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By Robin Scher / Independent Media Institute
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As Cryptocurrency Becomes Mainstream, Its Carbon Footprint Can't Be Ignored

As Bitcoin prices rise, so will the incentive to mine it, creating a feedback loop that spells trouble for the climate.

For advocates of cryptocurrency, the promise of an economic future that is managed by a blockchain (a decentralized database that is shared among the nodes of a computer network, as opposed to being held in a single location, such as a central bank) is compelling. For anyone paying attention, the rapid expansion of cryptocurrency has been stunning. In 2019, the global cryptocurrency market was approximately \$793 million. It's now expected to reach nearly \$5.2 billion by 2026, according to a [report](#) by the market research organization Facts and Factors. In just one year—between July 2020 and June 2021—the global adoption of cryptocurrency surged by more than [880 percent](#).

But the increasing popularity of cryptocurrency has environmentalists on edge, as the digital “mining” of it creates a massive carbon footprint due to the staggering amount of energy it requires. Based on data from the [Bitcoin Energy Consumption Index](#) from Digiconomist, an online tool created by data scientist Alex de Vries, the carbon footprint of Bitcoin, the world's largest cryptocurrency, is equivalent to that of New Zealand, with both emitting nearly [37 megatons of carbon dioxide](#) into the atmosphere every year, according to a February 2021 CNBC article.

To understand why this is a problem, it's important to explain what goes into creating a

cryptocurrency like Bitcoin. Unlike fiat money, which is regulated through central banks, transactions in Bitcoin are tracked through a public ledger consisting of a network of computers around the world: the blockchain. “Mining”—a process in which computational puzzles are solved in order to verify transactions between users, which are then added to the blockchain—allows this validation to take place, which is an energy-intensive process.

It’s been a bit of a wild ride for Bitcoin. The market price of a single bitcoin [plunged below \\$30,000](#) in June 2021 for the first time since January 2021—[falling](#) by more than half from its April peak of around \$65,000. Nevertheless, some [analysts](#) and [billionaire investors](#) are still feeling bullish about the crypto coin, as several leading businesses continue to adopt the currency

Goldman Sachs started [trading Bitcoin futures](#) (agreeing to transact the coin at a predetermined future date and price). Tesla [invested \\$1.5 billion in Bitcoin](#). PayPal [announced](#) in March 2021 that it would allow its U.S. customers to use cryptocurrency to pay its millions of online merchants. In September, El Salvador became the first country to make bitcoin [legal tender](#). This, coupled with the fact that [big-name brands](#) like AT&T, Home Depot, Microsoft, Starbucks and Whole Foods now accept bitcoin payments, could [pave the way for mainstream use](#). But if the bulls are right and the price of a single Bitcoin [eventually hits \\$500,000](#), it would [pump more carbon dioxide](#) into the atmosphere than what is released by countries like Brazil or Mexico.

Another sector shaken up by digital assets is the art world, as digital artworks have been [making headlines](#) for the huge amounts they’ve been selling for on the market through the use of nonfungible tokens, more commonly known as NFTs, a type of guarantee backed by the Ethereum blockchain. In simpler terms, the works are created, or “minted,” through a process called proof-of-work (PoW), which establishes its unique identity, as explained in an article on [Hyperallergic](#).

This is arguably an [improvement](#) over the traditional art market when it comes to storing the value of the original work but is terrible for carbon emissions. The carbon footprint of a single Ethereum transaction as of December 2021 was 102.38 kilograms of CO₂, which is “Equivalent to the carbon footprint of 226,910 VISA transactions or 17,063 hours of watching YouTube,” [according](#) to Digiconomist. Meanwhile, the electrical energy

footprint of a single Ethereum transaction is about the same amount as the power that an average U.S. household uses in 8.09 days, the website further states.

In March 2021, Austrian architect Chris Precht [announced](#) that he was “[abandoning] plans to sell digital artworks backed by NFTs due to the environmental impact of mining the digital tokens,” according to Dezeen magazine. He said that he had created three digital artworks and wanted to sell them using blockchain technology. “I wanted to create 300 tokens because I had three art pieces and I wanted to make each one in an edition of 100. ... I would have used the amount of electricity I usually use in two decades,” Precht [explained](#).

“[W]e’re largely powering 21st-century technology with 19th-century energy sources,” Andrew Hatton, head of information technology at Greenpeace United Kingdom, [told](#) CNBC. He attributes this energy usage to the “huge amount of data-crunching needed to create and maintain this cyber-currency,” a process that demands a lot of electricity. The problem, according to Hatton, is that “only about a fifth of the electricity used in the world’s data centers comes from renewable sources.”

Another crucial aspect of cryptocurrency is that there is only a limited supply available. So, over time, as more bitcoin is mined, the complex math problems needed for transactions get harder to solve, demanding more energy in turn. The system is designed this way so that each digital token that gets issued contains its own unique cryptographic reference to the blockchain, ensuring its security. The issue of energy usage over time is further exacerbated by incentives attached to mining. In terms of Bitcoin, each time a miner solves the complex hashing algorithm required to produce bitcoin (the “PoW”), they receive a small amount of the cryptocurrency itself.

The inherent problem with this, as Charles Hoskinson, co-founder of Ethereum, [told](#) CNBC, is that “the more successful bitcoin gets, the higher the price goes; the higher the price goes, the more competition for bitcoin; and thus the more energy is expended to mine [it].” As the price continues to rise, so will the incentive to mine the cryptocurrency, creating a feedback loop that spells trouble for the climate.

According to December 2021 figures from the Cambridge Bitcoin Electricity

Consumption Index, Bitcoin makes up around [0.52 percent of the total global electricity consumption](#). That might not sound like much, but Digiconomist calculates Bitcoin's total annual power consumption to be around 204.50 terawatt-hours, [equivalent to the power consumption of Thailand](#)

“Such numbers should be taken with a good deal of salt. Bitcoin’s energy use depends crucially on its price, which swings wildly. The authors [of a [paper](#) published in April in the journal Nature Communications] assume that the long-term trend will be upward because the rate at which new bitcoins are created is designed to halve every four years. Reality will doubtless prove more complicated,” [noted](#) the Economist. “But the general picture—that bitcoin is a dirty business—fits with other research. One oft-cited model, which uses publicly available blockchain data, reckons its global energy consumption is already equal to that of Kazakhstan, and that its carbon footprint matches Hong Kong’s.”

Another problem besides the gargantuan energy usage is where that energy comes from. There is no definitive statistic related to the proportion of renewable versus fossil fuel-powered electricity used for bitcoin mining. Earth.org cites [two conflicting measures](#) of Bitcoin’s energy usage: CoinShares, a cryptocurrency asset management and analysis firm, [reported](#) in 2019 that 74.1 percent of Bitcoin’s electricity comes from renewables, while the University of Cambridge puts that number at 39 percent, according to a [report](#) it issued in 2020.

A better indicator of Bitcoin’s electricity source is not how it is powered but where its power comes from. A March 2021 article by Quartz [estimates](#) that since April 2020, “around 65 percent of bitcoin mining capacity, or hashrate, was based in China due to its cheap electricity.” This figure should give a better understanding of the primary source of fuel currently powering Bitcoin.

In May 2021, at least half of China’s significant share of bitcoin mining was located in the coal-rich province of Xinjiang, according to the [Cambridge Bitcoin Electricity Consumption Index](#), cited by Quartz. In 2020, [63 percent](#) of China’s bitcoin mining came from coal-fired plants, Fortune reported in July 2021, citing figures from Rystad Energy. “The energy research firm estimates that if China were to eliminate bitcoin mining, it would cut CO2 emissions by 57 million... [metric tons]—the equivalent to what the entire

country of Portugal emits in a year,” the Fortune report noted.

Despite these figures, a more renewable, energy-conscious future may lie ahead for cryptocurrency. In September 2021, Chinese President Xi Jinping [told](#) the UN General Assembly that his country would “strive to peak carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060.” That could lead to provinces such as Xinjiang being forced to move more toward renewables. The call from Beijing has also prompted nearby territories such as Inner Mongolia (which made up 8.7 percent of China’s bitcoin mining in 2020) to ban all crypto mining in mid-2021. If the change doesn’t come from within China after these crackdowns, bitcoin mining may grow somewhere else as miners look “to explore clean energy like surplus natural gas, shifting their focus from China to countries like Iceland, Norway, and Canada,” according to [Quartz](#).

It’s important that any valid criticism of Bitcoin considers the broader perspective around energy usage. As Michel Rauch, a research affiliate at the Cambridge Centre for Alternative Finance, [explained](#) to CNBC, “Although we agree the amounts [of energy needed by Bitcoin] are ludicrous right now, that is still half as much as inactive home appliances in the U.S. consumed.” A similar line of logic could be applied to a variety of everyday tasks such as sending emails or [using the internet](#) in general, both of which use up a fair share of energy too.

“What we have here is people trying to decide what is or is not a good use of energy,” Meltem Demirors, chief strategy officer of CoinShares, [told](#) CNBC. For Demirors, Bitcoin’s energy transparency places it in a better position than other, more opaque energy-consuming industries such as the banking industry.

To this effect, a [May 2021 report](#) produced by Galaxy Digital, a financial services and investment management firm based in New York, puts the energy consumption of Bitcoin at less than half that produced by the banking and gold industries. Putting this finding into perspective, the report’s authors note that “Bitcoin is a fundamentally novel technology that is not a precise substitute for any one legacy system.” What this means is that, unlike traditional currency or gold, Bitcoin is “not solely a settlement layer, not solely a store of value, and not solely a medium of exchange.” This makes Bitcoin’s relative energy consumption productive in comparison to comparative sectors, given its robust potential

uses.

Galaxy Digital’s report further addresses the source of energy used by miners to generate Bitcoin. “Critics often assume that the energy expended by miners is either stolen from more productive use cases or results in increased energy consumption,” [according](#) to the report. “But because of inefficiencies in the energy market, bitcoin miners are incentivized to utilize nonrival energy that may otherwise be wasted or underutilized, as this electricity tends to be the cheapest.” A recent case in point can be found in El Salvador, where President Nayib Bukele has announced the use of [geothermal energy](#) to power its bitcoin mining.

The promise of such an endeavor offers hope for a more sustainable cryptocurrency future. Whether this will make much difference to the climate crisis in light of government and industrial inaction remains to be seen. Even if cryptocurrency finds a way to coexist with a fossil-free future, critics point out that the majority of the wealth created by Bitcoin goes to a disproportionately small number of investors. An [article](#) in the Wall Street Journal, while referring to a recent study by the National Bureau of Economic Research—which was conducted by researchers from the MIT Sloan School of Management and the London School of Economics—stated that “the top 10,000 bitcoin accounts hold 5 million bitcoins, an equivalent of approximately \$232 billion.” Speaking about Bitcoin, Antoinette Schoar, a finance professor at MIT Sloan School of Management and co-author of the study, said, “Despite having been around for 14 years and the hype it has ratcheted up, it’s still the case that it’s a very concentrated ecosystem.”

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Robin Scher is a writer based in South Africa. He is a graduate of the Cultural Reporting and Criticism program at New York University. Follow him on Twitter: [@RobScherHimself](#).

*Sender: Jenny Pierson
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