

Drought-stricken communities push back against data centers

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On May 17, the City Council of Mesa, Arizona, approved the [\\$800 million development of an enormous data center](#) -- a warehouse filled with computers storing all of the photos, documents and other information we store "in the cloud" -- on an arid plot of land in the eastern part of the city.

But keeping the rows of powerful computers inside the data center from overheating will require up to 1.25 million gallons of water each day, a price that Vice Mayor Jenn Duff believes is too high." This has been the driest 12

months in 126 years," she said, citing data from the National Oceanic and Atmospheric Administration. "We are on red alert, and I think data centers are an irresponsible use of our water."

Duff was the only Mesa City Council member to vote against [the development](#). But she's one of a growing number of people nationwide raising concerns about the proliferation of data centers, [which guzzle electricity and water](#) while creating relatively few jobs, particularly in drought-stricken parts of the United States.



The system used to cool servers inside the Apple Data Center in Mesa, Ariz. Tom Tingle / The Republic / USA Today Network

The spike in use of data-intensive cloud services such as video conferencing tools, video streaming sites like Netflix and YouTube and online gaming, particularly as people quarantined during the pandemic, has increased demand for the computing power offered by data centers globally. And this means more data centers are being built every day by some of America's largest technology companies, including Amazon, Microsoft and Google and

used by millions of customers. [According to the Synergy Research Group](#), there were about 600 “hyperscale” data centers, massive operations designed and operated by a single company that then rents access to cloud services, globally by the end of 2020. That’s double the number there were in 2015. Almost 40 percent of them are in the United States, and [Amazon, Google and Microsoft account for more than half of the total](#).

The U.S. also has at least 1,800 “colocation” data centers, warehouses filled with a variety of smaller companies’ server hardware that share the same cooling system, electricity and security, according to [Data Center Map](#). They are typically smaller than hyperscale data centers but, [research has shown](#), more resource intensive as they maintain a variety of computer systems operating at different levels of efficiency.

Many data center operators are drawn to water-starved regions in the West, in part due to the availability of solar and wind energy. Researchers at Virginia Tech estimate that one-fifth of data centers draw water from moderately to highly stressed watersheds, mostly in the Western United States, according to a [paper published in April](#).

Typically, where data centers are located is based on proximity to customers and infrastructure, the cost of land, the tax incentives offered by local governments and access to low-cost electricity, the researchers said.

“I am not sure the degree to which environmental considerations are in the decision-making process,” said Landon Marston, lead author of the paper.

All centers need some form of cooling technology, typically either computer room air-conditioning systems -- essentially large units that cool air with water or refrigerant -- or evaporative cooling, which evaporates water to cool the air. Evaporative cooling uses a lot less electricity, but more water. Since water is cheaper than electricity, data centers tend to opt for the more

water-intensive approach.

The growth in the industry shows no signs of slowing. The research company Gartner predicts that spending on global data center infrastructure will reach \$200 billion this year, an increase of 6 percent from 2020, followed by 3-4 percent annually over the next three years. This growth comes at a time of record temperatures and drought in the United States, [particularly in the West](#).

A data center run by Switch in the desert east of Reno, Nev., in 2018. Jason Henry / The New York Times / Redux Pictures

“The typical data center uses about 3-5 million gallons of water per day -- the same amount of water as a city of 30,000-50,000 people,” said Venkatesh Uddameri, professor and director of the Water Resources Center at Texas Tech University.

Although these data centers have become [much more energy and water efficient over the last decade](#), and don't use as much water as other industries such as agriculture, this level of water use can still create potential competition with local communities over the water supply in areas where water is scarce, he added.

But some tech companies like Google say they are trying to address their water use.

“As part of our water stewardship efforts, we're working to utilize water more efficiently and exploring ways to incorporate circularity,” said Gary Demasi, senior director of energy and location operations at Google. “We have a site-specific approach where we work within the constraints of the local hydrological environment to find the best solutions.”

He added that “many arid environments provide an abundant supply of

carbon-free solar and wind energy," which explains why data centers are drawn to those areas.

Sergio Loureiro, vice president of core operations for Microsoft, said that the company [has pledged to be "water positive" by 2030](#), which means it plans to replenish more water than it consumes globally. This includes reducing the company's water use and investing in community replenishment and conservation projects near where it builds facilities.

Amazon did not respond to requests for comment.

[Local concerns](#)

In recent years, [tensions over water use by data centers](#) have flared in communities across the United States. In 2017, conservation groups in South Carolina [criticized Google](#) over its request for a permit to draw 1.5 millions of gallons of water per day from a depleted aquifer to cool its expanding data center in Goose Creek. The facility already required 4 million gallons of tap water each day, and residents and conservation groups were concerned about the company's [impact on the dwindling groundwater supply](#). After a two-year battle with the South Carolina Coastal Conservation league over the plans, Google reached an agreement to use only groundwater under limited conditions, for example, during maintenance work or as a backup during drier months, and instead pay for an alternative source of surface water from the Charleston Water System.

Google spokeswoman Mara Harris said that the company partnered with local community stakeholders and water conservation experts to assess the data center's impact and conducted studies that showed that even in an "extreme worst-case scenario" the data center's water use in the area would be sustainable.

Both companies and consumers need to start treating water conservation as seriously as reducing carbon emissions, experts say.

"We are going to experience a drier and more water-scarce future, and every drop of water counts," said Newsha Ajami, director of urban water policy at Stanford's Woods Institute for the Environment. "It's not just Amazon, Microsoft and Google causing these water footprints. But it's you and me, searching and needing data that ends up in these data centers."

Ajami said that water has been historically undervalued as a resource in part because it has been cheap for companies to purchase. While many industries have taken great leaps in reducing their electricity use and carbon footprints, they lag behind in water efficiency throughout their supply chains, she said.

"We often overlook the communities impacted, who are often disadvantaged," she added. "If it was a wealthy community, maybe they wouldn't allow the data centers to be built in their backyard."

Jobs versus water

Water conservation experts say that a key challenge has been the lack of alignment between cities' economic development plans and their resource conservation efforts. Often the promise of attracting a household-name technology company to build a billion-dollar data center that will bring jobs and investment to the region will override concerns over the water supply.

Servers at the Apple Data Center in Mesa, Ariz. Tom Tingle / The Republic / USA Today Network

"Cities don't want to tell tech companies that they can't come to their city because of lack of water," said Cora Kammeyer, a senior researcher with the Pacific Institute, a nonprofit research organization that focuses on water

conservation.

Duff, the Mesa vice mayor, agrees.

“When it comes to economic development, I don’t think we are fully transparent about the water concerns,” she said. “We want to keep the image that we are a great place to invest and start a business. But we don’t like to talk about the water.” The Mesa project approved on May 17, which was submitted under the name of a developer called Redale LLC, has been shrouded in secrecy. The name of the company that will run the data center has only been supplied to the city under a nondisclosure agreement, although one Mesa city source, who was not authorized to speak publicly about the deal and spoke on the condition of anonymity, said it was Facebook. The specialist news site [Data Center Dynamics also reported that it was likely to be Facebook](#) based on similarities in the planning specifications to its other data centers. Facebook declined to comment, and Redale did not respond to a request for comment. The proposed data center will employ an estimated 150 people across three buildings and pay the city millions of dollars in sales tax on the construction and utilities.

Duff added that even though data centers don’t use as much water as other industries, they are “still depleting water in the desert, and that is a concern.”

She noted that this is the “eighth or ninth” data center project in Mesa. The city previously approved a Google facility, currently under construction, that will consume up to 4 million gallons of water per day, [as reported by Bloomberg](#). The Redale project represents a significant milestone to Mesa’s water supply as it’s the first where the city required the developer to obtain water credits from the Salt River Project to use groundwater in the event that the city can’t meet the data center’s demand for water.

“It’s the only way we could say we had enough water for the business,” Duff

said.

Surface water supplies that Arizona uses from Lake Mead, America's largest reservoir, and the Colorado River that feeds it, have already [dwindled to their lowest levels](#) ever, according to the Bureau of Reclamation, a federal water management agency. The water level is so low that federal restrictions are likely to be triggered on Arizona's water allocation from the reservoir, which could happen at the start of 2022. [Six other states in the West could also face such restrictions.](#)

As that happens, Duff said, more companies will start to draw on their "water credits" to use groundwater supplies. However, [according to research by Arizona State University](#), these water credits are over allocated, meaning that if everybody started using them at the same time, there wouldn't be enough water to go around.

"We are very resourceful, but I think we need to wake up," Duff said. "The analysis shows our safeguards aren't there and we need to come up with a concrete plan instead of a hope and a prayer."

[Pushing back](#)

To the south of Mesa, the city of Chandler, Arizona, has taken a different approach. In 2015 the city passed an ordinance that restricted new water-intensive businesses from developing unless they aligned with the city's plan for economic development. It effectively deters businesses that use a lot of water but don't create many jobs, including data centers, in favor of those that create thousands of jobs, [such as semiconductor plants](#).

The city's water resource manager, Gregg Capps, said the ordinance, the first of its kind in the U.S., was introduced as a direct result of discovering in 2013 how much water one of the data centers in the city was using after the

company started requesting additional water connections. "We didn't know a whole lot about them back then, but that brought our attention to their water use," he said.

His team took their concerns to the City Council, which spent months developing the ordinance. Since it was adopted in 2015, there have been no new data center developments in Chandler.

"Water is a strategic resource. It's important to us," Capps said.

Cool innovations

The Silicon Valley technology companies that dominate the hyperscale data center market -- Amazon, Google and Microsoft -- are conscious of the business and reputational risk associated with data centers' thirst. All of them have made some progress in reducing their data centers' water footprint through innovative cooling strategies. These include free-air cooling, which uses fresh outdoor air to cool a space, and immersion cooling, where servers are submerged in a liquid that boils at a lower temperature than water, taking the heat with it. However, free-air cooling only really works in cooler climates, and immersion was just used [for the first time in a commercial setting by Microsoft in April](#).

Some companies, [including Microsoft](#) have developed underwater or partially submerged data centers that rely on large bodies of already cool water to disperse heat.

Google's Demasi said that the company cooled its data centers using seawater in Finland, industrial canal water in Belgium and recycled wastewater in the United States, at its site in Douglas County, Georgia.

The Google data center in Hamina, Finland during its official opening in 2011. Jarno Mela / Lehtikuva / AFP via Getty Images

Switching over to new technologies can be extremely costly, and data center operators are more likely to wait until the end of the lifecycle of the existing equipment than retrofit cooling systems, said Todd Boucher, founder of the data center design firm Leading Edge Design Group.

[Future generations](#)

In Mesa, Duff is thinking about the legacy of the decisions her city, and others, are making about water now. "I am 61 years old, and I know that in whatever lifetime I have left I will not see the total impact of what we are doing today," she said. "But our children and their children will, and we have to take responsibility for that." "I hope the next generation does not look back at ours and say, 'What were you thinking?'" she said. "I'd like to think we saw the warnings and started taking aggressive measures in order to preserve our planet and our lives."

April Glaser contributed.