

Bitcoin's high energy consumption is a concern – but it may be a price worth paying

November 7 2018, by Steven Huckle



Credit: AI-generated image ([disclaimer](#))

Bitcoin recently turned 10 years old. In that time, it has proved revolutionary because it ignores the need for modern money's institutions to verify payments. Instead, Bitcoin relies on cryptographic techniques to prove identity and authenticity.

However, the price to pay for all of this innovation is a high carbon footprint, created by [Bitcoin mining](#).

Fundamental to that mining process is a peer-to-peer network of computers, referred to as validators, who perform [Proof of Work](#). In essence, this involves computers solving computationally-intensive cryptographic puzzles that prove blocks of transactions, which are recorded in a public asset ledger, known as a blockchain. This ledger is publicly viewable by all computers, which helps the system achieve consensus in an unreliable network of participants.

Validators are called miners because the computer, or node, that successfully validates one of those blocks is rewarded with "mined" Bitcoin. Thus mining is also the process by which Bitcoin adds new coins to the network.

But these processes consume a vast amount of power.

In my 2016 article, [Socialism and the Blockchain](#), I estimated Bitcoin mining's annual [energy](#) use at 3.38 TeraWatt hours (TWh), which I equated to the total 2014 annual consumption of Jamaica. [Recent estimates](#) show the currency's annual consumption rising exponentially, currently reaching an incredible 55TWh. Indeed, a new paper in [Nature Sustainability](#) suggests that the energy costs of mining cryptocurrencies exceed the costs of mining physical metals. Furthermore, the paper estimates that Bitcoin emitted between 3m and 13m metric tonnes CO₂ in the first half of 2018. [A team in Hawaii](#) even suppose that, if Bitcoin's adoption continues to rise, within a couple of decades, such emissions could help push global warming above 2°C.

However, both the study in *Nature* and the team in Hawaii make assumptions about the means of energy generation. In the light of the recent disturbing [UN 1.5°C Report](#), humanity would be wise to act on

the recommendation for an "unprecedented shift in energy systems". The hope is that such a shift towards large-scale renewable energy does occur, thus invalidating the assumptions made in those papers.

Nevertheless, concerns over Bitcoin's energy consumption remain, so [Ethereum](#), another cryptocurrency, is investigating a more energy efficient consensus algorithm known as [Proof of Stake](#). This method differs from Proof of Work because miners on this network use their economic stake to prove transactions and therefore, they are not performing energy intensive calculations.



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That introduces some complications – not least, how to ensure that people in this network act honestly, as they would have nothing to lose

by behaving dishonestly? Ethereum's proposed solution is to introduce penalties through measures such as penalising miners for simultaneously producing blocks on two versions of the blockchain. After all, only one of those blockchains is valid.

Bitcoin's Proof of Work overcomes such problems implicitly because it includes natural penalties since miners have to expend energy to prove transactions.

In economic game theory, a [Nash Equilibrium](#) is said to be reached when a system stabilises because no one gains by changing strategy from that which produces the stable state. Since Bitcoin rewards are given to miners only if their blocks help form the valid Bitcoin blockchain, the most profitable outcome, or the Nash Equilibrium, is for each miner to act in consensus with the majority.

As a result, Bitcoin's Proof of Work algorithm has proven effective, despite the excessive energy consumption.

A price worth paying?

In essence, my work looks at whether blockchains are a rebuttal to the hierarchies of capitalism. If Bitcoin promotes a way of organising that [does not rely on capitalist consumption](#), might that indirectly drive down society's energy use and help lessen its environmental impact? After all, consider the recent [alarming WWF report](#), which all but blamed capitalism for the dramatic decline in wildlife populations. We need alternatives.

Perhaps, then, Bitcoin's revolutionary offer, as an alternative to capitalism, means its energy use is a price worth paying? That argument holds some weight if it drives down consumption in other areas of society because Bitcoin mining is not the primary driver behind climate

change. However, even then, given the urgency of environmental degradation, if we continue to produce energy in a manner that creates so much warming CO₂, that argument may provide scant consolation.

Perhaps alternative consensus schemes, such as Ethereum's Proof of Stake, provide part of the solution. However, Bitcoin or not, if humankind is to avoid climate catastrophe, we need to take urgent action and find solutions that produce clean, sustainable energy. If we do that, humanity will benefit, and as a by-product, so will Bitcoin.

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