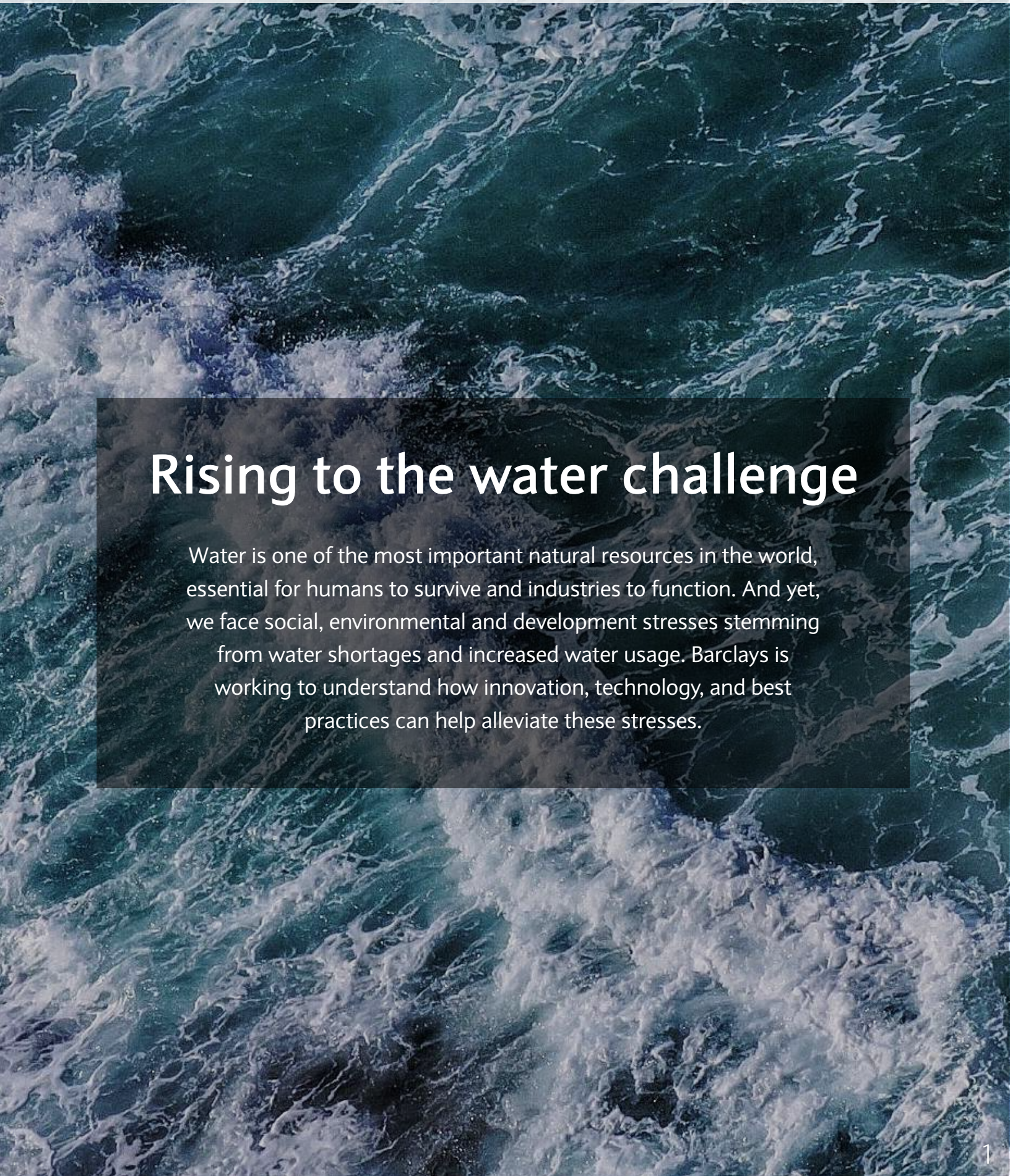


Rising to the water challenge

Water is one of the most important natural resources in the world, essential for humans to survive and industries to function. And yet, we face social, environmental and development stresses stemming from water shortages and increased water usage. Barclays is working to understand how innovation, technology, and best practices can help alleviate these stresses.

A crisis of quality and scarcity

The world is facing a potential global water crisis, driven by population growth, urbanization, and climate variability. Simply put, water is scarce, and what there is can often be of poor quality. Only a portion of the available groundwater in the U.S. is fit for human consumption, and is even inadequate for industrial reuse without treatment.

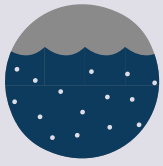
CAUSES

Population Expansion

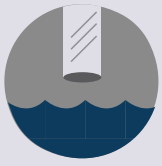
Economic Growth

Climate

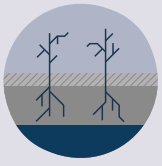
EFFECTS



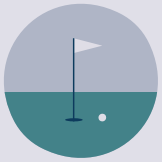
Lower water quality



Groundwater depletion



Recurring droughts



Inefficient water use and loss

The freshwater conundrum

Understanding global water shortages requires an appreciation of just how precious freshwater is. Most of the earth's water supply is saline, but most demand is for fresh. Saline water is unfit for human consumption, and is even unusable for industrial use. To manage growing demand and increasing stresses, the cost of treating saline water (desalination) needs to come down.

WHERE THE FRESHWATER IS

0.3%
Surface water

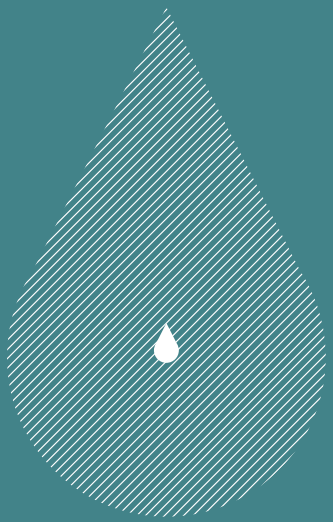
30%
Underground water

69.7%
Glaciers, snow, and icecaps

Source: FAO, 2016

EARTH'S WATER SOURCES

97.5%
Saline



2.5%
Fresh

Source: FAO, 2016

WITHDRAWALS IN 2010 IN US

14%

Saline

86%

Fresh

Source: FAO, 2016

Global implications of the water shortage

No one can predict the future, but available freshwater resources will certainly continue to decrease, due to the demands of a growing world population. Many parts of the world that are already experiencing a water shortage will see their water issues worsen, causing hardships for millions.

BY 2050

55%

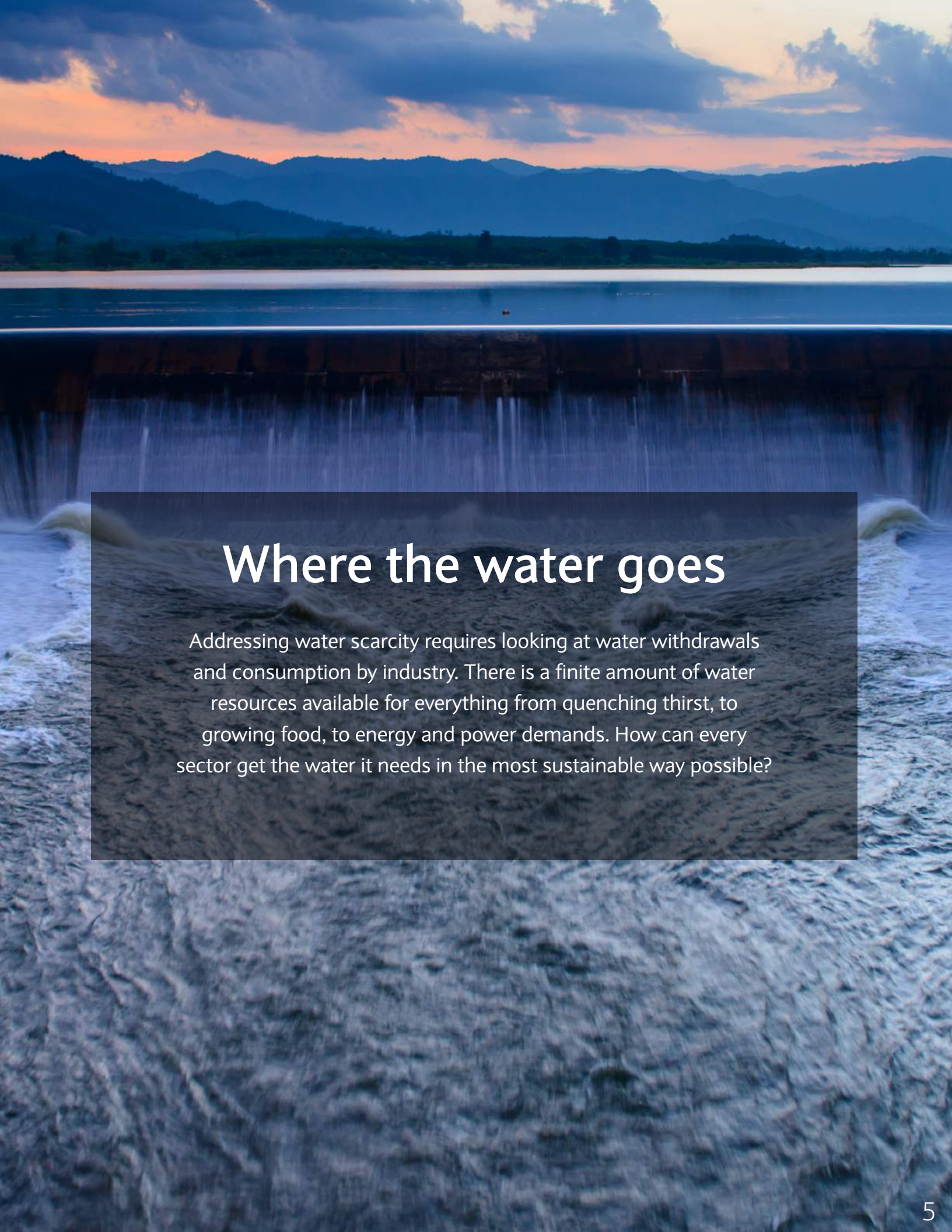
How much water demand is projected to increase globally.

Source: OECD

2/3

How much of the world's population could be under water stress conditions.

Source: FAO



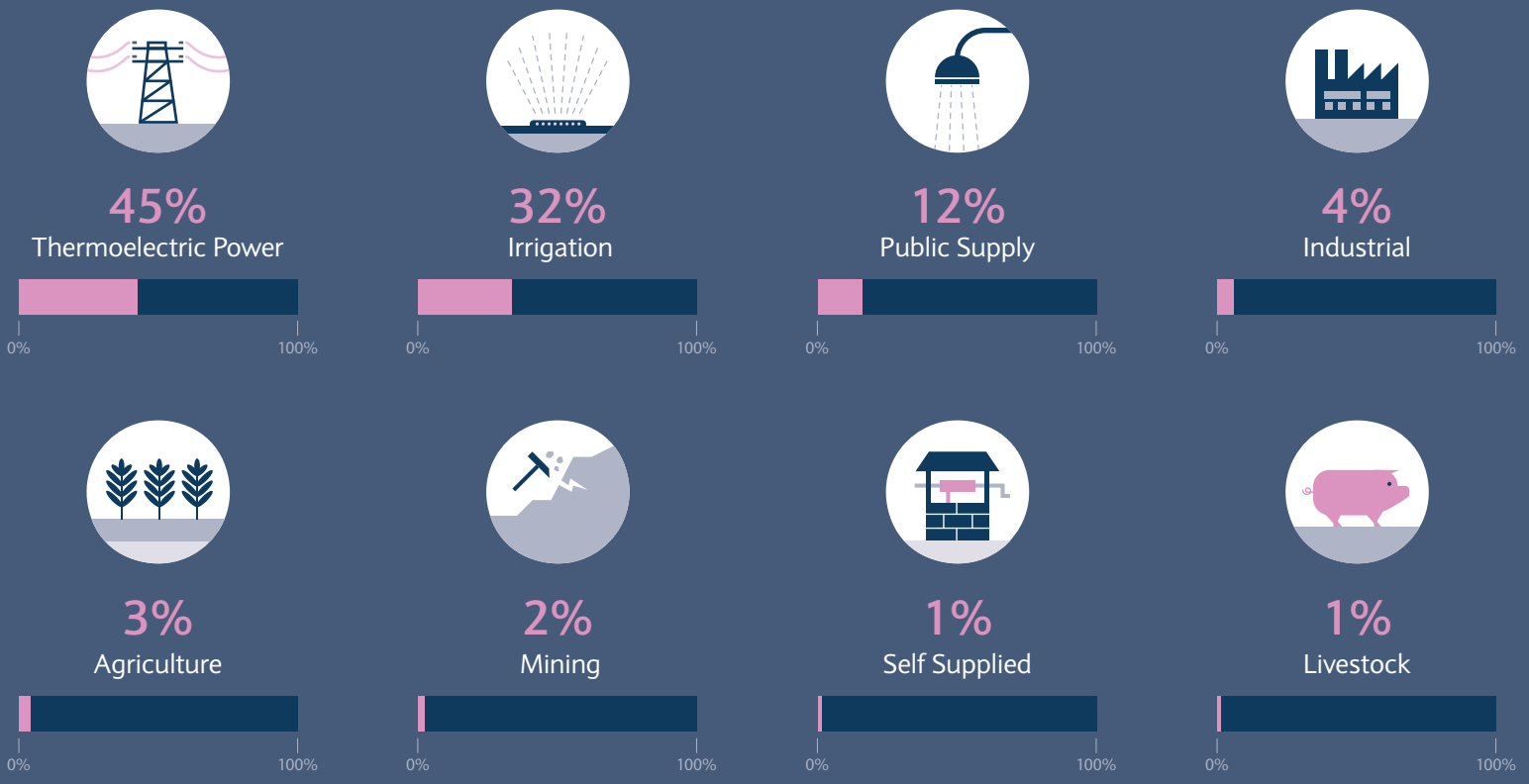
Where the water goes

Addressing water scarcity requires looking at water withdrawals and consumption by industry. There is a finite amount of water resources available for everything from quenching thirst, to growing food, to energy and power demands. How can every sector get the water it needs in the most sustainable way possible?

Water usage in the U.S.

Water withdrawals in the U.S. vary dramatically by industry. Thermoelectric power withdraws vastly more water than every other sector, followed by irrigation. This type of data is essential for leaders to formulate regulations, and for industries (particularly energy and agriculture) to find opportunities to work together and realize efficiencies.

WATER WITHDRAWALS BY INDUSTRY



Source: US Geological Survey

Mapping water stress in the U.S.

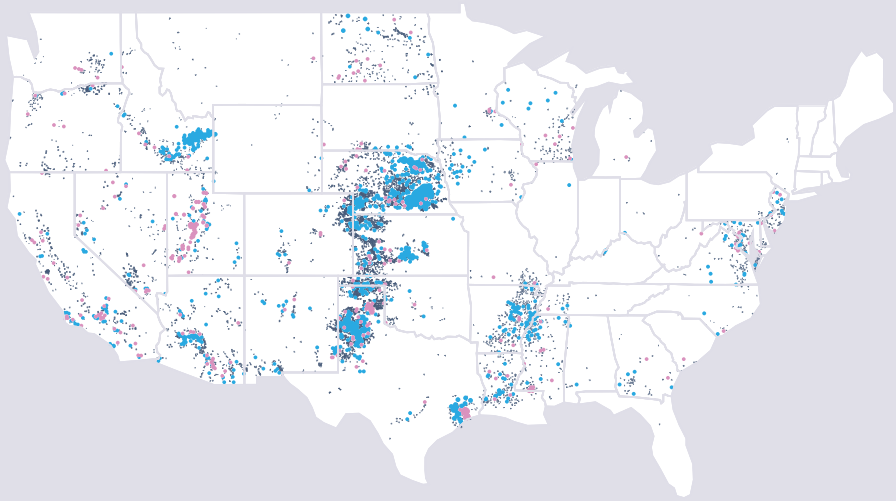
Water maps of the United States dramatize the wide variations in water supply, including the impacts of water withdrawals and climate-driven drought. Brackish water is unsuitable for human consumption without treatment, and may require additional treatment before use by some industries.

Groundwater Stress

This map illustrates the locations of wells where groundwater extraction is increasing, while replenishment is happening at a much slower rate.

Well location

- Wells where groundwater change is driven by agriculture.
- Wells where groundwater change is driven by other activities.
- Location of all other wells.



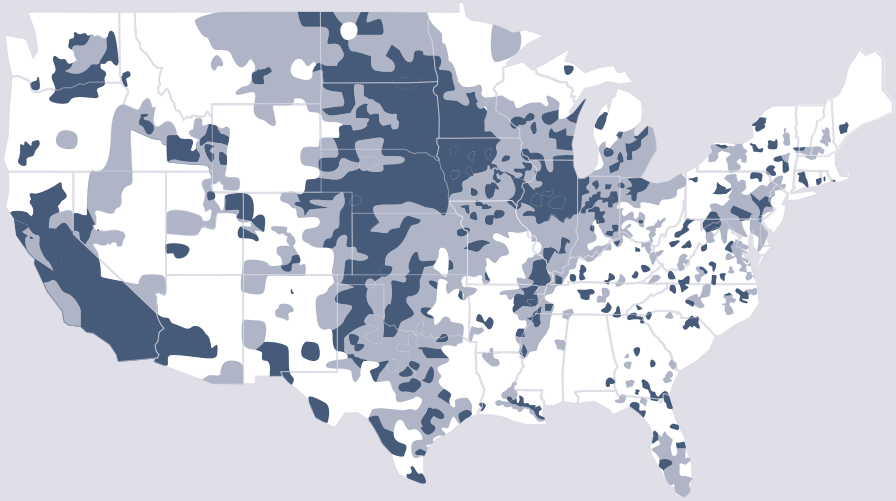
Source: Ho, M., V. Parthasarathy, E. Etienne, T. A. Russo, N. Devineni, and U. Lall (2016), America's water: Agricultural water demands and the response of groundwater, Geophys. Res. Lett., 43, 7546–7555, doi:10.1002/2016GL069797

Drought

This map illustrates water stress based on multi-year cumulative droughts from 1949-2009. Shades of blue represent water usage driven by human activity exceeding what is supplied by rainfall.

Drought risk driven by human activity

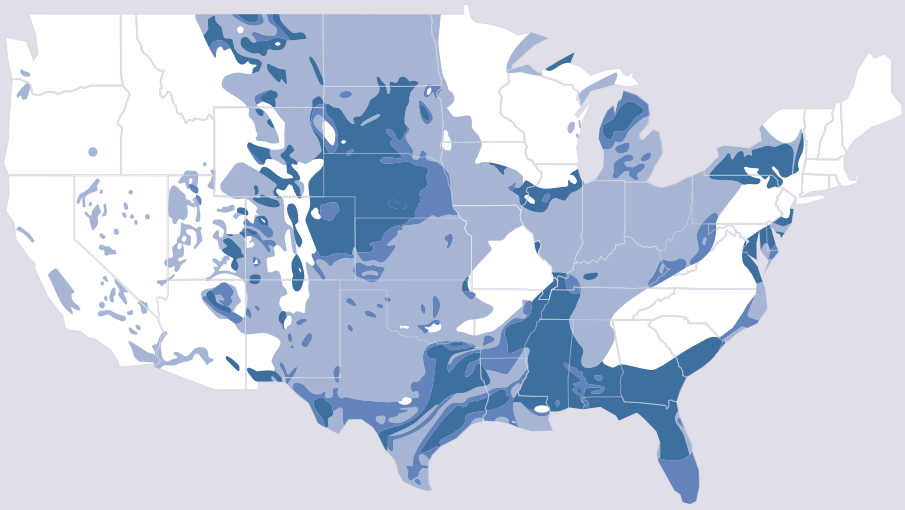
- Low
- Medium
- High



Source: Devineni, N., U. Lall, E. Etienne, D. Shi, and C. Xi (2015), America's water risk: Current demand and climate variability, Geophys. Res. Lett., 42, doi:10.1002/ 2015GL063487

Brackish Water

This map shows presence of brackish water, which has more salinity than freshwater, but less than seawater. Brackish water can be treated and used for drinking water and by many industries.



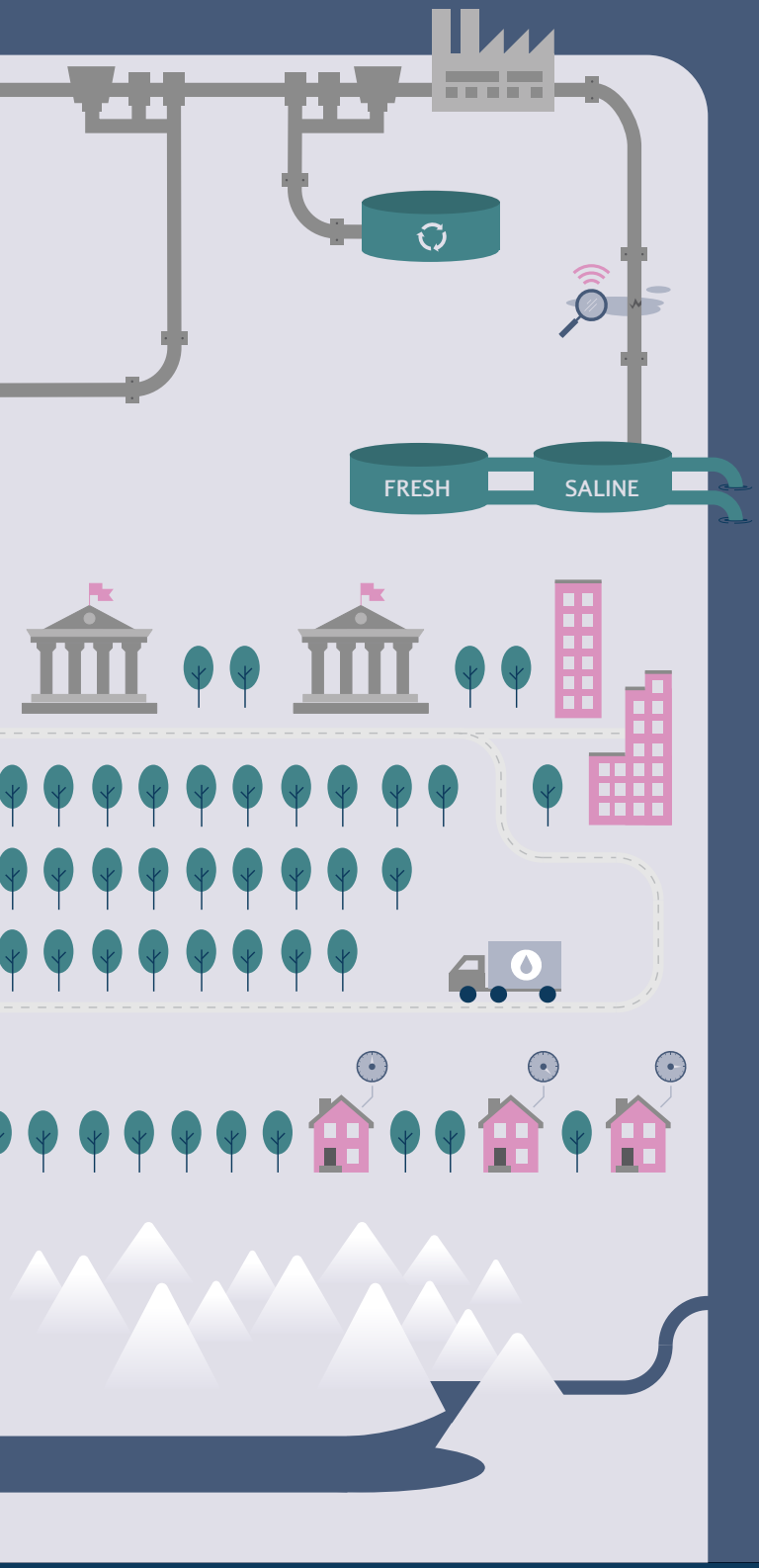
Source: USGS

Thinking about water differently

There are no easy answers to the water crisis, but there's no question that action needs to be taken now. Because water is a shared resource, companies must adapt to a new era, and work with local communities, government and industries, to safeguard water supplies, encourage efficient use of water resources, and create infrastructure to capture precipitation for future use.

Water solutions that work

Point-of-use treatment and reuse are some of the most cost-effective and promising solutions to the freshwater shortage. Infrastructure investments and improvements, in data management and technology, can promote alternative water sources and cross-industry water recycling.



Water recycling

Recycled water is used more than one time before it is returned back into the natural water cycle. It is used for purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, or replenishing a groundwater basin.

Leak detection

Acoustic monitoring is paired with smart meters to listen for leak "noise" that can help water utilities identify pipe leakage and prevent water loss.

Desalination

Widely used in the Middle East, desalination treats non-potable brackish and seawater to freshwater standards for oil and gas drilling, irrigation, industrial use, power plant cooling and drinking water.

Public/private partnership

New opportunities for collaboration have created sustainable solutions for water management. For example, farmers in Texas and California are using recycled water from oil and gas for irrigation on non-food crops.

Wastewater reuse

Reusing wastewater reduces dependence on freshwater supplies, infrastructure, and costs related to conveyance and pumping. Potable reuse treats wastewater to drinkable standards, using reverse osmosis, membrane filtration and advanced oxidation.

Smart metering

Smart meters read water usage in real time, and send it back to the utilities to evaluate consumption, identify leaks, reduce operating and maintenance costs, and improve billing accuracy.

Water security

Water is essential for human well-being and socio-economic development. Industries that integrate water security into their strategic plans, and cooperate with other water users, will be better positioned for an uncertain future.

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