



Atlanta Regional Commission

The Effects of Cryptocurrency Mining on the Atlanta Region

The bottom half of the slide features a perspective view of a long, brightly lit aisle in a data center. The aisle is flanked by rows of server racks on both sides. The racks are filled with equipment, and the floor is a light-colored, reflective surface. The lighting is a cool blue, and there are many small, glowing blue squares and lines floating in the air, giving a sense of digital activity and data flow.

July 20, 2022



BACKGROUND

What is Cryptocurrency Mining?

Mining is the process by which new units of cryptocurrency enter circulation. It is also how the transaction of finding crypto is verified, or “validated,” and the blockchain is updated.

There are multiple methods of mining, some that use far more resources than others. Because Bitcoin represents about 99% of all capitalization of cryptocurrency, the process that was created by Bitcoin is the most popular. This method, called Proof of Work validation requires enormous amounts of computing power and, therefore, a lot of electricity, and the natural resources needed to create it.

Proof of Work Mining

Proof of Work mining is the process by which new Bitcoins enter circulation. This process makes obtaining Bitcoin essentially free for the miner as he/she doesn't invest any cash. However, most miners spend heavily on the technology and electricity needed for the mining process.

To find a unit of Bitcoin, a miner must “solve” a complicated mathematical equation. What a miner is solving for is a 64-digit hexadecimal number that represents a unit of Bitcoin.

A 64-digit hexadecimal number might look something like this:

00000000000000000000000057fcc708cf0130d95e27c5819203e9f967ac56e4df598ee

[<https://www.investopedia.com/tech/how-does-bitcoin-mining-work/>]

Miners use hundreds or thousands of high-powered computers working simultaneously to solve for these 64-digit numbers until they find one that represents a unit of cryptocurrency.

If a miner validates a block of Bitcoin inaccurately - trying to use the same block twice or making a false claim, they are punished through the loss of resources they put into finding that block.

The Proof of Work method is the most popular mining process but is widely criticized for its use of resources. And now that much of the mining is done by corporations rather than individuals, it's also being criticized for its inequity.

Other Mining Methods

There are several other methods of mining cryptocurrency. They are discussed in the Addendum to this report. However, it's important to remember that Bitcoin accounts for 99% of all the cryptocurrencies on the market, and it exclusively uses Proof of Work mining.

RESOURCE USAGE

Electricity

Proof of Work mining requires enormous amounts of computing power, which in turn requires massive amounts of electricity. This has been one of the biggest knocks on Bitcoin over the last few years. In fact, Elon Musk recently said that he believes cryptocurrency has a strong future, but he will not invest in Bitcoin because of the harm it does the environment.

In a March 2022 article in *Business Insider*, The University of Cambridge estimated that Bitcoin mining alone generates 132.48 trillion kilowatt hours of electricity annually. This surpasses Norway's energy usage for the year 2020. [<https://www.businessinsider.com/personal-finance/cryptocurrency-environmental-impact>]

In a June 2022, article in *Yale Environment 360*, author Judith Lewis Mernit said, "By some estimates, the world's Bitcoin mining operations had an annual energy budget equal to the nation of Argentina."

That same article notes that the decommissioned coal-fired Greenridge power plant in New York was revived as a gas-powered plant in 2017 and is now a gas-fired mining facility. Likewise, Digihost will soon base a mining facility in a gas-fired power plant in Canada. [<https://e360.yale.edu/features/bitcoins-intensive-energy-demands-spark-a-crypto-backlash>]

Every four years, Bitcoin halves the value attributed to each unit discovered in the blockchain. This last occurred in 2020. That means that units of Bitcoin will be harder to find and mining the same value of Bitcoin will require more computing power. [*Business Insider*, 3/17/22]

Water

As with any process that requires large amounts of electricity, crypto mining also uses a lot of water. Water is required to cool the components of the electricity production process, making power production one of the world's largest users of water. It's estimated that electric power plants consume about 40% of all the fresh water used in the U.S. Water is also frequently used directly to cool mining facilities, as it is data centers. [<https://coinpedia.org/information/cryptomining-impacting-water-usage-globally/>]

In February 2021, *Coinpedia* estimated that one transaction on the blockchain can consume as much energy as an average household does in a week. The same article says that mining operations in North America and Europe use 16-50 gallons of water per kilowatt hour. And as was stated above, Bitcoin mining uses about 132.48 trillion kilowatt hours annually. [<https://coinpedia.org/information/cryptomining-impacting-water-usage-globally/>]

Many data centers and cryptocurrency facilities are finding more resource-friendly ways to cool their systems. For example, in cooler weather, they use a process that draws cool air from outside and flushes out the warm air. There are also examples – like the Google data center in Douglas County – where a data center uses non-potable water

for cooling before returning it to its source or to the local water utility. [<https://www.watertechonline.com/water-reuse/article/14215042/data-center-water-sustainability-and-stewardship>]

Some miners have made the best of their electricity situation. One man in Minnesota uses water to cool his small mining operation. He then pumps the heated water into his pool so his kids can swim year-round. [<https://cointelegraph.com/news/water-great-idea-bitcoin-mining-heats-this-swimming-pool>]

Air Pollution

Business Insider said that in 2020, Bitcoin mining led to 40 billion pounds of carbon dioxide emissions in the U.S., where 35% of global Bitcoin mining takes place. [<https://www.businessinsider.com/personal-finance/cryptocurrency-environmental-impact>]

A February 2022 article in *Science News for Students* stated that in 2018, each \$1 of value created from Bitcoin mining in the U.S. led to health and climate-damage costs of about \$0.49, or almost half the value of the mined currency. The same article also states that the Bitcoin mining industry produces about as much electronic waste each year as the country of Luxembourg. [<https://www.sciencenewsforstudents.org/article/mining-cryptocurrencies-power-pollution-waste-cost>]

PRESENCE OF MINING OPERATIONS

United States

China banned Bitcoin mining in 2021, meaning that most of the mining globally is now done in the U.S. – 35%. It is spread out across the country but is focused on states that have relatively cheap electricity and are generally business-friendly – like Texas, North Dakota, Kentucky, Tennessee, and Georgia.

A story on WSB-TV on February 24, 2022, stated that *Bloomberg* and *Fortune* named Georgia the top state for crypto mining. They estimate that 34% of all the mining-related computing power in the U.S. is generated here. That's compared to 12% in Kentucky, 10% in New York, and 8% in Texas.

The link below to the WSB story allows you to see and hear about a couple of local mining facilities: [<https://www.wsbtv.com/news/2-investigates/this-is-how-georgia-is-becoming-one-biggest-hubs-bitcoin-mining-digital-investing/NRI3333QONALDJ34VTMFL7BJPY/?outputType=amp>]

In an article by the Columbia Climate School of Columbia University, Joshua D. Rhodes of the Center on Global Energy Policy said, “The Texas grid operator ERCOT estimates that crypto miners may increase energy demand up to 6 gigawatts by mid-2023, roughly the equivalent of adding another Houston to the grid.” [<https://news.columbia.edu/2022/05/04/cryptocurrency-energy/>]

Georgia

The first mining operations in Georgia were in rural areas near Adel, Dalton, Fitzgerald, LaFayette, and Sandersville. These areas want the small number of jobs (10-30 depending on size) a mining facility brings and are more likely to negotiate lower energy costs.

CleanSpark, which claims to use green energy for its processes, has mining facilities in **College Park** and **Norcross**. College Park's city-owned utility uses 90% nuclear power and the facility's location near the airport means that noise is not a concern. [<https://www.ajc.com/news/bitcoin-miners-descend-on-georgia-to-mint-new-currency/KBNRFDJVFBFQXAFGII4TISVCPY/#:~:text=Since%202020%2C%20bitcoin%20mining%20companies,cheap%20electric%20rates%20for%20businesses>]

Core Scientific announced in December 2020 that it was adding 59,000 machines to its mining operations across the U.S., including doubling the size of its facility near Dalton.

[<https://www.nasdaq.com/articles/us-bitcoin-mining-firm-core-scientific-to-triple-capacity-with-massive-59000-machine-order>]

After the first few were built in Georgia, mining facilities developed a bad reputation for being loud and ugly, as well as for using too much electricity. All while providing relatively few jobs.

In February 2022, the city council in **Forsyth** (in Monroe County), denied a rezoning request for a mining facility based on its location near a residential area, saying that the noise would disrupt nearby residents. However, the city manager did note in the article that the city stood to benefit from selling power to the facility, leading one to believe that the council is not opposed to such a facility in Forsyth. [<https://www.41nbc.com/city-of-forsyth-denies-the-approval-of-bitcoin-mining-facility/>]

In July 2022, the city council in **Fayetteville** approved the zoning for a data center owned and operated by Quality Technology Services (QTS). However, the approval came with an agreement that the originally requested Bitcoin mining facility would not be part of the data center. [<https://thecitizen.com/2021/12/02/crypto-mining-site-coming-to-fayetteville/>]

The City of **Tifton** is taking a proactive approach. The city council voted in March on standards and regulations for any potential Bitcoin mining facilities that might want to open in the city.

https://www.tiftongazette.com/news/city-oks-cryptocurrency-site-regulations/article_fada2c82-aae7-11ec-ac2e-1fe57796846c.html

The Future

While the Proof of Work method is the original and most utilized mining method, most other methods require less computing power, and some are seen as more equitable. For these reasons, some experts see Proof of Stake or one of the other lesser-known methods as the future of crypto exchange: "Almost all cryptocurrency currencies are

mined with proof-of-stake right now. We just don't hear as much about it because Bitcoin represents 99% of all capitalization in cryptocurrency," said Colin Read, professor of economics and finance at the State University of New York. **"Bitcoin is cryptocurrency's Model T."** [<https://e360.yale.edu/features/bitcoins-intensive-energy-demands-spark-a-crypto-backlash>]

No matter the future of the mining process, the real question is about the future of cryptocurrency. Is it all a gimmick or fad? Or will it become the first global currency and be the basis for trade around the world?

Currently, cryptocurrency is so volatile that even experts have a hard time predicting its future. For example, early in 2022, the price of Bitcoin was up 61% and the price of Ethereum was up 409% over the previous year. [<https://www.fool.com/investing/stock-market/market-sectors/financials/cryptocurrency-stocks/future-of-cryptocurrency/>]

At the same time, the value of Bitcoin has been known to drop 30% in one day. [<https://www.forbes.com/sites/nicolelapin/2021/12/23/explaining-cryptos-volatility/?sh=7c5a4aef7b54>]

This volatility is attractive to investors who use Bitcoin to make money quickly but don't intend to be there for the long haul. This leads some experts to believe that as cryptocurrency prices become more stable, the interest from investors will slow. And since cryptocurrencies aren't based in anything with intrinsic value, it's impossible to tell how slower trading activity will impact its value.

ARC TAKEAWAY

If we assume that cryptocurrency and proof of work mining are here to stay, we must consider the impact the mining activity will have on our air and water quality. When one combines cryptocurrency mining with the region's other growing electricity demands, the Atlanta region will use a lot more electricity than it does today. Some of those growing demands include:

- population growth
- increased technology usage
- rise of electric vehicles

We are already seeing what grid expansion means for our wallets. Georgia Power recently asked the Public Service Commission to allow rate increases in 2023, 2024, and 2025. According to Georgia Power, the increases are needed to modernize the grid and transition away from fossil fuels. The company says that these improvements will lead to a more reliable and resilient power grid. [<https://www.ajc.com/news/georgia-power-seeks-rate-hike-of-nearly-12-over-three-years/272VHXR5MVBVTNJKQSBI5VOIQ4/>]

Perhaps the region's utilities could consider increasing the electricity rates that miners use. The Chelan County Public Utility District in Washington voted in June to create a new rate specifically for cryptocurrency mining operations. The rate is a 29% increase over the discounted, high-density load rate they paid prior to the increase. [<https://decrypt.co/102420/bitcoin-miners-will-see-29-rate-hike-hydroelectric-power-washington>]

We must also ensure that we have the water resources to sustain the increased electricity usage. Fortunately, most “green energy” methods of power generation use less water than burning coal. Even so, the more water we use for power generation, the less we have available for homes and businesses.

From a land-use perspective, cities that sell electricity are probably more likely to allow mining facilities, given that these facilities would provide large amounts of revenue. These local governments need to understand the strain these facilities put on resources, and that a mining facility built today might not be in business just a few years from now.

ADDENDUM

Below is information regarding other methods of mining for cryptocurrency. Many of these methods use less energy than Proof of Work mining.

Proof of Stake Mining

This form of mining is already used by many cryptocurrencies. And Ethereum, the second-largest cryptocurrency in the world, is developing an entire blockchain system around it:

- A miner (or validator, as they are known) contributes his/her own crypto in exchange for a chance to validate a new transaction, update the blockchain, and earn more cryptocurrency.
- The network selects a “winner” based on the amount of crypto each validator has in the pool and the length of time it’s been there – literally rewarding the most invested participants.
- The winner validates the latest block of transactions and other validators attest to its accuracy. Once properly validated, the network updates the blockchain.
- Participating validators receive a reward in the native cryptocurrency, generally in proportion to their stake.
- If a validator falsely validates a block of cryptocurrency, they are penalized by losing the money they put up as their stake.
- This method uses much less electricity but is criticized for its inequity.

Proof of Burn

As of March, only Slimcoin used this method, which was developed to address environmental concerns around Proof of Work mining:

- Validators “burn” an amount of their own cryptocurrency, permanently removing it from circulation. Essentially, miners are buying the right to mine for cryptocurrency.
- The more coins you burn, the faster you “mine” and the more likely you are to find and validate cryptocurrency.
- Like Proof of State, this method does not seem very equitable.

Proof of Capacity

A handful of currencies use this method:

- A miner/validator stores possible solutions to an algorithm on his/her computer's hard drive.
- The more capacity you have, the more solutions you can store and the more likely you are to have the correct solution.
- Once you find and validate a unit of cryptocurrency, it's yours.
- This method, while not requiring the miner to own cryptocurrency, does favor a miner who owns many computers or large amounts of virtual storage.

Proof of Elapsed Time

This method is used primarily in private/closed blockchains:

- A miner/validator is randomly selected through a lottery system to update the blockchain and earn cryptocurrency.
- While this method seems to be the fairest, miners are required to pay to join a closed blockchain.

WORKS CITED

Below is a list of articles used in writing this report. The links are listed in the order in which they appear:

<https://www.investopedia.com/tech/how-does-bitcoin-mining-work/>

<https://www.businessinsider.com/personal-finance/cryptocurrency-environmental-impact>

<https://e360.yale.edu/features/bitcoins-intensive-energy-demands-spark-a-crypto-backlash>

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Other Works

Below is a list of sources that were reviewed for the creation of this report but were not used.

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