

Bitcoin and the Planet

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WisdomTree

Contributor

There was some snark thrown around in February when Elon Musk's Tesla announced its purchase of \$1.5 billion of bitcoin out of their corporate treasury. Musk has been outspoken on the role of fossil fuels in causing climate change. The businesses which Musk leads are explicitly tackling this challenge. To cite the company's website: "Tesla's mission is to accelerate the world's transition to sustainable energy".

Not long after this announcement, the BBC ran a story on the significant energy usage of the Bitcoin network, as estimated by The Cambridge Centre for Alternative Finance. The Cambridge researchers calculated Bitcoin's energy usage to be 121.26 terawatt-hours per year, which, without being energy experts, we take to be significant consumption, on par with mid-size countries. The article's headline: "Bitcoin consumes 'more electricity than Argentina.'"1

The implication of the article is that Bitcoin consumes a lot of energy. Naturally, people question if this large amount of energy is only causing humans to burn more fossil fuels, emit more greenhouse gases, and otherwise accelerate climate change. Can one square Musk's embrace of bitcoin with the Bitcoin network's energy consumption? And, for readers of this piece, should investors who are concerned about ESG (Environmental, Social and Governance) issues invest in bitcoin?

Why does Bitcoin consume energy?

The Bitcoin network consumes energy. This is undeniable. The Bitcoin blockchain2 relies on a proof-of-work method for achieving consensus on the ledger. This method of consensus requires Bitcoin miners to use specialised computers to constantly compete to solve a puzzle to propose a new block (a group of transactions) to the blockchain. The computers, competing to propose a new block and earn their bitcoin reward, are consuming electricity this whole time. This competition, and the requisite work, are intrinsic to the functioning of the Bitcoin network. Through that lens, energy consumption is not really an externality of Bitcoin. In a way, it's the point.

Is Bitcoin mining inherently bad for the environment? (No)

If energy consumption is unavoidable, the cost of that energy becomes very important to Bitcoin miners as profit-maximising firms in a perfectly competitive market. To maximise profits, miners must constantly keep down their largest variable cost (electricity). This is not a hypothetical. Riot Blockchain, a publicly traded cryptocurrency miner, filed an annual report with the SEC (10-K) that contains interesting language:

The operation of a bitcoin or other cryptocurrency³ mine can require massive amounts of electrical power. Further, our mining operations can only be successful and ultimately profitable if the costs, including electrical power costs, associated with mining a bitcoin are lower than the price of a bitcoin. As a result, any mine we establish can only be successful if we can obtain sufficient electrical power for that mine on a cost-effective basis, and our establishment of new mines requires us to find locations where that is the case.⁴

Somewhat ironically given the global, intangible nature of Bitcoin, geographic location is critical for miners. While we often speak about energy on a global basis, the delivery of energy is a local problem, and, as Riot Blockchain points out, miners will locate as physically close to cheap energy sources as they can to lower their variable costs. To illustrate this phenomenon, we only need to look at the February 2021 blackouts in Texas in the US. The US as a country did not lack in energy at this point in time, but, as many first learned, much of Texas operates on a separate power grid than the eastern and western regions of the US. Delivering energy from one point to another is a costly process; it is not freely fungible around the globe or even within a country as this crisis has illustrated. The local nature of delivery is even more salient for renewable energy like wind or hydroelectricity, which cannot be stored in barrels on a tanker (a problem Tesla is working to solve with new battery technology). If energy cannot be distributed and would otherwise be wasted, a supplier would be incentivised to sell it cheaply to a user nearby.

So what is a Bitcoin miner to do? Locate yourself next to energy that is produced cheaply and would otherwise be wasted. While we do not have perfect data, observed patterns indicate this is what happens. Many analysts point out that China's central planning has overbuilt hydroelectric dams in certain regions such as Sichuan. These dams produce more energy than local users consume or grids can store. Sichuan is also one of the largest sources of Bitcoin mining, suggesting that miners, smartly, have been turning clean energy that might otherwise be wasted into, effectively, the Bitcoin network. Analysts will point to numerous other examples like this. Unlike physical materials miners, Bitcoin miners are much more mobile, able to quickly relocate to the nearest electricity source, regardless of the environment. In a sense, Bitcoin has impressively shown a way to convert wasted energy into a global asset with utility.⁵

Again, we do not have complete data here. Our review of the research has not shown that one can affirmatively state that a certain percentage of Bitcoin's energy consumption is from renewable energy for example. The burning of coal - still common in China - is undoubtedly a source of energy for Bitcoin miners. So long as it remains a source of energy cheaper than the price of bitcoin for miners in China, we suspect it will continue to be. Like most environmental problems, if society does not like the result of a firm's profit-maximising decision, it is incumbent on society to enforce costs commensurate with the negative externalities of that decision. And, if mining pools in Western countries take share away from China, you'd expect Bitcoin's energy mix to shift towards less polluting sources.

Compared to what?

There is a temptation for certain environmental analysts to argue that Bitcoin is merely something "extra" or "unnecessary" by comparing Bitcoin to traditional financial networks and institutions. They may argue the

incremental CO2 emission from a Visa transaction is significantly lower than that of a Bitcoin transaction, so Bitcoin is not justifiable from an environmental perspective.⁶

We struggle with these comparisons. Even the most enthusiastic Bitcoin advocates would admit that Bitcoin, the network has its limits as a network for small value payments, for which Visa - a centralised network - has proven well-suited. Other decentralised ledgers operate on a much more energy-efficient basis for transactions such as these than Bitcoin. We do not believe a bullish⁷ perspective on bitcoin requires one to believe that the Bitcoin network is going to replace Visa. In our view, that is highly unlikely.

Instead, bitcoin investors can simply believe the asset class will continue to have worth as a decentralised, censorship-resistant, scarce, and structurally deflationary⁸ asset. None of these characteristics are contingent on Bitcoin replacing Visa or the global financial system.

Even if you do not share this view and are looking for a way to compare Bitcoin's energy consumption to existing systems, we think this needs to be done on an 'apples to apples' basis. The energy consumed by the Bitcoin network isn't just to process the transactions but is also used to secure and reconcile the state of the ledger. In the traditional space, Visa processes the transaction, but it is reliant on the banking system to maintain accounts and reconcile holdings to ensure the system functions. All this activity requires computers, people and office buildings, all of which require energy.

So how should investors think about it?

One day, maybe we will have the data to provide a framework for investors to answer this question for themselves mathematically. But today, we do not.

Bitcoin - like gold, art, homes – requires energy to produce. By its nature, Bitcoin is well-suited to consume renewable and sustainable energy, more so than other scarce assets. There is nothing inherently anti-environmental about Bitcoin. As renewable energy sources get cheaper and costs of "dirty" energy sources continue to rise, Bitcoin's energy mix will further adjust towards sustainability.

As a more general thought, it's rare that major technological advancement results in a lower overall energy requirement than the state of the world that preceded it. The advent of the internet and smart phones increased the energy the average person consumes as a result of the hardware everyone now has. There is no reason to think that this trend will change but it does frame the environmental issue: how do we serve an ever-increasing energy demand without destroying the planet? This question needs to be solved urgently, but it is distinct from Bitcoin.

As such, we do not believe Tesla and Musk are inherently hypocritical for their adoption of Bitcoin.

In fact, we think those who are inclined to both environmental issues and Bitcoin can take some comfort in their decision as Tesla has an advanced understanding of energy supply and distribution.

Likewise, we believe investors can continue to invest in the asset class without feeling like they are abandoning ESG principles, although some investors may find the lack of data unsatisfying. There will continue to be research on this topic, and we will update our views as the research evolves.

About Bitcoin

Bitcoin operates as a decentralised, peer-to-peer financial exchange and value storage. Bitcoin operates without central authority or banks and is not backed by any government. Bitcoin generally experiences very high volatility. Bitcoin is also not legal tender. Federal, state or foreign governments may restrict the use and exchange of cryptocurrency, and regulation in the U.S. is still developing. Bitcoin exchanges may stop operating or permanently shut down due to fraud, technical glitches, hackers or malware.

1 <https://www.bbc.com/news/technology-56012952>; Cambridge Bitcoin Electricity Consumption Index (CBECI)

2 a distributed ledger system in which a record of transactions made in cryptocurrencies are maintained across computers linked in a peer-to-peer network.

3 a digital or virtual currency that is secured by cryptography, which makes it nearly impossible to counterfeit or double-spend.

4 https://www.sec.gov/Archives/edgar/data/1167419/000107997320000216/riot_10k-123119.htm

5 [Nic Carter: The Last Word on Bitcoin's Energy Consumption - CoinDesk](#)

6 [Bitcoin Energy Consumption Index - Digiconomist](#)

7 a position that benefits when asset prices rise.

8 The opposite of inflation, characterised by falling price levels.

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