

IS YOUR BITCOIN AFFECTING THE PLANET?

THE CARBON CONVERSATION AROUND CRYPTOCURRENCY

ESTIMATED READ TIME: 8 MINUTES





KEY TAKEAWAYS

Cryptocurrency is a decentralised digital alternative to fiat currency which offers economic independence and security to its users

Crypto-mining consumes more energy than some countries, generates kilotonnes of e-waste and accounts for approximately 0.3% of global annual greenhouse gas (GHG) emissions

Efforts are however being made to integrate clean energy into crypto ecosystems and mine using less energy

AT FIRST GLANCE, CRYPTOCURRENCIES - DIGITAL ALTERNATIVES TO PHYSICAL MONEY - APPEAR TO ESCHEW THE COSTS ASSOCIATED WITH TRADITIONAL FIAT CURRENCIES.



As intangible products, cryptocurrencies require no ores or agricultural inputs, no brick-and-mortar storage facilities or transportation networks. However, as it turns out, there is a high price attached to the production of cryptocurrencies, due to the hardware requirements and energy intensity of the creative process known as ‘mining’. The environmental impact in particular has made some governments, including Trinidad and Tobago’s, wary of permitting crypto-mining facilities.¹

So, what exactly is prompting concern?

DECODING CRYPTOCURRENCY

Before we can appreciate the problem, we must understand the product. Cryptocurrencies and crypto-assets are digital alternatives to government-issued currency that rely on a decentralised community of users to record and verify transactions and generate new units of currency.

Cryptocurrencies enable users to send and receive money without the intermediation of a bank.

When someone issues a payment to another person, the transaction goes into a public ledger or digital record book known as the blockchain, which is held in common across the computers of all the currency’s users. Before a transaction can be completed, however, the entire community (or more precisely their computers) must verify that the criteria for the transaction are met (eg. does the sender have the cryptocurrency he or she is attempting to send). Once there is consensus around the legitimacy of the transaction, the transfer is accepted and recorded in a new ‘block’ on the blockchain.

It is here that the concept of ‘mining’ comes in. Cryptocurrencies are essentially created by programmers using complex coding, and there are

¹<https://www.guardian.co.tt/news/manning-govt-not-supporting-bitcoin-mining-in-tt-6.2.1506442.9c3f27edd2>

²<https://news.climate.columbia.edu/2022/05/04/cryptocurrency-energy/>

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“...powerful computers are tasked with the problem-solving process (and ultimately mining new coins). These computers **work long hours** and **guzzle electricity**.”

almost 19,000 of them in circulation (although a handful dominate the market).²

It may help to visualise them as virtual vaults containing a fixed number of units of currency (coins) when they are created. In the case of the most famous currency, Bitcoin, its creator built the Bitcoin vault to hold 21 million coins.³ To release coins from the vault into circulation, users need to ‘mine’ them.

As mentioned above, building the record of transactions called the blockchain requires users to participate in the verification process. To incentivise their participation, many cryptocurrency systems such as Bitcoin are designed so that the user who first verifies a transaction (or group of transactions received around the same time) is rewarded with new coins. These coins are said to be ‘mined’ because work is required to release them. This reward gives users a hefty incentive to

participate in blockchain building. However, only one user can add a block to the chain (verify and record a transaction) at a given time, which leads to competition within the community of users.

To determine which user earns the right to add a block and get the reward, there is a turnstile built into many cryptocurrency systems called ‘Proof of Work’ (PoW).

Participants are given a complex mathematical problem to solve, and the first to do so gets to add the next block and earn new coins.

The complexity of these problems can necessitate trillions of solution attempts. For this reason, powerful computers are tasked with the problem-solving process (and ultimately mining new coins). These computers work long hours and guzzle electricity. As more and

more crypto-miners enter the fray with their mining machinery, the energy appetite of the crypto-mining industry is increasing.

THE ENERGY IMPACT

In the early days of crypto mining, when the user pool was small, new coins could be mined using personal computers and seconds’ worth of grid electricity.⁴ However, PoW systems are designed to make mining more difficult as the number of miners increases. Today, with an estimated 1 million miners operating around the world, it takes considerably more power and equipment to mine coins.⁵

For Bitcoin mining in particular, not only is expensive and specialised machinery required, but it can take nine years’ worth of a household’s electricity consumption to mine one coin.⁶

³<https://bitcoin.org/en/bitcoin-paper>

⁴<https://www.nytimes.com/interactive/2021/09/03/climate/bitcoin-carbon-footprint-electricity.html>

⁵<https://capitalcounselor.com/how-many-bitcoins-are-there/#:~:text=Overview%20of%20the%20Key%20Bitcoin%20Stats%20and%20Facts&text=There%20are%20approximately%201%2C000%2C000%20Bitcoin,18.74%20million%20bitcoins%20in%20circulation.>

⁶<https://www.nytimes.com/interactive/2021/09/03/climate/bitcoin-carbon-footprint-electricity.html>



This includes the cost of powering the mining machines and cooling them to prevent overheating.

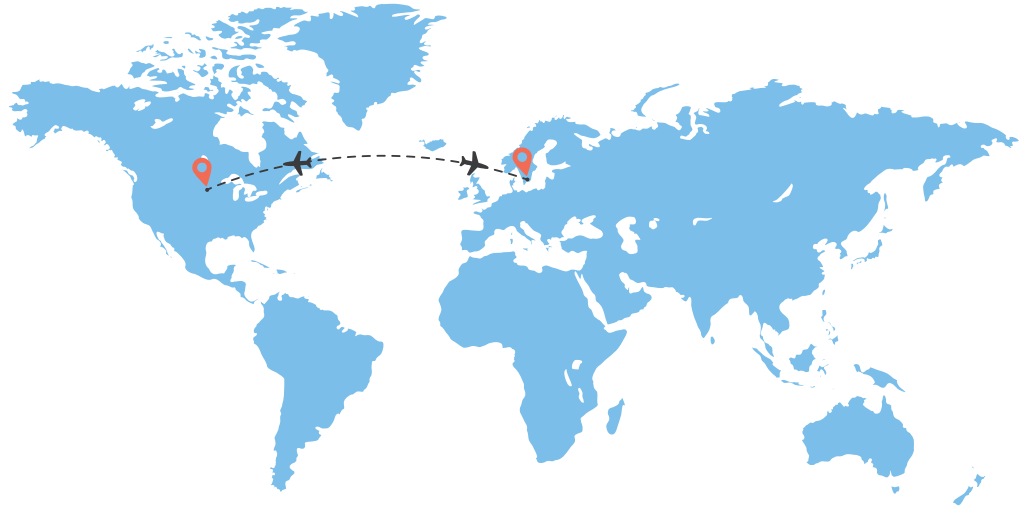
The exponential increase in energy demand has raised alarms in some corners. A 2022 White House report cited estimates that the annual global electricity usage for crypto-assets hovers between 120 and 240 billion kilowatt-hours – a range that surpasses the annual electricity consumption of such countries as Argentina and Australia.⁷

*It is worth noting that just two currencies account for the lion's share of that power consumption – As at August 2022, Bitcoin was estimated to account for **60% to 77%**, and Ethereum, **20% to 39%**.*⁸

Since crypto-mining is a decentralised process, distributed around the world, the impact of that energy consumption in terms of emissions varies from country to country, based on the fuel powering the grid. Prior to 2021, China was the leading country for mining operations because of its cheap power and unused capacity at rural hydroelectric dams and wind farms.⁹ However, state crackdowns on crypto-mining forced operations to migrate, and today, the USA is home to more than a third of the world's mining capacity.¹⁰

ANOTHER SOURCE FRAMED THE IMPACT OF BITCOIN MINING ALONE AS THE EQUIVALENT OF

1 million transatlantic flights.



Despite claims that much of the energy powering mining operations comes from renewable sources, several dying or defunct coal and natural gas plants have been resurrected across the US alone to service crypto-mining.¹¹ In one example, a coal plant in Montana was converted to supply a mining company, and year-on-year CO₂ emissions from the plant rose by more than 5,000%.¹² Another revived coal plant in New York – Greenidge Generation – was converted to use natural gas, but emissions still increased tenfold between 2019 and 2020.¹³

Estimates of the volume of carbon emissions contributed by crypto-mining vary due to the difficulty of geolocating mining operations, some of which are ‘underground’ to circumvent state regulations.

*The White House has suggested the number sits around 140 ± 30 million metric tonnes of carbon dioxide per year, or about **0.3%** of global annual GHG emissions.*¹⁴

Another source framed the impact of Bitcoin mining alone as the equivalent of 1 million transatlantic flights.¹⁵

As the value of certain currencies increase and more people are enticed to participate in mining, there are concerns that operations will increasingly favour destinations with cheaper electricity, which often rely on fossil fuels such as coal.

⁷<https://www.whitehouse.gov/wp-content/uploads/2022/09/09-2022-Crypto-Assets-and-Climate-Report.pdf>

⁸Ibid

⁹<https://www.npr.org/2022/02/24/1081252187/bitcoin-cryptocurrency-china-us>

¹⁰<https://www.statista.com/statistics/1200477/bitcoin-mining-by-country/>

¹¹<https://www.theguardian.com/technology/2022/feb/18/bitcoin-miners-activate-fossil-fuel-plant-co2-emissions-soared>

¹²Ibid

¹³<https://news.climate.columbia.edu/2021/09/20/bitcoins-impacts-on-climate-and-the-environment/>

¹⁴<https://www.whitehouse.gov/wp-content/uploads/2022/09/09-2022-Crypto-Assets-and-Climate-Report.pdf>

¹⁵<https://www.sunbirdcim.com/infographic/largest-bitcoin-mining-farms-world>

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There is also the growing problem of e-waste. Mining machines are highly specialised and cannot be re-purposed once obsolete. The rate of innovation in this sector means miners must replace their machines almost every year to remain competitive, which leads to significant waste. It is estimated that the Bitcoin network generates 11.5 kilotonnes of e-waste each year.¹⁶

THE OTHER SIDE OF THE COIN

Apologists argue that cryptocurrency's environmental impact is often decontextualised from its bigger picture importance in the global financial system.

One commentator pointed to the emissions footprint of household appliances, air conditioners and even data centres that support platforms like Netflix and Playstation, saying each of these consumes more power than Bitcoin.¹⁷ The reason these are not spotlighted in the same way is because they are 'accepted' as adding value to society, while the utility of cryptocurrencies is not fully understood or appreciated.

The reality, however, is that digital currencies help millions of people in countries with oppressive or unstable political systems to address their lack of economic freedom.¹⁸

IT IS ESTIMATED THAT THE BITCOIN NETWORK GENERATES

11.5 kilotonnes of e-waste

EACH YEAR



In this way, the emissions footprint of mining is as justifiable as the much larger footprint of other utilities, appliances and even entertainment services.

Another line of defense is that crypto-mining uses a significant amount of clean energy (estimates vary between 40-60%¹⁹). Some mining facilities in the US are built close to renewable energy facilities and help soak up excess supply or rely on microgrids,²⁰ while others commit to purchasing carbon offsets and investing in clean energy projects.²¹ Since the demand for energy to power mining is on the rise while the cost of renewables is falling, some project that mining can in fact incentivise the integration of cleaner energy into the mix. A few

crypto-asset companies are even exploring how stranded or vented methane from US oil and gas fields and landfills can be harnessed to power their operations.²²

Attention is also being paid to the emissions problem on the software side.

Some cryptocurrencies use a validation system called 'Proof of Stake' (PoS) instead of PoW. This requires up to 99% less energy, and crypto-giant Ethereum has already converted to this system.²³

If widely adopted, PoS and other less energy-intensive consensus mechanisms can considerably reduce the carbon impact of cryptocurrencies.

THE BOTTOM LINE

There is no doubt that cryptocurrencies and other digital assets have a role to play in our financial future. That said, as the world works feverishly to address carbon emissions, the rate of acceptance and adoption of these currencies will likely correlate in some measure with how cleanly they can be produced. Importantly, the necessary conversations are happening, and deliberate efforts are being made to align crypto and climate goals. ■

¹⁶<https://news.climate.columbia.edu/2021/09/20/bitcoins-impacts-on-climate-and-the-environment/>

¹⁷<https://www.weforum.org/agenda/2022/03/crypto-energy-consumption/>

¹⁸Ibid

¹⁹<https://time.com/6193004/crypto-climate-impact-facts/>

²⁰<https://www.coindesk.com/policy/2021/05/21/money-reimagined-hey-elon-bitcoin-can-green-the-grid/>

²¹<https://time.com/6193004/crypto-climate-impact-facts/>

²²<https://www.whitehouse.gov/wp-content/uploads/2022/09/09-2022-Crypto-Assets-and-Climate-Report.pdf>

²³<https://www.bloomberg.com/news/articles/2022-09-13/what-s-ethereum-eth-merge-proof-of-stake-differs-from-bitcoin-btc>