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Can salty, dirty water cool data centers?

Some data centers are already considering using desalination to get fresh water for cooling, according to new research.

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Data centers need water. And water byproducts from oil and gas and other industries need to go somewhere.

These two dynamics could be a match made in resource-sharing heaven, according to new research. Researchers from The University of Texas at Austin found that desalination technology—a process for separating salt from water—is a strong candidate to treat salty or contaminated water to help data centers' cooling needs, reducing pressure on local water supplies. They examined how several data centers could do this and looked at how treatment choice influences cost and environmental impact.

"We're not waiting for a futuristic technology to come along and solve this problem for us," said Vaibhav Bahadur, a professor in the Cockrell School of Engineering's Walker Department of Mechanical Engineering and one of the leaders of the research published recently in *Water Research*. "We can solve parts of this problem with the technology we already have; there's just a cost to it."

There are two main ways to separate salt from water: membranes (reverse osmosis) or heat. Membranes are more energy-efficient but struggle with water saltier than seawater. Using heat to turn water into vapor and then condense it back into freshwater works well for very salty water. But, it uses much more energy and is hampered by scaling of equipment.

Even the most energy-intensive water treatment uses a small fraction of a data center's total energy footprint, the researchers say. Data centers can become more efficient in their water usage, reducing stress on local water resources without drastically increasing costs or overall energy demand.

A logical partner for supplying produced water for data centers in Texas is already right here, the researchers say: the oil and gas industry.

"The Permian (Basin) puts out 1,200 Olympic-sized swimming pools per day, and right now this water is transported over long distances and injected underground. This is problematic in many ways including the risk of seismic activity" Bahadur said. "We're also running out of space to bury that water, by as early as 2030. We need to find a way to use it, and cleaning it up for data centers is a great way to do that."

The new research comes amid scrutiny of data center environmental impacts. In September, Texas Gov. Greg Abbott ordered a pause on new data center permits to further evaluate their impacts on local communities. Most recently, the Texas Attorney General's office announced a probe into water use of

existing data centers.

To quantify local water stress from data centers, the researchers developed a new metric called Saline Water Utilization Intensity (SWUI). This metric helps show how different desalination strategies affect the environment.

Of three data center scenarios studied in the paper, a project in Longview, TX achieved the lowest stress levels on local water sources, per the SWUI metric. It would use brackish groundwater and clean it using two-stage reverse osmosis, achieving high levels of freshwater recovery at low cost and relatively low energy use.

This is part of a larger effort from Bahadur and his colleagues at the UT Jackson School of Geosciences Bureau of Economic Geology's COMPASS consortium to educate all stakeholders in the data center debate: the general public, elected officials and data center companies. They're developing software to analyze individual projects, similar to the way the researchers did with desalination efforts, to give officials more insight into the impacts of data centers as they make important permitting decisions.

Bahadur and his COMPASS colleague Ning Lin recently testified before the Texas Senate's Committee on Water, Agriculture, and Rural Affairs to share their research on the water aspects of data centers.

"As they're making important decisions about data centers, local officials often have no objective analysis of water, power usage and other important factors," said Lin, the Bureau of Economic Geology's chief economist. "We hope to give decision-makers the tools they need to protect and benefit their communities."

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