

SUSTAINABILITY

Bitcoin has an electronic-waste problem

A global race for the cryptocurrency is consuming vast amounts of energy and materials

The surging popularity of bitcoin comes at a huge environmental cost. According to the latest analysis of its sustainability, the electronic currency uses as much energy as a medium-sized country and could generate thousands of metric tons of electronic waste per year (*Joule* 2019, DOI: 10.1016/j.joule.2019.02.007).

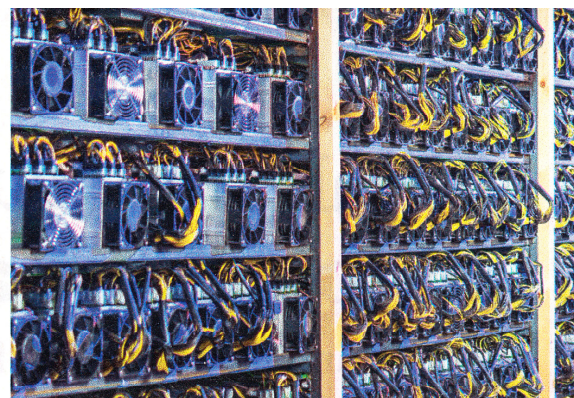
Users “mine” new bitcoins with customized computer chips that solve cryptography problems and record their ownership of this cryptocurrency in a shared database called a blockchain. As more bitcoins enter circulation—there are currently about 17.5 million of them—it gets progressively harder to mine new coins, requiring more computing power and, therefore, more energy.

Alex de Vries, a blockchain specialist at the accountancy firm PricewaterhouseCoopers

in Amsterdam, has calculated that bitcoin mining in 2018 used 40–62 TW•h of energy and had a carbon footprint of 19 million–30 million metric tons (t) of CO₂ emissions. Bitcoin already accounts for at least 20% of the energy consumption of the world’s data centers, de Vries says.

The analysis also provides the first picture of bitcoin’s electronic-waste generation. In 2013, currency miners switched to application-specific integrated circuits (ASICs) that can only perform mining algorithms. This triggered a computational arms race, in which only the most powerful ASICs can win the competition for new bitcoins. When newer versions of the circuits are released—once every 18 months or so—existing units are rendered obsolete and trashed.

Replacing the current generation of



Mining bitcoins uses enormous amounts of electricity and creates thousands of metric tons of electronic waste.

ASICs with the latest version, released in December, will generate at least 11,000 t of electronic waste. “It’s enormous, no question,” agrees Ruediger Kuehr, director of the Sustainable Cycles Programme at United Nations University, who was not involved in the study. “But it’s nothing in comparison to the global magnitude of e-waste.”

Miners could easily reduce the currency’s environmental footprint by adopting a more energy-efficient approach already used by other cryptocurrencies. But de Vries says the bitcoin mining community is resistant to such moves. Meanwhile, the bitcoin system was designed to withstand any government interference.—MARK PELOW, special to C&EN