

How to build greener data centers: Scientists say crank up the heat

October 18 2023



Researchers found that setting data centers at 41°C (105.8°F) can save up to 56% in cooling costs worldwide by relying on free-cooling, which uses ambient

air to cool the water in air conditioning systems. Credit: Yingbo Zhang and Shengwei Wang

Colder is not always better for energy-hungry data centers, especially when it comes to their power bills. A new analysis says that keeping the centers at 41°C, or around 106°F, could save up to 56% in cooling costs worldwide. The study, published October 10 in the journal *Cell Reports Physical Science*, proposes new temperature guidelines that may help develop and manage more efficient data centers and IT servers in the future.

"The [cooling system](#) accounts for over one-third of the data center's total [energy consumption](#), so many studies talk about reducing the energy consumption of cooling systems," says senior author Shengwei Wang of the Hong Kong Polytechnic University. "But rather than finding better ways to cool the data centers, why not redesign the servers to operate at higher temperatures?"

Data centers typically operate at temperatures between 20–25°C (68–77°F) today. The conventional cooling systems that maintain these centers work by pulling computer-generated hot air past water-chilled coils to cool down the air before it cycles back to the space. The heated water then enters either chillers or a process called free-cooling before circulating back to the coils. Unlike energy-intensive chillers that operate similarly to [air conditioners](#), free-cooling uses ambient air to cool the water with much less energy use.

To save energy, data centers are often built in colder areas to leverage free-cooling. But thanks to advances in electronic technology, engineers and scientists know that it's no longer necessary to blast the chiller-based air conditioning at data centers. Many IT servers already allow a higher

temperature operation above 30°C (86°F). This means that in most climates, including those that are hotter, data centers can also benefit from free-cooling by raising the temperature of data centers.

"The question is, to what temperature?" says Wang. To find out, Wang and his team built a model based on the conventional cooling system and simulated the system's operation under different climate conditions. The results showed that data centers in almost all regions across climate zones could rely nearly 100% on free-cooling throughout the year when operated at 41°C, which they coined "global free-cooling temperature." These data centers could save 13%–56% of energy compared to those that run at 22°C (71.6°F).

Depending on an area's temperature and humidity, the researchers say that [data centers](#) might not even need to raise the temperature that far to take full advantage of free-cooling. For example, the temperatures for Beijing, Kunming, and Hong Kong to entirely rely on free-cooling are 39°C (102.2°F), 38°C (100.4°F), and 40°C (104°F), respectively.

"But before we raise the [temperature](#) settings, we need to ensure three things," says Wang. "First, we need to ensure the reliability of server operation. Second, the computational efficiency needs to remain the same. Third, we need to ensure the servers' [energy](#) consumption is not increased by activating their built-in cooling protection, such as the fans." That said, Wang is optimistic that it is possible for the next generation of servers to work at up to 40°C without performance degradation.

"For the first time we can provide [cooling](#) system engineers and server design engineers a concrete goal to work towards," says Wang. "I think 41°C is achievable in the near future. We're only 10°C (18°F) or less away."

More information: The global energy impact of raising the space temperature for high-temperature data centres, *Cell Reports Physical Science* (2023). [DOI: 10.1016/j.xcrp.2023.101624](https://doi.org/10.1016/j.xcrp.2023.101624). [www.cell.com/cell-reports-phys ...](https://www.cell.com/cell-reports-phys...) [2666-3864\(23\)00444-7](https://www.cell.com/cell-reports-phys...)

Provided by Cell Press

Citation: How to build greener data centers: Scientists say crank up the heat (2023, October 18) retrieved 29 April 2024 from <https://techxplore.com/news/2023-10-greener-centers-scientists-crank.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.