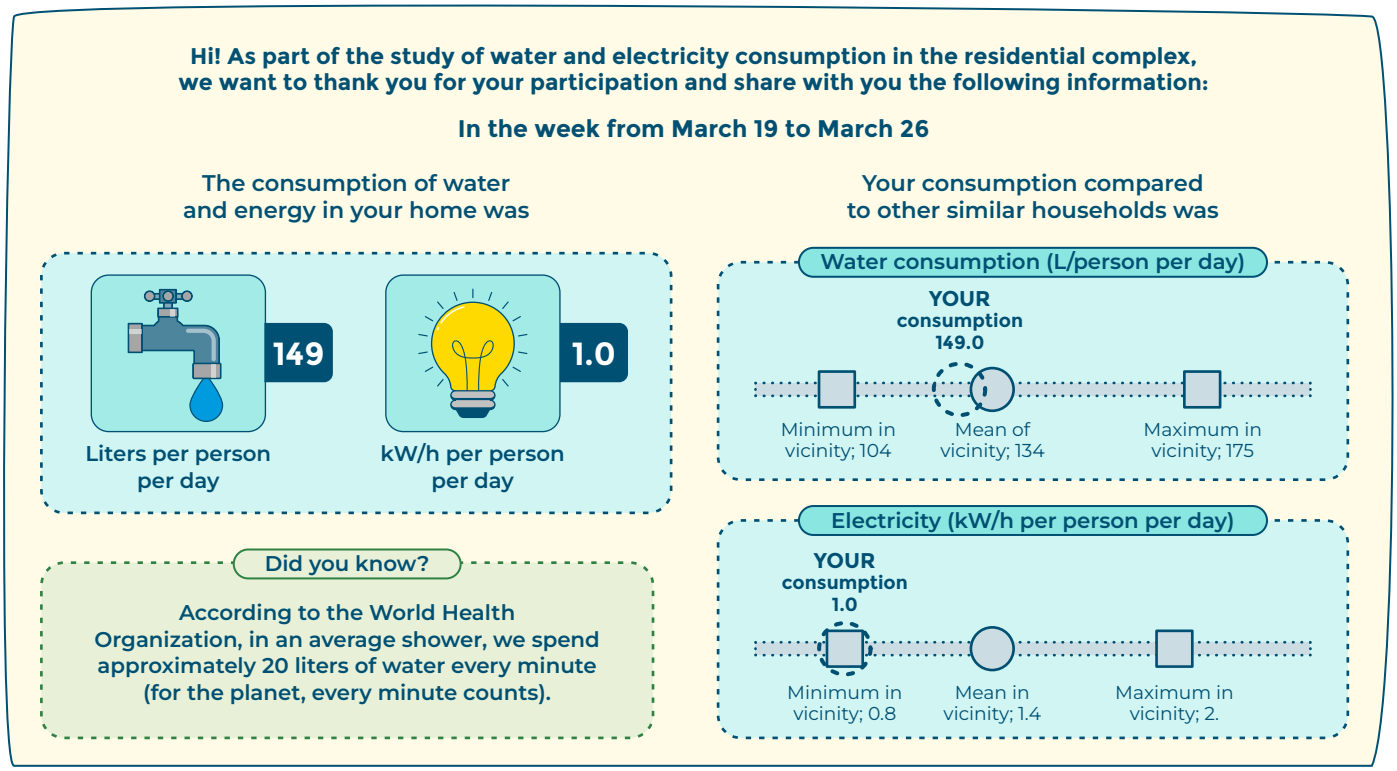
Providing Feedback

In Colombia, an intervention was developed to evaluate the effects of providing feedback on household water and electricity consumption (Restrepo and Morales-Pinzón, 2020). This intervention involved distributing printed reports to households over five weeks. The reports provided information on household consumption levels throughout the week, a graphic comparison with their neighbors' consumption, and practical tips and strategies for reducing consumption of the resource in question (see Figure 14). The content focused on water, electricity, or both, and varied only in whether it included tips for reducing resource use.

Households with higher water consumption were more likely to adopt water-saving practices and realize greater reductions in their water use, attributable to their high savings potential. The result highlights that providing feedback can be an effective tool for reducing water consumption and adjusting usage patterns.

FIGURE 14

Feedback Reports on Water and Electricity Use



Source: Adapted from Restrepo, J.D.C. and Morales-Pinzón (2020).

In Belén, Costa Rica, water consumption levels were 1.25 times higher than the national average, significantly increasing the risk of water shortages by 2030 if consumption patterns remain unchanged and no further investments are made in water infrastructure. As a result, reducing water usage became a critical policy priority for the region to mitigate the potential for future water scarcity. To identify behavioral barriers, a series of focus groups took place. The barriers included individuals' lack of awareness of their levels of water consumption, lack of a benchmark for comparison, and lack of information about concrete steps they could take to reduce their consumption.

An intervention by Miranda *et al.* (2020) developed three treatments tailored to address the barriers identified. One of them focused on providing feedback by adding a sticker to the water bill, which gave households direct insight into their water consumption. The stickers additionally included a smiling or frowning face, depending on the feedback, and salient colors to attract attention (see Figure 15).

This strategy, combined with the social norms intervention, achieved a 4.9% decrease in water consumption compared to the neighborhood benchmark.

Social Norms

Water consumption reports that include comparisons with similar households offer valuable information on expected water use, motivating users to adjust their usage to the average level.

To continue with the example of Costa Rica, a comparison of the water usage at neighborhood and city levels was included on the water bill, as a descriptive social norm. Findings show that **comparison with those who are more similar to the individual contacted, such as neighbors, generates a substantial reduction in water consumption of 1.29 m³, while the city comparison resulted in a smaller and non-significant reduction** (Miranda, Datta, and Zoratto, 2020).

FIGURE 15

Social Norms and Positive Reinforcement for Water Conservation

Source: Adapted from Miranda, J.J., *et al.* (2020).

It is necessary to take into account that **each detail can have a significant effect on the results.** In the previous paragraph, what could have happened to those under the average level? One possibility would be to anticipate an increase in their consumption, as they might perceive themselves as saving too much water while others around them are not making similar efforts. For this reason, **it was relevant to include positive reinforcement recognizing water-saving behaviors and encouraging households to continue this commitment.** In this initiative, this reinforcement took the form of a smiling face for those who reported water usage lower than the average and a message congratulating them for the achievement (see Figure 15).

Similarly, in Colombia, Torres and Carlsson (2018) analyzed a social information campaign designed to encourage water conservation. The intervention consisted of sending a monthly consumption report that includes normative messages comparing the household's water use with the consumption of an efficient neighbor (see Figure 16). The campaign lasted for a year and resulted in a 6.8% reduction in water consumption among targeted households. Interestingly, **households not directly targeted also reported a 5.8% reduction in their consumption.** The result highlights how social norms can influence behavior beyond the intended sample, creating positive spillover effects.

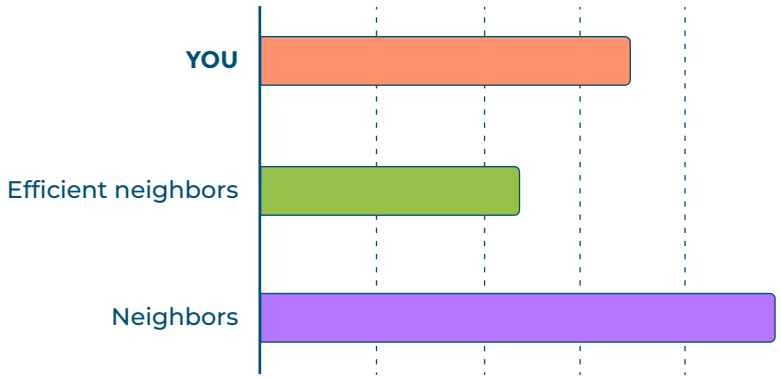
FIGURE 16

Monthly Water Use Report with Normative Messages

YOUR WATER CONSUMPTION REPORT

This consumption report is intended to help you understand your monthly water use. It also allows you to compare your current water use with that of your neighbors and efficient neighbors, who are similar to you.

Water consumption corresponding to this bill



Last month neighborhood comparison

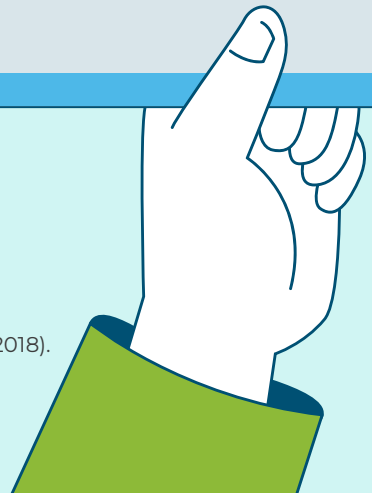
Last month your household used MORE water (3.0 m^3) than your efficient neighbors.

HOW I AM DOING?

- EXCELLENT
- **AVERAGE**
- ROOM TO IMPROVE

DO YOU KNOW THAT:

1. Your household neither uses water efficiently nor wastes it to a greater extent. With an additional effort to save water, you will be able to join the group of efficient neighbors.
2. This month 22 households joined the group of efficient neighbors.



Source: Adapted from Torres and Carlsson (2018).

Planning Tools

Miranda *et al.* (2020) additionally developed a third strategy to tackle the water problem in Costa Rica by providing a planning postcard on which residents could record their monthly water consumption and compare it with a benchmark printed on the card (see Figure 17). This strategy allowed residents to track their usage and provided actionable steps for conservation, leading to a 4.8% reduction in water consumption. Additionally, **the effects of the three interventions implemented (feedback, social norms, and planning tools) were sustained, highlighting the long-term potential of well-designed behavioral interventions in promoting water conservation.**

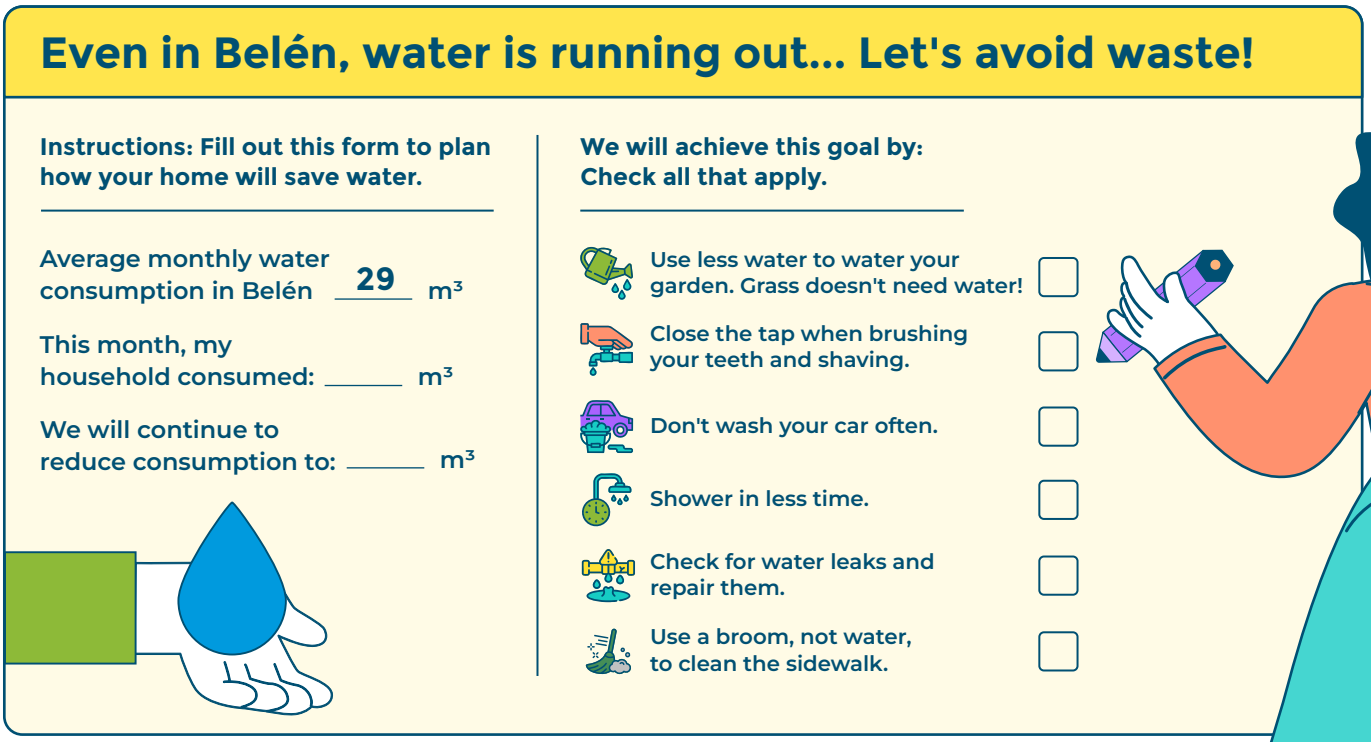
Nudging Techniques: Salience

Before the intervention of Miranda *et al.* (2020), residents from the Belén district were ignoring the levels of water consumption reported in their bill. This was because the details were not clearly visible, appealing or easily accessible, making it difficult for residents to track and adjust their water usage. To address the lack of awareness, a colorful sticker was included in the bill, drawing attention to their water consumption levels and making the information more noticeable (see Figure 15). This simple change generated a measurable reduction in water consumption among residents. This study highlights the importance of making information more salient to encourage desirable behaviors.

Designing effective behavioral interventions, however, requires careful attention to detail. For example, during a severe drought or water shortage, it is important to avoid creating a sense of insecurity about future water availability. This concern includes careful word choice in any campaign. While most campaigns follow an idea of "Save water," using the word "Save" can lead to a perception of future scarcity, increasing a preference for storing water rather than reducing its usage.

FIGURE 17

Water Consumption Planning Postcard



Source: Adapted from Miranda, J.J., *et al.* (2020).

6 Conclusions

6 Conclusions

- **Addressing water scarcity requires looking beyond infrastructure upgrades or regulatory reforms, it also demands a deep understanding of the psychological and social factors that shape water consumption.** In Latin America and the Caribbean, where unequal access and limited infrastructure undermine conservation efforts, incorporating behavioral insights into policy design has proven valuable in enhancing conservation outcomes. By identifying the behavioral drivers behind decisions about water use and embedding them in intervention design, strategies become more effective and sustainable over time.

- **Behaviorally informed strategies help overcome cognitive and social barriers that often limit the effectiveness of traditional approaches.** The interventions reviewed in this document show how such strategies can lead to significant and lasting reductions in water consumption. For instance, Bernedo *et al*. (2014) found sustained reductions that persisted even six years after the implementation ended. In addition to improving outcomes, behavioral approaches offer cost-effective solutions to curb overconsumption and strengthen long-term water management practices.

Tailoring interventions to address specific cognitive biases and behavioral barriers enhances their effectiveness, fostering sustainable behavior changes and leading to lasting reductions in water consumption.

- Existing evidence underscores the potential of behavioral strategies; however, further research is essential to understand how their effectiveness varies across different contexts. **The diversity of Latin America, which includes differences in infrastructure, technological access, and local social dynamics, requires interventions that are tailored to these specific conditions.** Future studies should prioritize identifying context-specific behavioral barriers and informing the design of targeted interventions.

- In conclusion, behavioral science offers a promising toolkit for tackling the urgent challenge of water scarcity. **By fostering context-sensitive interventions that combine behavioral insights with traditional policy strategies, and encouraging collaboration between policymakers, researchers, and communities, these approaches can promote long-term conservation and support sustainable water use across the region.**

ANNEX 1

Let's Design Our Own Intervention!

Behavioral economics interventions require following a rigorous design methodology. In this section, we will present a case study to illustrate the process of designing interventions that encourage the desired behaviors. This approach will be applied to target essential behaviors that are critical for reducing household water consumption.

1. DEFINE

1.1 Define Policy Challenge

To design an effective intervention, the first step is to clearly define the problem we aim to address.

Policy challenges often have a broad scope and involve several dimensions. Therefore, it is crucial to break down the problem and define the behavioral problem by identifying the target population and desired behavior.

Problem:
Residents of a specific city use too much water when taking a shower.

1.2 Define Target Population and Desired Behavior

The target population includes any actors involved in the problem, whether on the supply or the demand side. Understanding the context and analyzing the population's characteristics are essential for accurately choosing the actors for intervention.

A key rule in selecting the desired behavior is to ensure it can be observed.

Desired behavior:
Residents of a specific city shorten the time they keep the water running during showers.

2. DIAGNOSE

2.1 Identify Potential Behavioral Barriers

A proper diagnosis of the context and potential behavioral barriers is necessary to identify what hinders the adoption of the desired behavior.

To identify potential barriers, consider asking yourself these questions:

- What prevents residents from reducing the time the water runs during showers?
- What hinders residents from shortening their shower time, even if they believe they should?

Potential behavioral barriers in this context:

1. People do not realize they are wasting too much water.
   → **Barrier:** Lack of awareness
2. People forget to reduce their water usage during showers, even after making a commitment.
   → **Barrier:** Cognitive overload
3. People are used to long showers and see no reason to shorten them.
   → **Barrier:** Status quo bias

2.2 Validate the Barriers

This step involves validating the hypothesized behavioral barriers through surveys, in-depth interviews and/or focus groups of the target population.

2.3 Select Barriers to Tackle

Once the behavioral barriers are validated through data collection, the next step is to choose the barriers that will be addressed, based on time and monetary resources.

Selected behavioral barrier: Cognitive overload

3. DESIGN

3.1 Identify Behavioral Insights to Tackle Barriers

To effectively address the barrier, we will review similar contexts and assess the success of previously implemented measures. By combining this information with insights from the prior stage, we will determine potential solutions.

3.2 Design Treatments

Once we understand the situation and its underlying biases, we will design our own solutions and define the treatment to be evaluated.

Potential solutions include:

- Distribute stickers with reminder messages about reducing water use. Encourage placing them in key locations (i.e., near the shower) to address the decision-action gap.
- Provide hourglasses that run for the recommended shower duration for easy tracking.
- Create music playlists that correspond to the recommended shower duration, encouraging residents to limit their shower time to the length of the playlist.

3.3 Design Evaluation Strategy

Defining the evaluation strategy involves identifying key outcome variables that can be objectively measured, such as water usage in cubic millimeters per household.

Moreover, a rigorous methodology is crucial for producing valid conclusions, such as creating randomized groups for different treatments, including a control group.

4. TEST

In this stage, we evaluate the proposed solution through a pilot study. The results will enable us to determine the most effective design. This phase often intersects with the previous stage, as new insights generated during the pilot study can lead to improvements in the original design.

If the outcomes are satisfactory, policymakers may choose to implement the intervention and subsequently assess the results. If the results are favorable, the intervention can then be scaled up to a permanent policy.

ANNEX 2

Enhancing Water Efficiency with Technology and Behavioral Science

The adoption of advanced technologies and efficient appliances aligns with the goal of increasing water-saving behaviors by making conservation practices more convenient and effective. Low-flow showerheads and faucets, for example, are designed to reduce water use while maintaining performance, making it easier for individuals to **adopt water-saving habits without sacrificing comfort.** These fixtures require no additional effort from users, as they are simply integrated into daily routines and encourage ongoing water conservation without the need for constant reminders. Low-flow toilets further support this by reducing water use per flush, reinforcing the habit of conserving water in an effortless way.

Regarding outdoor water use, the inclusion of smart technology—such as efficient irrigation systems, drip irrigation systems and weather-based controllers based on real-time data and local weather conditions—helps homeowners avoid overwatering. This technological approach provides automated adjustments that make it easier for people to practice conservation without needing to manually track or adjust their watering schedules. **By making water-saving practices both easy and effective, these systems support consistent behavioral changes that contribute to overall water conservation efforts.** Together, these strategies leverage both technology and behavioral insights to create a more sustainable approach to managing household water use.

Similarly, **providing individual metering of water consumption has proven effective in promoting sustainable practices.** In Ecuador, utility payments in buildings or communities are sometimes equal among all households regardless of individual water consumption, leading to higher-than-optimal water usage—a phenomenon known as the "tragedy of the commons." To address this inefficiency, individual water meters were introduced for each household, enabling more accurate allocation of water costs based on actual consumption. This shift was intended to encourage more sustainable water use and reduce overall consumption by making households accountable for their specific usage. **The initiative led to a 20% decrease in water consumption in the year following the intervention,**[3] highlighting the effectiveness of this strategy in buildings previously reliant on communal meters. Furthermore, **this reduction in water consumption is comparable to the impact that could be achieved by raising the price by at least 66%, underscoring the significant influence of individual metering on promoting more efficient water use** (Carrillo *et al.*, 2024).

Much can also be learned by understanding how conservation efforts for other resources operate across the region. Another initiative in Ecuador involved a 2012 government-led refrigerator replacement program aimed at reducing household electricity consumption by providing energy-efficient units. The program resulted in a reduction of 15,780 MWh per year, equivalent to US$17 million. Beyond the immediate energy savings, the program also motivated people to use electricity efficiently and encouraged local industry to implement new technologies (Cobos *et al.*, 2017).

In addition, gamification has emerged as a potential strategy to enhance water conservation. This approach combines technology with elements of game and competition, motivating individuals to adopt water-saving behaviors. **By developing mobile apps or creating challenges that reward users for adopting water-saving habits, gamification**

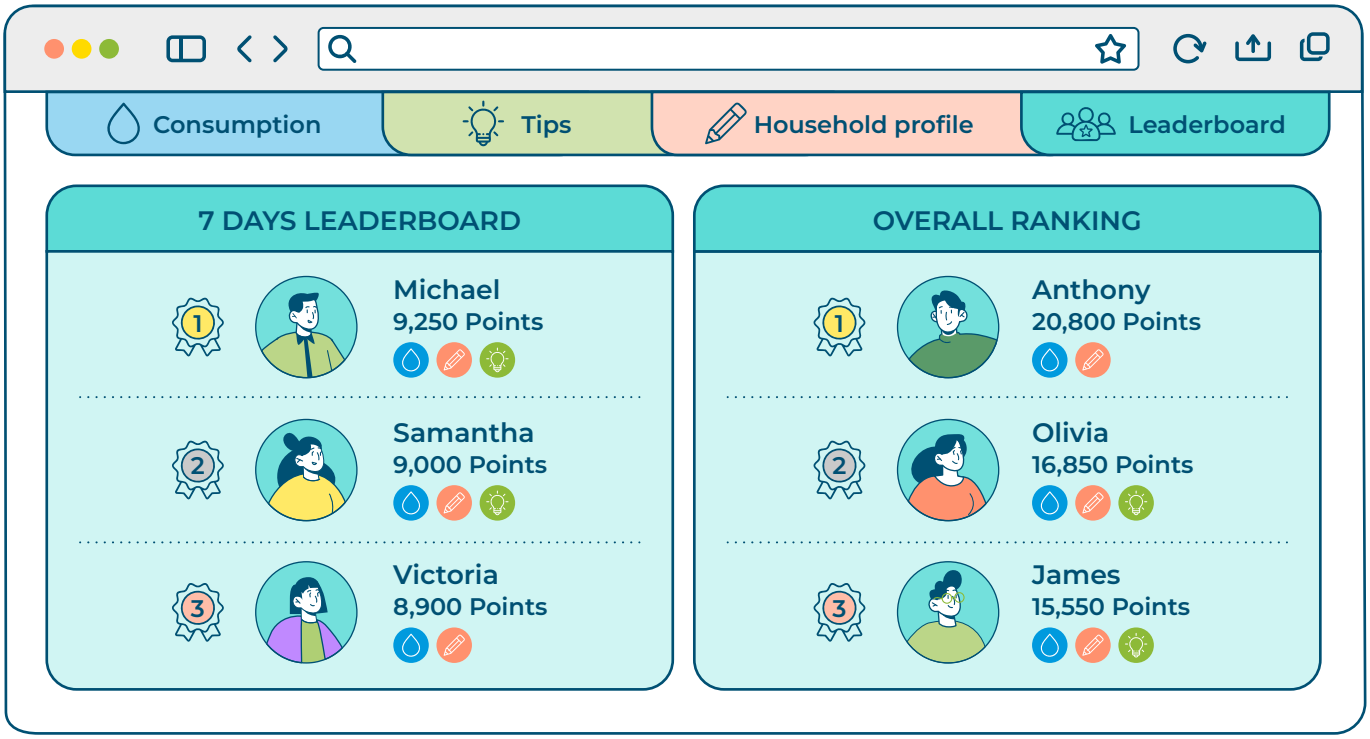
[3] The households that received the water meter were required to apply for its installation, indicating a self-selection bias in the treatment group.

leverages the principles of game design to turn water conservation into an enjoyable activity, encouraging individuals to consistently practice and improve their water-saving behaviors. Combining this strategy with efficient technologies, such as smart meters, can not only improve water usage but also engage users in a more interactive and consistent way. **Features of gamification such as feedback mechanisms, progress tracking, and rewards can further drive sustainable water use.** Novak *et al.* (2018), for example, used the SmartH2O platform to develop an intervention aiming at encouraging water conservation. The intervention consisted of providing water consumption information with gamified incentives, such as virtual rewards, tangible benefits, and social recognition (see Figure 18). Preliminary results revealed a significant impact, with the platform achieving a 27.5% reduction in water consumption.

These examples underscore how technology can be a powerful enabler of efficiency. **While technological advances provide tools to optimize water use, behavioral strategies enhance their adoption and impact.** By combining these approaches, households can achieve greater conservation outcomes and foster long-term sustainability.

FIGURE 18

Gamification for Water Conservation



Source: Adapted from Novak *et al.* (2018).

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