

Clean Water: Tap Into Tomorrow: Real-World Case Studies

Case Study: Cape Town

Four million people live in Cape Town, South Africa. Their water supply comes from rain, which is collected and stored in six reservoirs scattered around the city. But a drought that began in 2015 has created a serious water shortage; in 2018, reservoirs only held one fifth of their capacity. Residents live in dread of “Day Zero,” when the reservoirs will run dry and fresh water will stop flowing from taps.

Day Zero has been postponed several times as Cape Town institutes measures to make water last longer. The city has repaired leaky pipes. It has also lowered water pressure in pipes, so that less water comes out when people turn on their faucets. Each person is only allowed 13 gallons of water a day—the amount that an older toilet uses for three or four flushes—and fines are imposed when this limit is

exceeded. Nobody hoses down the sidewalk or washes their car any more. Farmers also have water restrictions that are 60% less than in pre-drought days. Once a farm hits its limit, their water is simply cut off.

With droughts becoming more common and more severe, water conservation can’t solve all of Cape Town’s problems. And even in non-drought years, residents will have to practice water conservation. Cape Town has an online “water dashboard” that shows residents the level of water in the reservoirs and how much water they should be using. This kind of information helps most people make necessary changes to their behavior. Those who continue to use too much water receive letters from the city and are warned that water-restricting devices will be installed if necessary.

¹ <https://www.abc.net.au/news/2018-11-11/drought-put-cape-town-on-a-countdown-to-day-zero/10477538>

Case Study: Fog Water Harvesting

About five inches of rain a year falls on Mount Boutmezguida in southern Morocco. People living in the region used to subsist on the rainwater they captured in cisterns or pulled up from wells, but drought cycles have become more frequent. The wells and cisterns are drying up.



Although the region has so little rain, it does have another potential source of water. Heavy swathes of fog roll in from the Atlantic Ocean and cover Mount Boutmezguida. Fog is a low-lying cloud composed of water droplets. Engineers have figured out a simple, cost effective way to capture these droplets: wind pushes the fog against giant nets to which the water droplets cling, gather, and slide down into troughs. The troughs connect to pipes and the clean water goes straight into people’s houses.

The first fog-harvesting nets failed. They ripped apart in the high mountain winds, which often reach 75 miles an hour. Engineers tested a number of prototype fabrics to find one that could resist these winds and be economical, food-safe, and UV-resistant. A 3D mesh system turns out to work best. The nets are easy to take care of too; a wrench and a socket wrench are all the villagers need to keep them functioning well. As of 2018, Mount Boutmezguida has the biggest fog-harvesting system in the world, and 800 homes receive 18 liters of water a day—up from the 8 liters of rainwater per family that used to be painstakingly collected.

Case Study: SmartBall Technology

Leaky pipes lose billions of gallons of water every year, all over the world. Finding those leaks has always been a challenge; water pipes are often many feet below the ground, traveling for miles beneath streets and sandwiched between other pipes and cables. Unless the leak is unmistakable, as in when a water main bursts and a fountain of water suddenly erupts, leaks can seep water for years without detection.



A new technology called a SmartBall can now find these leaks three or four times more effectively than other tools. The SmartBall looks a little bit like a bowling ball. It contains a hydrophone—a microphone designed to listen to sounds underwater. It can find extremely small leaks no matter how big the pipe or what materials the pipe is constructed from, and it provides data about the exact location of the leak. The SmartBall also contains a magnetometer that keeps the ball rolling through the pipe. It is encased in foam so that its own noises don't interfere with detecting the sounds of leaks.

The SmartBall can inspect pipelines that are 30 miles long, all the while emitting a sound every few seconds so that above-ground sensors know exactly where it is. In 2017 the city of Ottawa in Ontario, Canada used the SmartBall to assess the condition of a critical transmission main. It traveled along the pipeline for a couple of miles before its sensors detected the sound of a leak. The city could excavate at exactly the right spot to fix the leak, instead of expending money and manpower on incorrect guesswork. Now cities throughout North America and the rest of the world are making use of SmartBalls to save water and maintain pipelines.

Case Study: Nevada

Nevada relies on the Colorado River for its water; the Colorado River relies on snowmelt from the Rocky Mountains to keep it flowing. But the Colorado River Basin has been in a drought for 19 years. The reservoirs formed by dams along the river—Lake Mead and Lake Powell are the biggest—are at concerning low levels. The region is expected to get even drier as climate change continues.

Six other states also depend on the Colorado River. Nevada, Arizona, and California form what is known as the lower basin, while Colorado, New Mexico, Utah, and Wyoming are in the upper basin. These states must work together and make sacrifices to avoid triggering mandatory water restrictions set by the federal government. In 2019, these states negotiated a deal to conserve water that includes drought contingency plans (DCPs) for each state. This plan will be in effect through 2026. Through a series of complex regulations that have been hashed out despite political disagreements, Lower basin states have agreed to stop taking water from Lake Mead if it hits a dangerously low level, and to take less from it to prevent this degree of depletion. These states are also implementing water conservation efforts, with saved water being stored in Lake Mead.

The seven states “bank” water that has been saved via conservation to use as needed. Nevada just completed a new water intake system that can reach water at lower levels in Lake Mead. It is also building a new pumping station at Lake Mead to preserve access to Colorado River water for the southern part of the state. Specific conservation methods include recycling wastewater for irrigating golf courses and parks; some water is recycled and returned to the Colorado River. Groundwater is being tapped in addition to river water, although how much and how fast to use it are topics of debate. Researchers are investigating the possibility of desalination projects with California and Mexico, to make use of seawater and brackish water.

Nevada pays residents to replace lawns, which require a huge amount of water to maintain, with landscaping that is drought tolerant. Residents are only supposed to water their yards on certain days of the week and at certain times of day to minimize water evaporation. Residents also have tiered pricing for their water use. If they use more than a certain amount, the price increases substantially. These incentives have helped people to change their behavior around water.