

A single Bitcoin transaction could use as much water as a backyard swimming pool

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Credit: CC0 Public Domain

Cryptocurrency mining uses a significant amount of water amid the

global water crisis, and its water demand may grow further. In a commentary [published](#) November 29 in the journal *Cell Reports Sustainability*, financial economist Alex de Vries provides the first comprehensive estimate of Bitcoin's water use. He warns that its sheer scale could impact drinking water if it continues to operate without constraints, especially in countries that are already battling water scarcity, including the U.S.

"Many parts of the world are experiencing droughts, and freshwater is becoming an [increasingly] scarce resource," says de Vries, a Ph.D. student at Vrije Universiteit Amsterdam. "If we continue to use this valuable resource for making useless computations, I think that reality is really painful."

Previous research on crypto's resource use has primarily focused on [electricity consumption](#). When mining Bitcoins, the most popular cryptocurrency, miners around the world are essentially racing to solve mathematical equations on the internet, and the winners get a share of Bitcoin's value. In the Bitcoin network, miners make about 350 quintillion—that is, 350 followed by 18 zeros—guesses every second of the day, an activity that consumes a tremendous amount of computing power.

"The right answer emerges every 10 minutes, and the rest of the data, quintillions of them, are computations that serve no further purpose and are therefore immediately discarded," de Vries says.

During the same process, a large amount of water is used to cool the computers at large data centers. Based on data from previous research, de Vries calculates that Bitcoin mining consumes about 8.6 to 35.1 ggaliters (GL) of water per year in the U.S.

In addition to cooling computers, coal- and gas-fired power plants that

provide electricity to run the computers also use water to lower the temperature. This cooling water is evaporated and not available to be reused. Water evaporated from hydropower plants also adds to the water footprint of Bitcoin's power demand.

In total, de Vries estimates that in 2021, Bitcoin mining consumed over 1,600 GL of water worldwide. Each transaction on the Bitcoin blockchain uses 16,000 liters of water on average, about 6.2 million times more than a credit card swipe, or enough to fill a backyard swimming pool. Bitcoin's water consumption is expected to increase to 2,300 GL in 2023, de Vries says,

In the U.S., Bitcoin mining consumes about 93 GL to 120 GL of water every year, equivalent to the average water consumption of 300,000 U.S. households or a city like Washington, D.C.

"The price of Bitcoin just increased recently and reached its highest point of the year, despite the recent collapse of several cryptocurrency platforms. This will have serious consequences, because the higher the price, the higher the [environmental impact](#)," de Vries says.

"The most painful thing about cryptocurrency mining is that it uses so much computational power and so much resources, but these resources are not going into creating some kind of model, like artificial intelligence, that you can then use for something else. It's just making useless computations."

At a value of more than \$37,000 per coin, Bitcoin continues to expand across the world. In countries in Central Asia, where the dry climate is already putting pressure on freshwater supply, increased Bitcoin mining activities will worsen the problem. In Kazakhstan, a global cryptocurrency mining hub, Bitcoin transactions consumed 997.9 GL of water in 2021. The Central Asia country is already grappling with a

water crisis, and Bitcoin mining's growing water footprint could exacerbate the shortage.

De Vries suggests that approaches such as modifying Bitcoin mining's software could cut down on the power and water needed for this process. Incorporating [renewable energy sources](#) that don't involve water, including wind and solar, can also reduce water consumption.

"But do you really want to spend wind and solar power for crypto? In many countries including the U.S., the amount of renewable energy is limited. Sure you can move some of these renewable energy sources to crypto, but that means something else will be powered with fossil fuels. I'm not sure how much you gain," he says.

More information: Bitcoin's Growing Water Footprint, *Cell Reports Sustainability* (2023). [DOI: 10.1016/j.crsus.2023.100004](https://doi.org/10.1016/j.crsus.2023.100004).
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