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Cryptocurrency Mining and the Electricity Sector

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Cryptocurrency Mining and the Electricity Sector

The popularity of cryptocurrencies, such as Bitcoin, and their underlying blockchain technology presents both challenges and opportunities for the electricity sector. Cryptocurrency is a type of digital asset that is sometimes referred to as *virtual currency*. Cryptocurrency mining ("cryptomining") is the process of validating transactions on a digital ledger and adding transactions to the ledger's permanent record. For providing the computing power for the validations, miners are awarded some amount of cryptocurrency in return, making it a potentially lucrative endeavor.

As investment in Bitcoin and other cryptocurrencies has increased, the electricity demand to support cryptocurrency mining activities has also increased. The increased electricity demand—when localized—can exceed the available generation capacity. If a utility invests in a new power plant or in infrastructure upgrades to meet the increased demand, the utility might raise rates to recover the cost of those capital investments. In instances where a utility may be able to accommodate the increased electricity demand, increased sales might lead a utility to reduce rates.

Not all cryptocurrencies require energy-intensive mining operations. Some cryptocurrencies, such as Ether, can operate under algorithms that require less electricity. In addition, blockchain technologies could present opportunities for the electricity sector by facilitating power and financial transactions on a smart grid. Some see an opportunity to leverage cryptocurrency mining facilities as a way to manage growth in electricity demand and to moderate wholesale power prices during times of peak demand or low generator availability.

Some U.S. state governments are developing various policies in response to growth in electricity demand from cryptocurrency mining activities. Some states have considered or imposed limits on cryptomining development. Other states have offered reduced electricity rates, tax incentives, or opportunities to participate in electric load reduction programs to attract and retain miners.

There are potential options that could be adopted by the federal government to address electricity consumption and affordability concerns. These options include better quantifying and tracking the size of proposed and existing cryptocurrency mining operations, incentivizing the development and operation of power plants to increase electricity generation, and improving the energy efficiency of cryptocurrency mining facilities through the consideration of the adoption of technologies and processes that promote energy delivery optimization. Approaches to improve energy efficiency could include funding research and development of technologies for cooling, technologies for waste heat optimization, and algorithms for use in consensus mechanisms or for other computational purposes. Some of these options could have implications beyond cryptocurrency miners, potentially affecting data center facilities broadly. Other policy options to facilitate the communication of information between the federal government and electricity sector stakeholders could respond to concerns regarding electricity security associated with cryptocurrency mining facilities.

In the 119th Congress, there are several bills that could address cryptocurrency mining and electricity sector issues. The Clean Cloud Act of 2025 (S. 1475 and H.R. 6179) and the Data Center Transparency Act (H.R. 6984) address data collection content and frequency for cryptocurrency mining facilities and data centers. The Preventing Rate Inflation in Consumer Energy (PRICE) Act (H.R. 6983) would address concerns about electricity generation by requiring data centers of a certain size to generate all of the electricity that the facility consumes. Accompanying the Intelligence Authorization Act for Fiscal Year 2026 (S. 2342), the report by the Select Committee on Intelligence, S.Rept. 119-51, in describing concerns with certain cryptocurrency mining operations, would direct the intelligence community to work together with law enforcement partners to shut down those operations that pose a threat to national security. Other bills related to addressing electricity security issues would expand the Department of Energy's authorities; these include the Energy Emergency Leadership Act (H.R. 7258) and the Energy Threat Analysis Center Act of 2026 (H.R. 7305).

SUMMARY

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Introduction

The popularity of cryptocurrencies such as Bitcoin and Ether present both challenges and opportunities to the electricity sector. Cryptocurrency is a type of digital asset that is sometimes referred to as *virtual curren*cy. Cryptocurrency was developed to move away from the centralized power of the banking system and move toward a decentralized network. Cryptocurrency mining (*cryptomining*) is the process of creating additional units of cryptocurrency and validating cryptocurrency transactions on a distributed ledger, or blockchain.

As interest in cryptocurrencies has increased, the electricity demand to support cryptocurrency mining activities has also increased. The increased electricity demand—when localized—can exceed the available power capacity and increase customers' electricity rates. But not all cryptocurrencies require energy-intensive mining operations. Some cryptocurrencies can operate under algorithms that require less energy.

This report provides an overview of blockchain technology and cryptocurrency mining, describes where cryptocurrency mining occurs, discusses estimates of electricity consumption from current and projected cryptocurrency mining operations, and identifies selected policy options and considerations for cryptocurrency mining within an electricity sector context.

Blockchain Technology and Cryptocurrency Mining

Blockchain provides a means of transacting among parties who may not otherwise trust one another. Blockchain is a database technology that records and stores information in blocks of data that are linked, or *chained*, together. Data stored on a blockchain are continually shared, replicated, and synchronized across the nodes in a network—individual computer systems or specialized hardware that communicate with each other and store and process information. In the case of the Bitcoin or Ethereum blockchains, these technologies can include encryption and peer-to-peer (P2P) networks.[1] Some blockchain networks allow individuals engaging in transactions to also be the ones to validate them. This system is designed to enable tamper-resistant recordkeeping without a centralized authority or intermediary.

Cryptocurrencies, such as Bitcoin and Ether, provide a means of validating transactions in a decentralized network that is outside of an intermediary, such as a bank for financial transactions or a title company for real estate transactions. This validation can be done in bulk and is final and immediate, making cryptocurrency an attractive avenue for certain financial transactions. Cryptocurrencies are built to allow the exchange of some digital asset of value (the cryptocurrency). Bitcoin is the most popular cryptocurrency, representing approximately 60% of the cryptocurrency market capitalization as of December 1, 2025.[2]

[1] Ethereum is the blockchain that is the platform for Ether, a cryptocurrency. A peer-to-peer (P2P) network allows a disparate system of computers to connect directly with each other without the reference, instruction, or routing of a central authority. P2P networks allow for the sharing of files, computational resources, and network bandwidth among those in the network. Encryption is used to ensure that parties trading assets on a blockchain have rights to that asset and to ensure that data held in the blockchain are tamper resistant. Christian Catalini, "How Blockchain Applications Will Move Beyond Finance," *Harvard Business Review*, March 2, 2017, https://hbr.org/2017/03/how-blockchain-applications-will-move-beyond-finance.

[2] CoinGecko, "Cryptocurrency Prices by Market Cap," accessed December 1, 2025, https://www.coingecko.com/.

Cryptocurrency Mining

Bitcoin has a near supermajority capitalization in the cryptocurrency industry. Because of this, many of the studies related to cryptocurrency mining focus on Bitcoin (these studies may or may not consider other cryptocurrencies). There are three primary avenues to gain ownership of the Bitcoin cryptocurrency: purchase Bitcoin directly; earn Bitcoin in return for a product or service; or create Bitcoin through *mining*.[3]

Bitcoin and other cryptocurrencies each implement their own blockchain. In the case of Bitcoin, mining involves the computational work to validate transactions and bundle those transactions to create and publish a new block in a blockchain.[4] In blockchain networks generally, miners are incentivized to participate with a monetary or reputational reward. New blocks may be added to a blockchain through a variety of methods, as discussed below. The process followed to achieve agreement within a distributed system on the current state of the blockchain is called a *consensus method* or *consensus algorithm*.

Bitcoin's Consensus Mechanism

The Bitcoin network is a P2P, decentralized network. The Bitcoin protocol sets the rules and conditions that participants on the network follow, and changes to the protocol require consensus from network participants (miners). Miners on the network validate transactions. Valid transactions can be bundled into a block, and the data will have an authenticator or *hash value*. Hash values are used to ensure the integrity of data—in this case, to confirm that a block of data in the blockchain has not been modified. Miners seek to verify the hash value by identifying a numeric value (*nonce*) that, when inserted into an algorithm, returns a string of characters that matches the hash value. The security properties of hash algorithms are such that a miner tests nonces until a valid hash is found for a block.[5]

For Bitcoin, new blocks are added to the blockchain through proof-of-work (PoW). Under PoW, miners attempt to solve a difficult computational problem, or puzzle. PoW identifies a nonce, which is used to generate a hash value. By inserting different nonces into the algorithm, miners seek to identify a hash value for a given block that begins with a certain number of zeros. They add data to the block by changing the nonce in order to change the hash value and discover the solution. The process of identifying these valid nonces and hashes is computationally and energy intensive, and this activity is the essence of mining.[6]

Generally, by solving the problem or puzzle, miners win the opportunity to post the next block and possibly gain a reward for doing so. In the case of Bitcoin, miners who are first to create and publish new blocks in the blockchain are rewarded with Bitcoin. Once the problem is solved and a valid hash is identified, the miner announces it to the community using P2P networking. Other users can validate the solution immediately—without going through the resource-intensive computation process, by trying their nonce and seeing the hash value.[7] Once the majority of the community of users validates and confirms the block, it is added to the chain. For Bitcoin, the

[3] For more information on Bitcoin, see CRS Report R43339, *Bitcoin: Questions, Answers, and Analysis of Legal Issues*.

[4] CRS Report R45116, *Blockchain: Background and Policy Issues*.

[5] Fan Zhang et al., "REM: Resource-Efficient Mining for Blockchains," *Proceedings of the 26th USENIX Security Symposium*, August 16-18, 2017, p. 1429 (hereinafter Fan Zhang et al., 2017).

[6] For an example of how this works, see Anders Brownworth, "How Blockchain Works," November 5, 2016, http://blockchain.mit.edu/how-blockchain-works.

[7] Fan Zhang et al., 2017, p. 1429.

winner of the puzzle is awarded some amount of Bitcoin that is generated (or mined) by that block, plus any fees users have attached to their transactions to promote their transactions being published quickly.

Miners are held to a strict set of rules that maintain the overall market structure. There are a limited number of Bitcoin to be mined, which creates a value attributed to scarcity. For Bitcoin, the algorithm adjusts in complexity such that new blocks are typically published every 10 minutes. The rewards for published blocks halve every 210,000 blocks, so the reward of new Bitcoin diminishes by half roughly every four years (e.g., the reward of 50 Bitcoins per block in 2008 was reduced to 25 in 2012).[8] The last halving occurred on April 19, 2024, with the reward reduced from 6.25 Bitcoin to 3.125 Bitcoin.[9] On the date that block was generated, trading for 1 Bitcoin closed at approximately $63,844; for example, on March 5, 2026, trading for 1 Bitcoin closed at approximately $70,995.[10]

Bitcoin is rewarded on a first come, first served basis, meaning whoever solves and publishes the solution first is rewarded with Bitcoin. Miners throughout the network compete against each other in a race to be the first to resolve the PoW and earn the reward. This competition leads to many miners expending electricity in an attempt to be the first miner to correctly resolve the PoW.

PoW is also vulnerable to attacks. A malicious actor could devote enormous computational resources to rewriting a blockchain—developing different transactions with different nonce and hash values. Since PoW blockchains publish new blocks to the longest available chain, the malicious actor could publish their fraudulent blockchain at a point where their chain is the longest, and the system would accept it as the valid one. By rewriting the chain, the malicious actor could determine the distribution of resources (i.e., which accounts have Bitcoin and how much the accounts hold). This is known as a "51% attack." Such an attack would be difficult to execute—it would require substantial energy consumption, space, equipment, and money—and it would be difficult to avoid getting caught. But PoW algorithms are not invulnerable to such attacks, and some blockchains (though not Bitcoin's) have been affected by this kind of attack in the past.[11]

Mining Technology

The technology used by cryptocurrency miners has advanced since the first Bitcoin was mined in 2009.[12] Early miners were able to earn Bitcoin and other cryptocurrencies relatively easily with affordable equipment. Bitcoin could initially be mined on a central processing unit (CPU) such as a personal laptop or desktop computer. As interest in Bitcoin mining increased, miners discovered that graphic cards—using graphics processing units (GPUs)—could more efficiently run hashing algorithms and aid in mining. Field Programmable Gate Arrays (FPGAs) then replaced graphic

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[8] According to Satoshi Nakamoto, the creator of Bitcoin, "To compensate for increasing hardware speed and varying interest in running nodes over time, the proof-of-work difficulty is determined by a moving average targeting an average number of blocks per hour. If they're generated too fast, the difficulty increases." See Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," paper, October 2008, https://bitcoin.org/bitcoin.pdf.

[9] Blockchain, "Bitcoin Block 840,000," April 19, 2024, https://www.blockchain.com/explorer/blocks/btc/840000.

[10] Price data provided by CryptoCompare to Yahoo!Finance; see Yahoo!Finance, "Bitcoin USD Price (BTC-USD)," https://finance.yahoo.com/quote/BTC-USD/history?p=BTC-USD.

[11] Kai Sedgwick, "Verge Is Forced to Fork After Suffering a 51% Attack," *Bitcoin News*, April 5, 2018, https://news.bitcoin.com/verge-is-forced-to-fork-after-suffering-a-51-attack/; Investopedia, "What Is a 51% Attack on Blockchain? Risks, Examples, and Costs Explained," August 20, 2025, https://www.investopedia.com/terms/1/51-attack.asp#toc-who-is-at-risk-of-51-attack.

[12] Blockchain, "Bitcoin Block 0," January 3, 2009, https://www.blockchain.com/explorer/blocks/btc/000000000019d6689c085ae165831e934ff763ae46a2a6c172b3f1b60a8ce26f.

cards, as the circuits in an FPGA could be configured and programmed by users after manufacturing.[13] In 2013, application-specific integrated circuits (ASICs) were introduced and have replaced FPGAs and graphic cards.[14] ASICs are designed for a particular use—such as Bitcoin mining.

As more sophisticated equipment has been adopted, miners have also moved away from working individually to working in larger groups. Many miners have determined it is more cost efficient to join "mining pools" that help disperse the electricity and equipment costs (while also dispersing the profits) and increase the speed or likelihood of a successful transaction. Often, ASICs used for Bitcoin mining are housed in data centers that may have access to low-cost electricity.[15] While these developments have transformed Bitcoin mining into a more consolidated industry, they have not resolved the energy consumption issue or the computational excesses, as different Bitcoin mining pools must still compete against one another using the PoW method. A potential option for Bitcoin mining that could address energy consumption would be the development and adoption of an optical proof-of-work consensus mechanism that would use photonic (light-based) integrated circuits, which can be more energy-efficient than conventional electronic integrated circuits.[16]

Other Consensus Mechanisms

Many alternative algorithms to PoW exist; two of the more prominent options are proof-of-stake (PoS) and proof-of-authority (PoA) (see **Figure 1**).

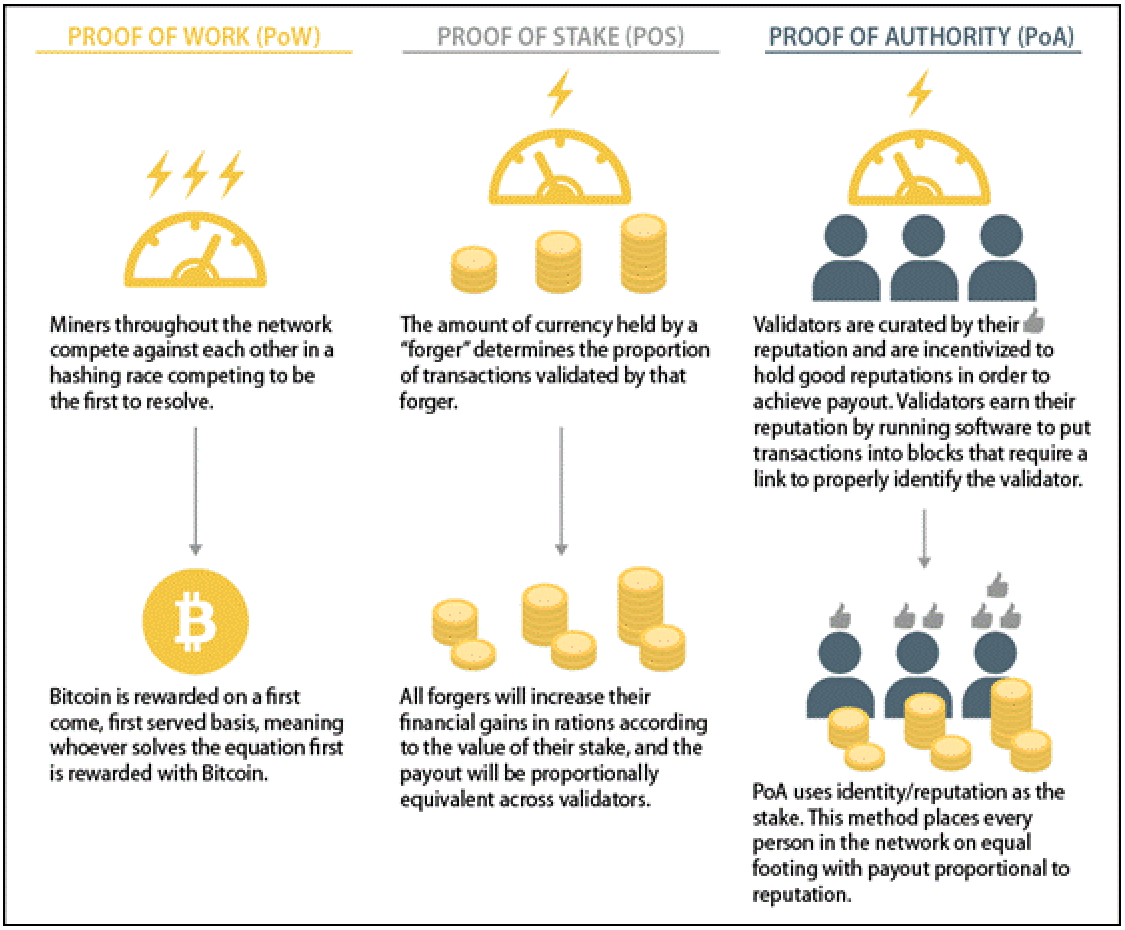
[13] Harold Vranken, "Sustainability of Bitcoin and Blockchains," *Current Opinion in Environmental Sustainability*, vol. 28 (2017), p. 3 (hereinafter Vranken, 2017).

[14] Christine Kim, "The Rise of ASICs: A Step-by-Step History of Bitcoin Mining," *CoinDesk*, September 14, 2021, https://www.coindesk.com/tech/2020/04/26/the-rise-of-asics-a-step-by-step-history-of-bitcoin-mining.

[15] Data centers are facilities—buildings or parts of buildings—used to store, manage, and disseminate electronic information for a computer network. They house servers, which are computers used to perform network-management functions such as data storage and processing, and communications equipment and devices to connect the servers with the network. These facilities may range in size from small rooms called *server closets*, or even parts of rooms, within a conventional building, to large dedicated buildings called enterprise-class data centers. Larger centers may be purpose-built or retrofitted. For more information on data centers, see CRS Report R48646, *Data Centers and Their Energy Consumption: Frequently Asked Questions*, by Martin C. Offutt, Ling Zhu, and Ashley J. Lawson.

[16] Sunil Pai et al., "Experimental Evaluation of Digitally Verifiable Photonic Computing for Blockchain and Cryptocurrency," *Optica*, vol. 10, no. 5 (May 2023), pp. 552-553.

Figure 1. Comparison of Selected Blockchain Consensus Mechanisms



Source: CRS.

Notes: The lightning bolt/gauge icons represent energy intensity. Depiction does not correlate to actual measurements of usage. Bitcoin is used as an example of the PoW consensus mechanism; other cryptocurrencies also use the PoW consensus mechanism. For PoA, the thumbs-up sign represents a positive reputation.

The proof-of-stake option depends on the community's actual stake in the blockchain ledger; it does not require that users consume excess electricity in a race to be the first to solve computations. The more stake a *forger* (analogous to a forger of metal; PoS role replacing *miner*) holds, the more transactions the forger can validate. This method skips the energy-intensive hashing race. Forgers earn currency through transaction fees for building a new block (and thereby validating a transaction). Who gets to validate a new block is determined by the amount of cryptocurrency forgers have staked. In this manner, forgers are incentivized to build only valid transactions, to avoid placing their own investment at risk. If a forger added a block to the blockchain based on an invalid transaction, the forger would risk losing their stake. Independent nodes verify transactions within the blockchain network.

The potential electricity and cost reductions of PoS led to changes in some major cryptocurrencies. On September 15, 2022, in a highly publicized event called the "Merge," the Ethereum blockchain shifted from a PoW to PoS validation process. While other blockchain networks use PoS, the Merge was significant because the Ether cryptocurrency was the second-largest cryptocurrency by market capitalization at the time and was the largest cryptocurrency to transition from PoW to PoS. Ethereum predicted the Merge would cut its energy consumption by

99.5%, a prediction that has been supported by some outside analyses.[17] According to news outlets, the Merge prompted some Ethereum miners to either cease operation or switch to mining other PoW blockchain networks since their equipment could no longer be used on PoS networks. These changes reduced the overall energy consumption of the Ethereum blockchain but may have increased the energy consumption by other networks as miners migrated.

Proof-of-authority (PoA) is another method of validating transactions in a blockchain. There is not a formal definition of PoA, and the definition may differ from one group to another.[18] One understanding of PoA—as it relates to cryptocurrency—has validators curating their own reputation in order to achieve payout. Validators earn their reputation by running software to put transactions into blocks that require a link to properly identify that validator. This method places every person in the network on equal footing—each person has only one identity.[19] An alternative understanding of PoA, among the supply chain industry, uses a blockchain network to track logistics transparently. In these systems, certain users can only post certain transactions—usually those related to their activity. PoA provides a level of scalability and security within certain networks that PoS or PoW cannot.

Consensus mechanisms can have limitations. While PoS and PoA both reduce energy consumption levels and require far less sophisticated equipment, they both create a more controlling and limited environment. PoW requires community decisionmaking. PoS and PoA are more individualistic, and the power rests in those with the most stake or highest reputation. The individualistic nature of PoS and PoA could undermine the concept of the decentralized nature of the distributed ledger system design, which is one of the fundamental principles in cryptocurrency.[20]

Where Is Cryptocurrency Mined?

Several factors contribute to ideal cryptocurrency mining locations, including electricity costs and regulations.[21] Electricity costs are often affected by geographical characteristics, such as proximity to hydroelectric power or lower ambient temperature that can reduce the demand for cooling of the facility and cryptocurrency mining equipment. Local and national governments around the world have responded differently to the growth of Bitcoin and other cryptocurrencies: Some are actively developing cryptocurrency industries, some are restricting the use of cryptocurrencies or the mining of cryptocurrencies, and some are regulating cryptocurrencies in an effort to balance financial innovation and risk management.[22]

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[17] Charlyn Ho, "One Year After the Merge: Sustainability of Ethereum's Proof-of-Stake Is Uncertain," *Forbes Digital Assets*, October 11, 2023, https://www.forbes.com/sites/digital-assets/2023/10/11/one-year-after-the-merge-sustainability-of-ethereums-proof-of-stake-is-uncertain/; EU Blockchain Observatory Forum, *Ethereum Merge Trend Report*, April 2023, pp. 7-9, https://blockchain-observatory.ec.europa.eu/document/download/3f78c885-d14e-47cb-b183-f22ef529a258_en?filename=EUBOF3.0_Ethereum_Merge_Trend_Report_final.pdf&prefLang=sl.

[18] Brian Curran, "What Is Proof of Authority Consensus? Staking Your Identity on the Blockchain," *Blockonomi*, July 5, 2018, https://blockonomi.com/proof-of-authority/.

[19] Binance Academy, "Proof of Authority Explained," August 13, 2023, https://www.binance.com/en/academy/articles/proof-of-authority-explained; Alexandru A. Maftei et al., "Blockchain for Internet of Things: A Consensus Mechanism Analysis," *2023 13th International Symposium on Advanced Topics in Electrical Engineering (ATEE)*, Bucharest, Romania, March 2023, pp. 1-5, https://ieeexplore.ieee.org/document/10108211.

[20] Joseph Young, "Proof-of-Work vs Proof-of-Stake: Merits and Disadvantages," *Coinfox*, September 14, 2016, http://www.coinfox.info/news/reviews/6417-proof-of-work-vs-proof-of-stake-merits-and-disadvantages.

[21] For more detail and examples of different government approaches to cryptocurrencies, see CRS Report R45440, *International Approaches to Digital Currencies*.

[22] For more information, see CRS Report R45440, *International Approaches to Digital Currencies*.

Data on Bitcoin mining, specifically, are available; similar data on other currencies are less available. According to the Cambridge Bitcoin Electricity Consumption Index, in December 2021, major Bitcoin mining pools were concentrated in the United States (38%), China (21%), and Kazakhstan (13%).[23] Other countries and regions where significant cryptocurrency mining activities have been identified include Canada and Russia.

In 2021, the Chinese government banned all cryptocurrency transactions, which caused an exodus of cryptocurrency miners to other countries, including the United States. Reportedly, a portion of Chinese miners continued their operations illegally, but the ban impacted the overall global distribution of cryptocurrency mining and, consequently, total energy consumption and fuel mix. In December 2021, China, despite changes in regulation, remained a popular location for cryptocurrency mining, partly due to the comparatively low cost of electricity.[24] In some countries, such as Iran and Kazakhstan, concerns over power reliability have resulted in other restrictions to cryptocurrency mining operations.[25]

A sample survey of the Bitcoin network in 2024—representing approximately 48% of the Bitcoin network's hashrate—found that the network's mining activities, according to respondents' headquarters, had largely shifted to North America since 2021.[26] According to the survey, the top five countries, based on reported power consumption, were the United States (75.4%), Canada (7.1%), Paraguay (3.4%), Norway (2.8%), and Kazakhstan (2.6%).[27]

Many mining pools have opened facilities in the United States in areas that can provide reliable electricity at affordable rates. In the United States, the sale of electricity is governed by a patchwork of federal, state, and local regulations. For the sale of electricity, the states generally have regulatory jurisdiction over retail electricity transactions, though federal and municipal authorities may also play a role.[28] State approaches to regulation vary considerably. Some states and cities dealing with an influx of cryptocurrency mining (because of affordable electricity rates) are instituting local laws as issues arise.

In 2024, the U.S. Energy Information Administration (EIA), the lead federal agency for collecting, analyzing, and disseminating data on U.S. and global energy supply and consumption, conducted a study of the domestic cryptocurrency mining industry. EIA identified mining facility locations in 21 states; the majority of the identified facilities for which EIA had location data were located in Texas, Georgia, and New York.

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[23] CBECI, "Bitcoin Mining Map," January 2022, https://ccaf.io/cbnsi/cbeci/mining_map.

[24] Michel Rauchs et al. "2nd Global Cryptoasset Benchmarking Study," University of Cambridge, December 2018, https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2019-09-ccaf-2nd-global-cryptoasset-benchmarking.pdf.

[25] Peter Guest, "Bitcoin Mining Was Booming in Kazakhstan. Then It Was Gone," *MIT Technology Review*, January 12, 2023, https://www.technologyreview.com/2023/01/12/1066589/bitcoin-mining-boom-kazakhstan/; Reuters, "Iran Bans Cryptocurrency Mining for 4 Months amid Power Cuts," May 26, 2021, https://www.reuters.com/technology/iran-bans-cryptocurrency-mining-4-months-amid-power-cuts-2021-05-26/; Nasser Karimi and Jon Gambrell, "Bitcoin Mining Is One of the Suspected Causes of the Power Outages Disrupting Life in Iran," Associated Press News, December 13, 2024, https://apnews.com/article/iran-blackouts-bitcoin-sanctions-nuclear-program-9ff962e2bc7931e4f4dca79407316df3.

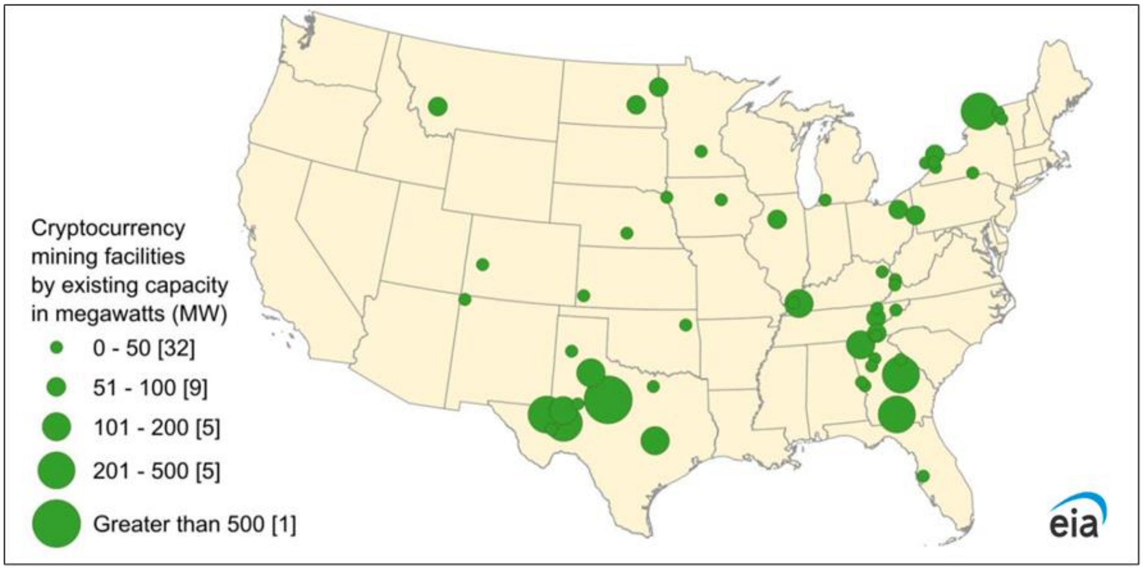
[26] Cambridge Centre for Alternative Finance, *Cambridge Digital Mining Industry Report: Global Operations, Sentiment, and Energy Use*, 1st ed., University of Cambridge Judge Business School, April 2025, p. 46, https://www.jbs.cam.ac.uk/wp-content/uploads/2025/04/2025-04-cambridge-digital-mining-industry-report.pdf.

[27] Cambridge Centre for Alternative Finance, *Cambridge Digital Mining Industry Report: Global Operations, Sentiment, and Energy Use*, 1st ed., University of Cambridge Judge Business School, April 2025, p. 47, https://www.jbs.cam.ac.uk/wp-content/uploads/2025/04/2025-04-cambridge-digital-mining-industry-report.pdf.

[28] For a details on jurisdiction of state and federal policies in regard to electricity markets, see CRS In Focus IF11411, *The Legal Framework of the Federal Power Act*.

Figure 2. Locations and Power Capacity of Selected U.S. Cryptocurrency Mining Operations

Data as of January 2024



Source: Energy Information Administration (EIA), "Tracking Electricity Consumption from U.S. Cryptocurrency Mining Operations," *Today in Energy*, February 1, 2024.

Notes: The representative size shown for a facility is based upon estimates contained in EIA's approach. The number in brackets in the legend represents the number of facilities. EIA identified 137 cryptocurrency mining facilities in its analysis, but had location and energy capacity data for only the 52 facilities identified on the map, which does not include Alaska and Hawaii. This map does not represent a complete inventory of cryptocurrency mining operations in the United States.

The demand for electricity for cryptocurrency mining and other large-scale computing facilities is increasing rapidly in Texas. In 2022, cryptocurrency mining accounted for 3% of local peak electricity demand.[29] In 2024, EIA estimated that electricity demand from large flexible loads—such as cryptocurrency mining operations and data centers—could represent 10% of total electricity consumption on the main electricity grid in Texas in 2025.[30]

How Much Electricity Is Consumed by Cryptocurrency Mining?

Cryptocurrency mining requires electricity to (1) operate the devices computing the calculations required to maintain the integrity of the blockchain and (2) thermally regulate the devices for optimal operation. A *node*, or computing system, on the blockchain may be composed of an individual user (who may be operating a single computer or a group of computers) or a group of

[29] White House, Office of Science and Technology Policy, *Climate and Energy Implications of Crypto-Assets in the United States*, September 2022, p. 5.

[30] The expected demand from large flexible loads was estimated to be 54 billion kilowatt-hours in 2025, which would represent about 10% of the electricity consumption forecasted for the Electric Reliability Council of Texas's (ERCOT's) grid. ERCOT manages 90% of the electric load in Texas. Energy Information Administration (EIA), "Data Centers and Cryptocurrency Mining in Texas Drive Strong Power Demand Growth," *Today in Energy*, October 3, 2024, https://www.eia.gov/todayinenergy/detail.php?id=63344.

users that have pooled resources; as such, the exact number of connected devices on the network is unknown.

Devices have different hashrates—the number of calculations (or hash functions) performed on the network per second—and have different power requirements. Devices with greater hashrates can perform more calculations in the same amount of time than devices with lesser hashrates. For example, "a hashrate of 14 terahashes [14 trillion attempted mining solutions] per second can either come from a single Antminer S9 running on just 1,372 W [watts], or more than half a million [Sony] Playstation-3 devices running on 40 MW [megawatts, or million watts]."[31] As technology continues to advance, hashrates and power use are expected to change. In 2025, the Antminer S19 XP Hyd could operate with a hashrate of 255 terahashes per second on 5,304 W of power while a MicroBT Whatsminer M50S could operate with a hashrate of 126 terahashes per second on 3,276 W.[32]

Four main factors contribute to the electricity consumption of cryptocurrency mining: (1) hardware computing power, (2) network hashrate, (3) difficulty of the cryptographic puzzle, and (4) thermal regulation for the hardware (also referred to as "cooling").[33]

These factors, some of which also interact with the price of Bitcoin, can alter the energy intensity of mining. For instance, in December 2017, the price of Bitcoin rose, which increased the value of the reward miners receive, attracting more miners to the network. As the mining network grew and the competition increased, the network hashrate increased, and the network adjusted to increase the difficulty of the puzzle. Miners sought out more powerful equipment, which increased the computational efficiency on a per-device basis but also increased power consumption overall for the mining network. [34]

Global Bitcoin Network

Several studies have examined the energy consumption associated with the global Bitcoin network; information on the Bitcoin network is provided below. Fewer studies have examined power requirements for other cryptocurrencies, although those studies have found comparatively lower network hashrate power requirements than for Bitcoin.[35]

While technology advancements in devices used for Bitcoin mining have led to increases in the hashrates of mining devices (i.e., improved device efficiency), the network's hashrate has also increased as the popularity of Bitcoin has increased. In mid-March 2018, the Bitcoin network's average daily hashrate was approximately 26 quintillion hashing operations every second.[36] In

[31] Antminer S9 is an application-specific integrated circuit (ASIC) designed for mining Bitcoin and is one of the miners commercially available. A single Playstation-3 device—a home video game console with software capable of supercomputing—has a hashrate of 21 megahashes per second and a power use of 60 watts. See Alex de Vries, "Bitcoin's Growing Energy Problem," *Joule*, vol. 2 (May 16, 2018), p. 801 (hereinafter de Vries, 2018).

[32] MinerStat, "MicroBT Whatsminer M50S vs Antminer S19 XP Hyd," accessed April 10, 2025, https://minerstat.com/compare/microbt-whatsminer-m50s-vs-antminer-s19-xp-hyd?units1=1&units2=1.

[33] George Kamiya, "Bitcoin Energy Use—Mined the Gap," International Energy Agency (IEA), July 5, 2019 (hereinafter IEA, 2019).

[34] IEA, 2019.

[35] Power network requirements were compared for Bitcoin, Ethereum, Litecoin, and Monero; see Max J. Krause and Thabet Tolaymat, "Quantification of Energy and Carbon Costs for Mining Cryptocurrencies," *Nature Sustainability*, vol. 1 (November 2018), pp. 711-718 (hereinafter Krause and Tolaymat, 2018); White House, Office of Science and Technology Policy, *Climate and Energy Implications of Crypto-Assets in the United States*, September 2022, p. 6.

[36] De Vries, 2018.

March 2026, the Bitcoin average daily hashrate was within the range of 840 quintillion to 1,600 quintillion hashing operations per second.[37]

Estimates of the power consumption of the global Bitcoin network depend on the efficiency of different hardware, the number of machines in use, and the cooling requirements for large-scale mining facilities. **Figure 3** presents various estimates for the power required by the global Bitcoin network worldwide. Generally, these estimates use hashrates and miner hashing efficiencies to estimate energy consumption and account for additional facility energy loads (e.g., thermal regulation) through a power usage effectiveness (PUE) ratio.[38] One study relied upon hardware data derived from initial public offering (IPO) filings to estimate power consumption.[39]

Global power requirement estimates for Bitcoin have generally increased within the last 10 years. The average annual daily power demand estimate in 2022 by Cambridge Bitcoin Electricity Consumption Index (CBECI) for the global Bitcoin network was 12.3 gigawatts (GW) in **Figure 3**, which is more than 1% of U.S. electricity generating capacity (or approximately 0.1% of global electricity generating capacity).[40]

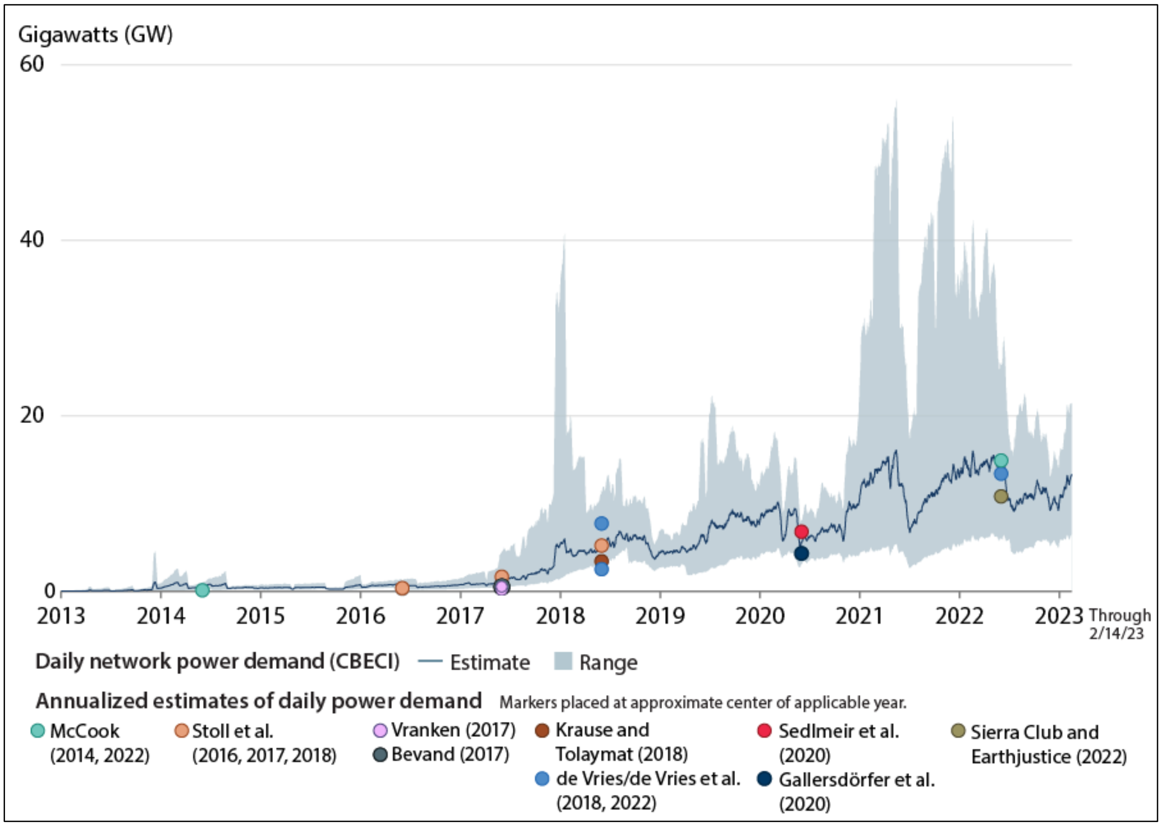
[37] BitInfoCharts, "Bitcoin Hashrate Historical Chart," accessed April 3, 2026, https://bitinfocharts.com/comparison/bitcoin-hashrate.html#3m.

[38] The power usage effectiveness (PUE) ratio is the proportion of total data center energy used (in the numerator) to total IT equipment energy used (in the denominator). For example, a data center with a PUE ratio of 1 would use no electricity other than the IT equipment. A data center with a PUE ratio greater than 1 would use energy for cooling and for the IT equipment. U.S. Office of Management and Budget, "Memorandum for Heads of Executive Departments and Agencies: Data Center Optimization Initiative," M-16-19, August 1, 2016, https://obamawhitehouse.archives.gov/sites/default/files/omb/memoranda/2016/m_16_19_1.pdf, pp. 6-7. This memorandum was rescinded in 2019.

[39] Christian Stoll et al., "The Carbon Footprint of Bitcoin," *Joule*, vol. 3 (July 2019), p. 1648.

[40] According to EIA, in 2022 the total U.S. electric power sector capacity was approximately 1,105 gigawatts (GW); see "Table 9. Electricity Generating Capacity" in EIA, *Annual Energy Outlook 2023*, March 16, 2023, https://www.eia.gov/outlooks/aeo/. The total installed global electricity generating capacity in 2022 was estimated to be 8,522 GW; see EIA, "International Electricity Capacity," https://www.eia.gov/international/data/world/electricity/electricity-capacity.

Figure 3. Global Daily Power Requirement Estimates for Bitcoin Networks



Sources: CRS using Cambridge Centre for Alternative Finance, Cambridge Judge Business School, University of Cambridge, "Cambridge Bitcoin Electricity Consumption Index (CBECI)"; Hass McCook, *An Order-of-Magnitude Estimate of the Relative Sustainability of the Bitcoin Network*, 2nd ed., July 15, 2014, p. 37, https://Bitcoin.fr/public/divers/docs/Estimation_de_la_durabilite_et_du_cout_du_reseau_Bitcoin.pdf; Hass McCook, "Drivers of Bitcoin Energy Use and Emissions," Financial Cryptography and Data Security, FC2022 International Workshops; Max J. Krause and Thabet Tolaymat, "Quantification of Energy and Carbon Costs for Mining Cryptocurrencies," *Nature Sustainability*, vol. 1 (November 2018); Christian Stoll et al., "The Carbon Footprint of Bitcoin," *Joule*, vol. 3 (July 2019), p. 1648; Gallersdörfer et al., "Energy Consumption of Cryptocurrencies Beyond Bitcoin," *Joule*, vol. 4, no. 9 (September 2020); M. Bevand, "Op Ed: Bitcoin Miners Consume a Reasonable Amount Energy—And It's All Worth It," *Bitcoin Magazine*, 2017, https://Bitcoinmagazine.com/articles/op-ed-Bitcoin-miners-consume-reasonable-amount-energy-and-its-all-worth-it/; Harold Vranken, "Sustainability of Bitcoin and Blockchains," *Current Opinion in Environmental Sustainability*, vol. 28 (2017); Alex de Vries, "Bitcoin's Growing Energy Problem," *Joule*, vol. 2 (May 16, 2018); Alex de Vries et al., "Revisiting Bitcoin's Carbon Footprint," *Joule*, vol. 6, no. 3 (March 2022); J. Sedlmeir et al., "The Energy Consumption of Blockchain Technology: Beyond Myth," *Business and Information Systems Engineering*, vol. 62 (June 2020); and Sierra Club and Earthjustice, *The Energy Bomb: How Proof-of-Work Cryptocurrency Mining Worsens the Climate Crisis and Harms Communities Now*, 2022.

Notes: CBECI estimate and range for daily network power demand in this figure assume a nominal average electricity cost of $0.05 per kilowatt-hour. For the lower bound, CBECI assumes the use of efficient hardware and a power usage effectiveness (PUE) ratio of 1.01. For the upper bound, CBECI assumes the use of less efficient but profitable hardware and a PUE ratio of 1.20.

Domestic Electricity Consumption

In 2024 EIA conducted an assessment of electricity consumption in the United States by the cryptocurrency mining industry.[41] EIA analyzed the industry using both a "top-down" approach and a "bottom-up" approach to estimate electricity consumption. The top-down approach relied on data from CBECI. EIA assumed that the share of global activity in the United States remained at approximately 38% to estimate domestic Bitcoin mining electricity use from 25 terawatt-hours (TWh) to 91 TWh, which represents between 0.6% and 2.3% of all United States electricity demand in 2023.[42] The bottom-up approach identified 137 mining facilities as of 2023. EIA identified maximum electricity use for 101 of those mining facilities for a total estimated power demand of 10.275 GW in 2023, or approximately 2.3% of total U.S. average annual power demand in 2023.[43] EIA assumed a utilization rate of 80% for mining capacity (as mining facilities often run at less than their maximum designed capacity) to estimate electricity use of 70 TWh per year, which is within the range of the top-down approach.

The Department of Energy (DOE) also examined the energy consumption of cryptocurrency mining in its response to direction by Congress in the Energy Act of 2020 (Section 1003 of Division Z, P.L. 116-260) to study and make available to the public an update to a report that compares estimates and projections of energy usage of data centers. In addition to estimating total U.S. data center electricity use, the report estimated total cryptocurrency electricity use.[44] The study noted the limited information transparency of the cryptomining industry. The analysis focused on Bitcoin mining and equipment manufactured by the three hardware producers (Bitmain, MicroBT, and Canaan) with an estimated combined market share that exceeds 85%.[45] These three hardware companies, founded in China, reportedly started to produce equipment in the United States in 2024 in response to concerns over tariffs on imports from China.[46] Other study assumptions include a hardware lifetime of five years, a two-month deployment lag of hardware introduction, and PUE ratios of 1.1 and 1.2 (to model more efficient and less efficient equipment, respectively). The analysis relied on CBECI data to provide lower- and upper-bound estimates. For 2024, estimates range from approximately 25 TWh to 100 TWh.[47]

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[41] EIA, "Tracking Electricity Consumption from U.S. Cryptocurrency Mining Operations," *Today in Energy*, February 1, 2024, https://www.eia.gov/todayinenergy/detail.php?id=61364 (hereinafter EIA, "Electricity from U.S. Cryptocurrency Mining," 2024).

[42] Total U.S. electricity demand was 3,900 TWh in 2023. EIA, "Electricity from U.S. Cryptocurrency Mining," 2024.

[43] EIA identified the "maximum power capacity needed to run the mining rigs in MW." The maximum power capacity needed is the power demand at a given time, often in units of MW or GW. This is different from *electricity demand*, which is the amount of power needed over time and which is in units of energy such as TWh. EIA, "Electricity from U.S. Cryptocurrency Mining," 2024.

[44] Arman Shehabi et al., *2024 United States Data Center Energy Usage Report*, Lawrence Berkeley National Laboratory (LBNL), LBNL-2001637, December 19, 2024, https://eta.lbl.gov/publications/2024-lbnl-data-center-energy-usage-report (hereinafter LBNL 2024 report).

[45] LBNL 2024 report, p. 59.

[46] Samuel Shen and Vidya Ranganathan, "Dominant Chinese Makers of Bitcoin Mining Machines Set Up US Production to Beat Tariffs," Reuters, June 18, 2025, https://www.reuters.com/world/china/dominant-chinese-makers-bitcoin-mining-machines-set-up-us-production-beat-2025-06-18/; Jacob Rozen, "China's Pivot to US Production: Game-Changer for Bitcoin Mining," *CoinGeek*, July 14, 2025, https://coingeek.com/china-pivot-to-us-production-game-changer-for-bitcoin-mining/; Wolfie Zhao, "MicroBT Opens US Online Shop with 10,000 WhatsMiner Monthly Production Capacity," *TheEnergyMag*, September 22, 2025, https://www.theenergymag.com/news/2025-09-22/microbt-us-online-shop-bitcoin. For more information on U.S. tariffs on imports from China, see CRS In Focus IF12990, *U.S.-China Tariff Actions Since 2018: An Overview*, by Karen M. Sutter.

[47] The estimates are shown in Figure 6.1 of LBNL 2024 report (p. 61) and appear to fall within a bound of 25 terawatt-hours (TWh) to 100 TWh.

The report also estimated the potential growth of Bitcoin mining in the United States, but did not estimate potential growth for any other cryptocurrencies. The authors developed linear regression models that linked Bitcoin price and energy consumption across different hardware efficiency scenarios. Assuming a "best-guess" hardware efficiency scenario, the model showed that price variations are correlated with changes in energy consumption. The model indicated that for every $1,000 monthly increase in the price of Bitcoin, U.S. cryptocurrency mining energy consumption increased by 0.58 TWh.[48] The report used this finding to model two potential scenarios: the projected growth in energy consumption if Bitcoin doubled in price (x2) between 2024 and 2028 or if Bitcoin quintupled in price (x5) during the same time. The scenarios indicate a potential cryptocurrency increase in electricity consumption in 2028, with consumption ranging from 60 TWh to 480 TWh, depending on price increases and potential hardware efficiencies.[49]

Selected Approaches to Managing Cryptocurrency Mining Electricity Demand

Cryptocurrency mining activities can incur costs associated with equipment, facilities, labor, and electricity. Mining pool companies around the world therefore seek cheap, reliable electricity to reduce costs. As miners are not typically bound by geographic location—they can access networks remotely—they may choose to locate their physical operations in areas with favorable electricity rates and policies. Conversely, miners may choose to *not* locate operations in areas with restrictive regulations or high electricity prices. Some local governments may discourage mining operations due to concerns about electricity availability, electricity affordability, and environmental effects such as noise, water use, and emissions of greenhouse gases and other air pollutants.

New York

In New York, cryptocurrency mining companies initially sought electricity from New York Power Authority's (NYPA's) hydroelectric facility on the St. Lawrence River in 2017.[50] As the demand for electricity by cryptocurrency mining companies increased in New York, policymakers responded in different ways. Concerns over electricity prices, available generation, and environmental effects associated with cryptocurrency mining activities led some New York communities to pass moratoria on new cryptocurrency mining operations.[51] In 2022, New York

[48] LBNL 2024 report, p. 63.

[49] LBNL 2024 report, pp. 64-65.

[50] Antonio Villas-Boas, "This US City Is the First to Ban the Mining of Cryptocurrencies," World Economic Forum, March 19, 2018, https://www.weforum.org/stories/2018/03/for-the-first-time-a-us-city-has-banned-cryptocurrency-mining/.

[51] Examples of communities that have implemented moratoria on new cryptocurrency mining operations include Plattsburgh, NY (from March 2018 to March 2019), and North Tonawanda, NY (from July 2024 to July 2026). Joe LoTemplio, "Plattsburgh Halts Cryptocurrency Mining," *Adirondack Daily Enterprise*, March 19, 2018, https://www.adirondackdailyenterprise.com/news/local-news/2018/03/plattsburgh-halts-cryptocurrency-mining/; Associated Press, "City Lifts Ban on Cryptocurrency Mining Operations," March 1, 2019, https://apnews.com/general-news-f4b9c82d2c8b47a0aff94f2a92c04286; Mackenzie Shuman, "North Tonawanda, N.Y., Bans New Crypto Mining for 2 Years," *Government Technology*, July 17, 2024, https://www.govtech.com/policy/north-tonawanda-n-y-bans-new-crypto-mining-for-2-years; and North Tonawanda Common Council, "City of North Tonawanda Local Law #2: Resolution to Adopt a Two-Year Moratorium on Cryptocurrency Mining and Data Processing Centers," passed July 16, 2024, https://www.northtonawanda.gov/documents/Common%20Council/Moritorium-2.pdf.

State passed a two-year moratorium that blocked issuance of permits and approval of applications for new cryptocurrency mines while the state evaluated their environmental effects.[52]

Other policy responses include addressing concerns about electricity availability and increased electricity prices for other customers. For example, in 2018 the New York Public Service Commission (NYPSC), which regulates and oversees the electric, natural gas, water services, and telecommunication industries in New York, determined that municipal power authorities could issue a new tariff on high-density-load customers (such as cryptocurrency mining operations) that meet certain conditions.[53] Another example is from the New York Independent System Operator (NYISO), which in 2022 updated its load forecasting procedures to require data submission requirements for large load facilities (such as qualifying cryptocurrency mining operations or data centers).[54]

In May 2025, the New York State Department of Environmental Conservation and the Department of Public Service released a draft report on cryptocurrency mining operations.[55] The draft report provided publicly available information on 11 cryptocurrency mining operators in New York, which together represent a total electric demand of approximately 7.7 TWh.[56] The majority of the electric demand (6.1 TWh) is met with electricity supplied by the electric grid, with the remaining 1.6 TWh provided from power generation located on-site at the cryptocurrency mining facilities.[57] According to data provided by NYISO, the draft report indicated that cryptocurrency operators could add approximately 790 MW of increased load through 2026. This requested load increase by cryptocurrency operators accounted for approximately 28% of the total large load requests before NYISO as of March 2024.[58] The report concluded that cryptocurrency mining operators "will have unavoidable energy uses which may contribute to challenges meeting New York's renewable energy transition goals" and noted that effects such as greenhouse gas emissions, electronic waste, waste heat generation, and noise pollution are likely unavoidable.[59] The report identified potential mitigation options that need further evaluation to include waste heat recapture and demand response programs.

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[52] NY Laws of 2022, Chapter 628, which is also known as "the cryptocurrency mining law" or "the cryptocurrency moratorium."

[53] New York Public Service Commission, "PSC Allows Upstate Municipal Power Authorities to Charge Higher Electricity Rates for Heavy Electricity-Using Cryptocurrency Companies," 18018/18-E-0126, March 15, 2018, https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={8541EBEE-E3F7-4989-B121-868F2D2D5804}.

[54] According to the New York Independent System Operator (NYISO), "Pursuant to the NYISO's Transmission Expansion and Interconnection Manual, the NYISO Load interconnection procedures apply to Load Interconnections that are either: a) greater than 10 MW connecting at a voltage level of 115 kV or above, or b) 80 MW or more connecting at a voltage level below 115 kV." See NYISO, *Load Forecasting Manual*, M-06, October 2025, p. 1, https://www.nyiso.com/documents/20142/2924447/load_fcst_mnl.pdf/a694b1c4-7d1b-9382-d171-ff2fbd7ccd0c.

[55] New York State Department of Environmental Conservation, New York State Department of Public Service, *Draft Generic Environmental Impact Statement for Cryptocurrency Mining Operations Using Proof-of-Work Authentication: New York Statewide Evaluation*, prepared by Ramboll Americas Engineering Solutions and Energy Infrastructure Partners, May 2025, https://dec.ny.gov/sites/default/files/2025-05/cryptocurrencygeis.pdf (hereinafter Draft GEIS, May 2025).

[56] Draft GEIS, May 2025, pp. 12-13. Electric demand is based on available electric capacity data and assumes that the facility is operating for 8,760 hours per year, or approximately 24 hours each day.

[57] Draft GEIS, May 2025, pp 12-13. Electric demand is based on available electric capacity data and assumes that the facility is operating for 8,760 hours per year, or approximately 24 hours each day. Other factors such as greenhouse gas emissions, air emissions, water use, noise, and electronic waste are also considered within the draft GEIS report.

[58] Draft GEIS, May 2025, p. 18. In addition to proposed connections considered by NYISO, other proposed connection requests may fall under procedures of other local and state jurisdictions and may not be captured by the analysis.

[59] Draft GEIS, May 2025, p. 45.

Texas

Electricity consumption is increasing quickly in Texas, which is home to some of the largest known operating cryptocurrency mining facilities.[60] The Electric Reliability Council of Texas (ERCOT) serves as the independent system operator of the electric grid in Texas and is responsible for reviewing and managing interconnection requests for large energy loads such as cryptocurrency mining operations.[61]

In 2022, ERCOT developed the process for approving requests for *large flexible loads*, which ERCOT considers to be loads greater than 75 MW, among other characteristics.[62] In 2024, ERCOT was tracking large load requests totaling 63 GW, and by December 2025, ERCOT was tracking approximately 226 GW of large loads requesting interconnection, with many requests exceeding 1 GW per site.[63] The majority of these requests in 2025—approximately 73%—were for data centers. Separately, another 9% of the total (i.e., approximately 20 GW) were for cryptocurrency mining facilities.[64]

ERCOT set up the large flexible load program to help manage growth in electricity demand and to moderate wholesale power prices during times of peak demand or low generator availability. Cryptocurrency mining facilities and some other large load facilities can enter into voluntary curtailment agreements with ERCOT and participate in energy and ancillary service markets. Because cryptocurrency mining operations can curtail energy consumption rapidly compared to other large energy loads, operators in Texas can reduce costs by avoiding higher prices or added fees during peak demand; resell electricity at higher prices; and, in some cases, receive payments for offering to reduce energy-intensive operations.[65] Some see leveraging the energy market to increase profits as an opportunity for cryptocurrency mining operators; others are critical of policies that allow operators to receive payments during periods when other electric customers are experiencing higher costs, such as when the grid is challenged by extreme weather events (e.g., Winter Storm Uri in February 2021, or multiday heatwaves in July 2022 and July 2023).[66]

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[60] EIA, "Data Centers and Cryptocurrency Mining in Texas Drive Strong Power Demand Growth," *Today in Energy*, October 3, 2024, https://www.eia.gov/todayinenergy/detail.php?id=63344; EIA, "Electricity from U.S. Cryptocurrency Mining," 2024.

[61] The Electric Reliability Council of Texas (ERCOT) manages approximately 90% of Texas's electrical load and serves 24 million customers. According to the Federal Energy Regulatory Commission (FERC), "The transmission of electric energy wholly within ERCOT is not subject to the Commission's jurisdiction under sections 203, 205, or 206 of the Federal Power Act." FERC, "ERCOT," January 27, 2025, https://www.ferc.gov/industries-data/electric/electric-power-markets/ercot. For more information on federal electricity issues, see CRS Report R47521, *Electricity: Overview and Issues for Congress*, by Ashley J. Lawson. For more information on the Federal Power Act, see CRS In Focus IF11411, *The Legal Framework of the Federal Power Act*, by Adam Vann.

[62] EIA, "Data Centers and Cryptocurrency Mining in Texas Drive Strong Power Demand Growth," *Today in Energy*, October 3, 2024, https://www.eia.gov/todayinenergy/detail.php?id=63344; Bill Blevins, "Large Flexible Load Taskforce Interconnection and Planning Working Session," June 24, 2022, https://www.ercot.com/files/docs/2022/06/23/LFLTF%20working%20session_06242022.pptx.

[63] Kristi Hobbs, "Item 16.2: System Planning and Weatherization Update," ERCOT Board of Directors Meeting, December 8-9, 2025, pp. 2-3, https://www.ercot.com/files/docs/2025/12/02/16.2-System-Planning-and-Weatherization-Update_Revised.pdf.

[64] Kristi Hobbs, "Item 16.2: System Planning and Weatherization Update," ERCOT Board of Directors Meeting, December 8-9, 2025, p. 2, https://www.ercot.com/files/docs/2025/12/02/16.2-System-Planning-and-Weatherization-Update_Revised.pdf.

[65] Gabriel J.X. Dance et al., "The Real-World Costs of the Digital Race for Bitcoin," *New York Times*, April 9, 2023 (updated January 3, 2024), https://www.nytimes.com/2023/04/09/business/bitcoin-mining-electricity-pollution.html.

[66] Fred Cantu, "Texas Senate Bill Seeks to Regulate Bitcoin Miners and Their Electricity Consumption," CBS Austin, (continued...)

Texas has taken steps to encourage the cryptocurrency mining industry and to manage the expected increases in power demand. For example, in 2021, Texas enacted legislation to establish a Texas Work Group on Block Chain Matters to develop a plan for the industry and recommendations to support the industry.[67] Another example is the Texas Energy Fund; through enacted legislation and a constitutional amendment approved by voters in 2023, the Public Utility Commission of Texas was directed to administer programs within the created Texas Energy Fund, which provides grants and loans to finance electricity generation projects in Texas.[68] Further, some in the industry have developed mobile Bitcoin mining facilities as an approach to making use of stranded natural gas assets in Texas and North Dakota.[69] Some consider such activities as a means of efficiently using natural gas resources that might otherwise be left in the ground; others note potential complicating factors regarding surface land use agreements and existing regulatory programs for oil and gas production operations.[70]

Policy Considerations

Congress may consider options to address the electricity implications of cryptocurrency mining.[71] Selected considerations discussed below pertain to energy consumption and associated emissions; electricity, efficiency, and affordability; and cryptocurrency mining and energy security.

Electricity Data Availability

Many studies note the limited availability of reliable electricity consumption and location data for cryptocurrency mining facilities.[72] Congress may consider the role of federal agencies in relation

March 28, 2023 (updated March 29, 2023), https://cbsaustin.com/news/local/texas-senate-bill-seeks-to-regulate-bitcoin-miners-and-their-electricity-consumption-riot-platforms-ercot-rockdale; Gabriel J.X. Dance et al., "The Real-World Costs of the Digital Race for Bitcoin," *New York Times*, April 9, 2023 (updated January 3, 2024), https://www.nytimes.com/2023/04/09/business/bitcoin-mining-electricity-pollution.html; EarthJustice, "Cryptocurrency Mining in Texas," September 12, 2023, https://earthjustice.org/feature/cryptocurrency-mining-texas; Russell Gold, "Bitcoin Miners Could Save the Texas Grid—or Sink It," August 2022, https://www.texasmonthly.com/news-politics/texas-bitcoin-mining-solar-power-grid/; Tech Transparency Project, *Cryptocurrency Miners' Sweetheart Deal with Texas Threatens an Already Fragile Grid*, July 21, 2022, https://www.techtransparencyproject.org/articles/cryptocurrency-miners-sweetheart-deal-texas-threatens-already-fragile-grid.

[67] David Green and Siddhartha Kazi, "Cryptocurrency in Texas: Opportunities and Challenges in Mining Digital Coins," *Fiscal Notes*, August 2022, https://comptroller.texas.gov/economy/fiscal-notes/archive/2022/aug/crypto-tx.php.

[68] Texas 88th Leg., R.S., Ch. 465 (S.B. 2627), Sec. 2, eff. November 7, 2023; Texas 89th Leg., R.S., Ch. 337 (S.B. 2268), Sec. 1, eff. June 12, 2025; Texas Proposition 7, Creation of State Energy Fund Amendment (2023); Texas Energy Fund Online, "The Texas Energy Fund," accessed January 9, 2026, https://www.txenergyfund.texas.gov/.

[69] Stranded natural gas assets are natural gas resources, reserves, or infrastructure that are uneconomical to develop, produce, operate, or otherwise recover. National Energy Technology Laboratory (NETL) and DOE, *Stranded Natural Gas Roadmap*, 2020, p. 1, https://netl.doe.gov/sites/default/files/2020-12/Stranded-Natural-Gas-Roadmap-04142020.pdf; Jacob Rozen, "Stranded Gas Finds Purpose in Powering Block Reward Mining," *CoinGeek*, September 5, 2025, https://coingeek.com/stranded-gas-finds-purpose-in-powering-block-reward-mining/.

[70] Kenney Broadnax, "Digital Gold: The Impact of Bitcoin Mining on Texas Surface Owners' Rights," *Oil and Gas, Natural Resources, and Energy Journal*, vol. 11, no. 1 (2025), pp. 29-32, https://digitalcommons.law.ou.edu/cgi/viewcontent.cgi?article=1506&context=onej; Emily Burns, "Not All That Glitters Is Black Gold: Using Stranded Gas to Mine Cryptocurrencies and the Public Regulation of Waste," *Oil and Gas, Natural Resources, and Energy Journal*, vol. 11, no. 1 (2025), pp. 36-37, https://digitalcommons.law.ou.edu/cgi/viewcontent.cgi?article=1507&context=onej.

[71] Other cryptocurrency topics that may be of interest to Congress (e.g., a regulatory framework or market structure as proposed in H.R. 3633) are not discussed in this report. For a discussion on other cryptocurrency policy issues, see CRS Report R47425, *Cryptocurrency: Selected Policy Issues*, by Paul Tierno.

[72] See, for example, EIA, "Electricity from U.S. Cryptocurrency Mining," 2024; and LBNL 2024 report, pp. 65 and 67-68.

to certain aspects of the cryptocurrency mining industry, such as data collection content and frequency.

In the 119th Congress, the Clean Cloud Act of 2025 (S. 1475 and H.R. 6179) would amend the Clean Air Act and direct the Administrator of the Environmental Protection Agency (EPA), in conjunction with the Administrator of EIA, to collect information from cryptomining facilities and data centers and their electricity suppliers. Another bill, the Data Center Transparency Act (H.R. 6984), would direct EPA to report on water use, discharges to water, and greenhouse gas emissions by data centers and EIA to report on electricity consumption by data centers and other energy characteristics. H.R. 6984 would define *data center* according to the definition in Section 453(a) of the Energy Independence and Security Act of 2007 (P.L. 110-140; 42 U.S.C. §17112(a)).

EIA has attempted to collect additional information on energy consumption beyond the study previously discussed. In January 2024, EIA requested and received an emergency clearance pursuant to Office of Management and Budget (OMB) procedures to collect data to develop more rigorous estimates of electricity use by U.S. cryptocurrency miners.[73] In February 2024, EIA issued a notice and request for comments on a proposed extension of the collection of information for a cryptocurrency mining facilities survey.[74] On March 1, 2024, EIA formally withdrew and ceased the emergency collection of data request as part of its negotiation with Bitcoin mining companies in response to legal proceedings.[75] To date, EIA has not made another attempt to collect data on the cryptocurrency mining industry. Reportedly, in December 2025, the Administrator of EIA stated that EIA intends to launch several new surveys, including a survey on data centers.[76] On March 25, 2026, EIA announced that it "is launching three voluntary pilot field studies to evaluate energy consumption in data centers."[77] According to a letter from the administrator of EIA in response to a request by Senators Josh Hawley and Elizabeth Warren, "Following evaluation of the pilot studies and resulting data, we currently plan to develop a mandatory survey(s) under the notice and public comment procedures of the Paperwork Reduction Act."[78]

Electricity Consumption and Associated Emissions

Opinions differ on whether future growth in Bitcoin will significantly impact electricity consumption and associated air emissions. Some argue that sustainability concerns due to electricity consumption are misplaced, and that the competitiveness of Bitcoin mining means that only miners with the most competitive mining hardware and the lowest electricity costs will

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[73] The original collection was approved by the Office of Management and Budget on January 26, 2024, under the emergency approval provisions of the Paperwork Reduction Act.

[74] EIA, "Agency Information Collection Proposed Extension," 89 *Federal Register* 9140, February 9, 2024.

[75] Robert Walton, "EIA Reaches Agreement with Bitcoin Miners, Will Destroy Collected Data and Publish New Survey Proposal," *UtilityDive*, March 1, 2024, https://www.utilitydive.com/news/crypto-miners-biden-administration-agreement-EIA-data-collection/708859/.

[76] Arathy Somasekhar, "EIA to Ditch Some Existing Reports and Launch New Surveys on Minerals, Data Centers," Reuters, December 5, 2025, https://www.reuters.com/business/energy/eia-ditch-some-existing-reports-launch-new-surveys-minerals-data-centers-2025-12-05/.

[77] EIA, "EIA Launches Pilot Survey on Energy Use at Data Centers," press release, March 25, 2026, https://www.eia.gov/pressroom/releases/press585.php.

[78] Letter from Tristan Abbey, Administrator of U.S. Energy Information Administration, to Senator Warren, April 9, 2026, https://www.warren.senate.gov/imo/media/doc/sen_elizabeth_warren_-_eia.pdf; Molly Taft, "The US Government Will Ask Data Centers How Much Power They Use," *WIRED*, April 15, 2026, https://www.wired.com/story/the-us-government-to-ask-data-centers-how-much-power-they-use/.

persist over time.[79] They further argue that this competitiveness could lead to fewer miners using energy-inefficient hardware, as miners that use such hardware may no longer be able to compete effectively. Some anticipate that electricity demands will diminish as the reward incentive shifts from discovering new Bitcoin to earning revenue through transaction fees; they therefore argue that high electricity consumption from mining Bitcoin is a temporary issue.[80]

Others recognize the volatility of cryptocurrency markets but observe that network hashrates of several cryptocurrencies have trended upward, suggesting that electricity consumption—and potentially carbon dioxide (CO_2) emissions, if the electricity is provided by fossil-fuel electric power generation without emission capture technology—may increase.[81] These estimates of electricity consumption from network hashrates do not include electricity required for cooling systems and other operations and maintenance activities associated with cryptocurrency mining, so the potential energy consumption and emissions effects could be greater.[82]

One 2018 study on projections of Bitcoin growth considered the potential effects on global CO_2 emissions should Bitcoin eventually replace other cashless transactions.[83] The study found that the associated energy consumption of Bitcoin usage, if broadly adopted for cashless transactions, could potentially produce enough CO_2 emissions to lead to a 2˚C increase in global mean average temperature within 30 years under certain assumptions.[84]

Some have argued that the scenarios in the 2018 study overestimate associated CO_2 emissions by not excluding unprofitable mining equipment, not accounting for technology changes in electric power production and fuel types (and subsequent CO_2 emissions), and not considering other factors.[85] More broadly, some argue that the projections of Bitcoin energy consumption and subsequent emissions do not consider other factors, including the potential effects of a collapse of

[79] Vranken, 2017, p. 8.

[80] According to researcher Christian Catalini, current energy trends of Bitcoin are not permanent and, "once we're at scale and so few bitcoins are being mined that it is essentially irrelevant for the system, the revenue for the miners will have to come from transaction fees. So in equilibrium, the energy and security provided by the network from this wasteful computation will have to be equivalent to the transaction fee." See Chris Mooney and Steven Mufson, "Why the Bitcoin Craze Is Using Up So Much Energy," *Washington Post*, December 19, 2017, https://www.washingtonpost.com/news/energy-environment/wp/2017/12/19/why-the-bitcoin-craze-is-using-up-so-much-energy.

[81] Dongna Zhang et al., "Implications of Cryptocurrency Energy Usage on Climate Change," *Technological Forecasting and Social Change*, vol. 187, no. 122219 (2023), https://doi.org/10.1016/j.techfore.2022.122219; Gianluca Guidi et al., "The Environmental Burden of the United States' Bitcoin Mining Boom," *Nature Communications*, vol. 16 (March 2025), p. 2970.

[82] Krause and Tolaymat, 2018, p. 712.

[83] Camilo Mora et al., "Bitcoin Emissions Alone Could Push Global Warming Above 2˚C," *Nature Climate Change*, vol. 8 (November 2018), pp. 931-933; Camilo Mora et al., "Mora et al. Reply," *Nature Climate Change*, vol. 9 (September 2019), pp. 658-659, https://doi.org/10.1038/s41558-019-0538-1.

[84] Camilo Mora et al., "Bitcoin Emissions Alone Could Push Global Warming Above 2˚C," *Nature Climate Change*, vol. 8 (November 2018), pp. 931-933; Camilo Mora et al., "Mora et al. Reply," *Nature Climate Change*, vol. 9 (September 2019), pp. 658-659.

[85] E. Masanet et al., "Implausible Projections Overestimate Near-Term Bitcoin CO_2 Emissions," *Nature Climate Change*, vol. 9 (September 2019), pp. 653-654, https://doi.org/10.1038/s41558-019-0535-4; N. Houy, "Rational Mining Limits Bitcoin Emissions," *Nature Climate Change*, vol. 9 (September 2019), p. 655, https://doi.org/10.1038/s41558-019-0533-6; L. Dittmar and A. Praktiknjo, "Could Bitcoin Emissions Push Global Warming Above 2 °C?" *Nature Climate Change*, vol. 9 (September 2019), pp. 656–657, https://doi.org/10.1038/s41558-019-0534-5. For more on how the U.S. energy sector has changed since 2014, see CRS In Focus IF12288, *Energy Transition: Affordability, Emissions, and Security*.

Bitcoin prices on hashrates or energy consumption, or whether the capital invested in Bitcoin mining equipment could be used for mining other cryptocurrencies or for other purposes.[86]

Projections of continued growth in energy consumption have led some to call for reform in the cryptocurrency industry.[87] Others argue that continued reliance on fossil-fuel-based electricity is the issue and not the energy intensity of Bitcoin.[88]

Some private-sector efforts have focused on switching to renewable energy sources to reduce reliance on fossil fuels. The Crypto Climate Accord is an alliance of industry members who have committed to net-zero emissions by 2030 for all their crypto-related operations.[89] Some studies have found that cryptocurrency mining combined with renewable energy development could reduce costs and payback periods for renewable energy developers compared to renewable energy projects that connect and deliver electricity to a grid system.[90] Critics contend that cryptomining's energy consumption, a "feature" of the PoW system, could continue to grow and draw renewable electricity generation away from other sectors and negate their potential beneficial impact on GHG emissions.

Congress may consider the federal role in addressing the energy consumption and associated emissions related to the data centers supporting the cryptocurrency mining industry. In the 119th Congress, the Preventing Rate Inflation in Consumer Energy (PRICE) Act Act—H.R. 6983—would require data centers that consume at least 50 MW per day to have on-site electricity generation capable of producing all of the electricity required to operate the data center; the bill also sets clean energy targets for each data center to be met by certain dates.

Electricity, Efficiency, and Affordability

In addition to projections for increased electricity demand from cryptocurrency mining and from data centers due to expanded use of artificial intelligence, other sectors (e.g., manufacturing and transportation) could also increase electricity demand. Meeting increased electricity demand could create challenges for local or regional electric grid reliability and electricity affordability.[91]

86 Krause and Tolaymat, 2018, p. 712; S.A. Sarkodie et al., "Trade Volume Affects Bitcoin Energy Consumption and Carbon Footprint," *Finance Research Letters*, vol. 48 (May 2022), pp. 7-8, https://doi.org10.1016/j.frl.2022.102977.

87 Spyros Foteinis, "Bitcoin's Alarming Carbon Footprint," *Nature*, vol. 554 (February 2018), p. 169, https://www.nature.com/articles/d41586-018-01625-x.

88 Stuart Wimbush, "Cryptocurrency Mining Is Neither Wasteful nor Uneconomic," *Nature*, vol. 554 (March 2018), p. 443, https://www.nature.com/articles/d41586-018-03391-2; Gianluca Guidi et al., "The Environmental Burden of the United States' Bitcoin Mining Boom," *Nature Communications*, vol. 16 (March 2025), p. 2970.

89 For information on the accord, see Crypto Climate Accord, https://cryptoclimate.org/accord/. For information on guidance and accounting of emissions, see Marc Johnson and Sahithi Pingali, *Guidance for Accounting and Reporting Electricity Use and Carbon Emissions from Cryptocurrency*, December 15, 2021, https://cryptoclimate.org/wp-content/uploads/2021/12/RMI-CIP-CCA-Guidance-Documentation-Dec15.pdf.

90 Ali Hakimi et al., "Renewable Energy and Cryptocurrency: A Dual Approach to Economic Viability and Environmental Sustainability," *Heliyon*, vol. 10 (November 2024), p. e39765; "From Mining to Mitigation: How Bitcoin Can Support Renewable Energy Development and Climate Action," *ACS Sustainable Chemistry & Engineering*, vol. 11, no. 45 (November 2023), https://doi.org/10.1021/acssuschemeng.3c05445.

91 U.S. Congress, House of Representatives, *Bipartisan House Task Force Report on Artificial Intelligence*, 118th Cong., 2nd sess., December 2024, pp. 162-173, https://www.speaker.gov/wp-content/uploads/2024/12/AI-Task-Force-Report-FINAL.pdf; CRS Report R48646, *Data Centers and Their Energy Consumption: Frequently Asked Questions*, by Martin C. Offutt, Ling Zhu, and Ashley J. Lawson.

Managing the affordability, reliability, and availability of electricity for cryptocurrency mining facilities, data centers, and other electric customers continues to be of interest to Congress.[92]

Executive actions may also alter the U.S. electricity market. For example, on April 8, 2025, President Trump issued executive orders aimed at supporting coal-fired electricity generation and strengthening electricity reliability and security.[93] On October 23, 2025, Secretary of Energy Chris Wright submitted a letter and advance notice of proposed rulemaking to the Federal Energy Regulatory Commission (FERC) concerning the interconnection of large loads directly to the interstate transmission system.[94] On October 27, 2025, FERC invited public comments on the proposal.[95] FERC received comments from several Members of Congress expressing the importance of electricity affordability for residential customers when considering the interconnection of large loads and new generation.[96] Congress may consider FERC authorities and resources as it considers addressing large load interconnections and the extent to which large loads such as cryptocurrency mining operations could participate in energy and ancillary markets.

In addition to efforts focused on electricity generation, there may be opportunities for energy efficiency. One proposed option is the use of the waste heat generated from cryptocurrency mining equipment. Proponents have proposed directly leveraging the waste heat for space heating

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[92] See, for example, U.S. Congress, House Science, Space, and Technology Committee, Investigations and Oversight Subcommittee, *Powering America's AI Future: Assessing Policy Options to Increase Data Center Infrastructure*, hearing, 119th Cong., 2nd sess., February 24, 2026; U.S. Congress, House Energy and Commerce Committee, *Converting Energy into Intelligence: The Future of AI Technology, Human Discovery, and American Global Competitiveness*, hearing, 119th Cong., 1st sess., April 7, 2025; U.S. Congress, House Energy and Commerce Committee, Energy Subcommittee, *Scaling for Growth: Meeting the Demand for Reliable, Affordable Electricity*, hearing, 119th Cong., 1st sess., March 5, 2025; U.S. Congress, Senate Energy and Natural Resources Committee, *Full Committee Hearing to Examine the Opportunities, Risks, and Challenges Associated with Growth in Demand for Electric Power in the United States*, 118th Cong., 2nd sess., May 21, 2024.

[93] Executive Order 14260 of April 8, 2025, "Protecting American Energy from State Overreach," 90 *Federal Register* 15513, April 14, 2025, https://www.federalregister.gov/documents/2025/04/14/2025-06379/protecting-american-energy-from-state-overreach; Presidential Proclamation of April 8, 2025, "Regulatory Relief for Certain Stationary Sources to Promote American Energy," 90 *Federal Register* 16777, April 21, 2025, https://www.federalregister.gov/documents/2025/04/21/2025-06936/regulatory-relief-for-certain-stationary-sources-to-promote-american-energy; Executive Order 14261 of April 8, 2025, "Reinvigorating America's Beautiful Clean Coal Industry and Amending Executive Order 14241," 90 *Federal Register* 15517, April 14, 2025, https://www.federalregister.gov/documents/2025/04/14/2025-06380/reinvigorating-americas-beautiful-clean-coal-industry-and-amending-executive-order-14241; and Executive Order 14262 of April 8, 2025, "Strengthening the Reliability and Security of the United States Electric Grid," 90 *Federal Register* 15521, April 14, 2025, https://www.federalregister.gov/documents/2025/04/14/2025-06381/strengthening-the-reliability-and-security-of-the-united-states-electric-grid.

[94] Letter from Chris Wright, Secretary of Energy, to Chairman David Rosner and Commissioners of FERC, October 23, 2025, https://www.energy.gov/sites/default/files/2025-10/403%20Large%20Loads%20Letter.pdf.

[95] FERC, Interconnection of Large Loads to the Interstate Transmission System, Docket No.: RM26-4-000.

[96] Letter from Sen. Markey et al. to Chairman Swett of FERC, November 13, 2025, https://www.markey.senate.gov/imo/media/doc/ferc_data_center_energy_costs_letter.pdf; Letter from Sens. Lee and Heinrich to Chairman Swett and Commissioners of FERC, November 18, 2025, https://www.energy.senate.gov/services/files/897F8081-26B9-4215-B476-1A5AC6ABE15C; Letter from Rep. Subramanyam et al. to the Commissioners of FERC, November 21, 2025, https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20251125-4001&optimized=false&sid=6e4a00ca-f6c6-40a2-b985-a33e20dbdda5; Letter from Rep. Mannion to Chairman Swett of FERC, December 2, 2025, https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20251204-4000&optimized=false&sid=6e4a00ca-f6c6-40a2-b985-a33e20dbdda5; Letter from Reps. Pallone and Castor to Chairman Swett of FERC, December 5, 2025, https://democrats-energycommerce.house.gov/sites/evo-subsites/democrats-energycommerce.house.gov/files/evo-media-document/december-2025-ferc-data-centers-letter.pdf.

purposes, while opponents cite the inefficiency of generating heat in this manner, particularly at the residential building scale.[97]

Another option could be transitioning from a PoW consensus mechanism to a less energy-intensive consensus mechanism, such as what Ethereum completed in 2022 with the Merge. A 2022 report by the White House Office of Science and Technology Policy recommended that Congress might consider legislation "to limit or eliminate the use of high energy intensity consensus mechanisms for crypto-asset mining."[98]

Congress could also consider the role of the federal government in funding research in energy technology development, including waste heat optimization, and in algorithmic efficiency, whether for cryptocurrency consensus mechanisms, artificial intelligence, or other computational purposes.[99]

Cryptocurrency Mining and Energy Security

Congress may consider potential energy security implications of cryptocurrency mining. In the 119th Congress, the Senate Select Committee on Intelligence report accompanying S. 2342—the Intelligence Authorization Act for Fiscal Year 2026—stated concerns about Chinese-owned cryptocurrency mining facilities in the United States. The report mentioned the privately owned Chinese company Bitmain—reportedly considered to have about 80% of the market share of cryptocurrency mining hardware—and noted that cryptocurrency mining facilities are equipped with machinery made by Bitmain.[100] Concerns noted in the report include (1) the potential for Bitmain personnel in China to remotely control cryptocurrency mining equipment located within the United States, and (2) the potential for Chinese-owned cryptocurrency mining facilities sited near U.S. defense installations or other sensitive infrastructure to provide an opportunity for China to collect intelligence.[101] In describing concerns with certain cryptocurrency mining operations, S.Rept. 119-51 states that "the Committee directs the relevant elements of the [Intelligence Community] to work together with law enforcement partners in an effort to shut down any Chinese cryptocurrency mining operations that pose a threat to national security."[102]

The ability to remotely disrupt the operation of cryptocurrency mining equipment has been a concern for several years. In 2017, a "backdoor" in Bitmain's firmware was identified that could

[97] Kevin Williams, "Americans Are Heating Their Homes with Bitcoin This Winter," CNBC Crypto World, updated November 26, 2025, https://www.cnbc.com/2025/11/16/bitcoin-crypto-mining-home-heating-energy-bills.html.

[98] White House, Office of Science and Technology Policy, *Climate and Energy Implications of Crypto-Assets in the United States*, September 2022, p. 7. https://bidenwhitehouse.archives.gov/wp-content/uploads/2022/09/09-2022-Crypto-Assets-and-Climate-Report.pdf.

[99] U.S. Congress, House of Representatives, *Bipartisan House Task Force Report on Artificial Intelligence*, 118th Cong., 2nd sess., December 2024, p. 174, https://www.speaker.gov/wp-content/uploads/2024/12/AI-Task-Force-Report-FINAL.pdf.

[100] U.S. Congress, Senate Intelligence (Select) Committee, *Intelligence Authorization Act for Fiscal Year 2026*, report, 119th Cong., 1st sess., July 29, 2025, S.Rept. 119-51, pp. 18-19; Jacob Rozen, "Bitmain's Move to US Sets New Direction for Mining," *CoinGeek*, September 29, 2025, https://coingeek.com/bitmain-move-to-us-sets-new-direction-for-mining/.

[101] A third concern identified in the report pertains to customs and trade issues related to the importation of the equipment; these issues are not discussed herein. U.S. Congress, Senate Intelligence (Select) Committee, *Intelligence Authorization Act for Fiscal Year 2026*, report, 119th Cong., 1st sess., July 29, 2025, S.Rept. 119-51, pp. 18-19.

[102] U.S. Congress, Senate Intelligence (Select) Committee, *Intelligence Authorization Act for Fiscal Year 2026*, report, 119th Cong., 1st sess., July 29, 2025, S.Rept. 119-51, p. 19.

remotely direct cryptocurrency mining machines to stop operating.[103] Bitmain released updates to address the issue in the firmware in 2017, and again in 2019 after another vulnerability was identified.[104] Such potential vulnerabilities, if left unaddressed, could have implications for the energy sector. The power demand of cryptocurrency mining facilities is typically stable over the course of a day, as it is driven by internal computational needs.[105] A sudden, unexpected operational stop could lead to voltage fluctuations and cause flicker, affecting power quality and bulk power system reliability.[106]

Some have cited national security concerns associated with siting cryptocurrency mining facilities near U.S. defense installations. In May 2024, President Biden blocked a real estate purchase and cryptocurrency mining facility development by MineOne (majority-owned by Chinese nationals) near Francis E. Warren Air Force Base (Warren AFB), a strategic missile base and home to Minuteman III intercontinental ballistic missiles in Wyoming; in doing so, then-President Biden cited national security risks linked to foreign-owned real estate and foreign-sourced mining equipment.[107] The May 2024 order followed a review and investigations by the Committee on Foreign Investment in the United States (CFIUS), an interagency body chaired by the Secretary of the Treasury, which referred the issue to the President, having found that

> the proximity of the foreign-owned cryptocurrency mining facility to a strategic missile base and key element of America's nuclear triad, and the presence of specialized and foreign-sourced equipment potentially capable of facilitating surveillance and espionage activities, presented a significant national security risk.[108]

The real estate transaction was not filed with CFIUS until after an investigation, which occurred "as a result of a public tip," reportedly by a team at Microsoft.[109] Congress may consider whether

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[103] Aaron van Wirdum, "Bitmain Can Remotely Shut Down Your Antminer (and Everyone Else's)," *Bitcoin Magazine*, April 26, 2017, https://bitcoinmagazine.com/culture/bitmain-can-remotely-shut-down-your-antminer-and-everyone-elses.

[104] Alyssa Hertig, "Antbleed: Bitcoin's Newest New Controversy Explained," *CoinDesk*, April 27, 2017 (updated December 10, 2022), https://www.coindesk.com/markets/2017/04/27/antbleed-bitcoins-newest-new-controversy-explained; Aaron van Wirdum, "Will This Vulnerability Finally Compel Bitmain to Open Source Its Firmware?," *Bitcoin Magazine*, February 20, 2019, https://bitcoinmagazine.com/business/will-vulnerability-finally-compel-bitmain-open-source-its-firmware; Bitmain, "Antminer Firmware Update – February 2019," February 28, 2019, https://blog.bitmain.com/en/antminer-firmware-update-february-2019/.

[105] North American Electric Reliability Corporation (NERC), *Characterization and Risks of Emerging Large Loads*, white paper, July 2025, p. 7, https://www.nerc.com/globalassets/who-we-are/standing-committees/rstc/whitepaper-characteristics-and-risks-of-emerging-large-loads.pdf.

[106] NERC, *Characterization and Risks of Emerging Large Loads*, white paper, July 2025, pp. 35-36.

[107] Executive Office of the President, "Order of May 13, 2024, Regarding the Acquisition of Certain Real Property of Cheyenne Leads by MineOne Cloud Computing Investment I L.P.," 89 *Federal Register* 43301, May 16, 2024, https://www.federalregister.gov/documents/2024/05/16/2024-10966/regarding-the-acquisition-of-certain-real-property-of-cheyenne-leads-by-mineone-cloud-computing.

[108] U.S. Department of the Treasury, "Statement on the President's Decision Prohibiting the Acquisition by MineOne Cloud Computing Investment I L.P. of Real Estate, and the Operation of a Cryptocurrency Mining Facility, in Close Proximity to Francis E. Warren Air Force Base," press release, May 13, 2024, https://home.treasury.gov/news/press-releases/jy2335.

[109] Executive Office of the President, "Order of May 13, 2024, Regarding the Acquisition of Certain Real Property of Cheyenne Leads by MineOne Cloud Computing Investment I L.P.," 89 *Federal Register* 43301, May 16, 2024, https://www.federalregister.gov/documents/2024/05/16/2024-10966/regarding-the-acquisition-of-certain-real-property-of-cheyenne-leads-by-mineone-cloud-computing; Gabriel J.X. Dance and Michael Forsythe, "Across U.S., Chinese Bitcoin Mines Draw National Security Scrutiny," *New York Times*, October 13, 2023 (updated October 18, 2023), https://www.nytimes.com/2023/10/13/us/bitcoin-mines-china-united-states.html.

CFIUS authorities and composition are sufficient to respond to increased concerns associated with foreign-owned cryptocurrency mining operations within the United States.[110]

In November 2025, it was reported that the Department of Homeland Security opened an investigation into Bitmain to examine whether machines can be remotely controlled for purposes such as surveillance or espionage activities or to interfere with electric power grid operations.[111] The results of the investigation and any potential recommendations or subsequent actions could have implications for the energy sector, Bitmain and competitors such as MicroBT and Canaan, and the U.S. cryptocurrency mining industry broadly. If cryptomining facility operators were required to cease operations or change technology, rapid reductions in energy demand could create stability issues, and extended reductions in energy demand could lead to meaningful change in a local utility's costs or sales (or both).

Congress may consider whether additional federal authorities are needed to address electricity cybersecurity issues. Two bills in the 119th Congress that would provide additional authorities to DOE related to energy security and cybersecurity issues include the Energy Emergency Leadership Act (H.R. 7258) and the Energy Threat Analysis Center Act of 2026 (H.R. 7305). H.R. 7258 would amend Section 203 of the Department of Energy Organization Act (P.L. 95-91) by adding energy emergency and energy security functions to the responsibilities for the Department's Assistant Secretaries. H.R. 7305 would amend Section 40125(c) of the Infrastructure Investment and Jobs Act (IIJA; P.L. 117-58) to expand the authorities for the energy sector operational support for cyberresilience program "to strengthen the collective defense, response, and resilience of the United States energy sector," to clarify that the program is not subject to the Federal Advisory Committee Act (FACA; 5 U.S.C. Chapter 10), to exempt information shared through the program from public disclosure, and to extend the authorization of appropriations for the program through FY2031.

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[110] For more information on the Committee on Foreign Investment in the United States, see CRS In Focus IF10177, *Committee on Foreign Investment in the United States (CFIUS)*, by Cathleen D. Cimino-Isaacs and Karen M. Sutter.

[111] Anthony Cormier et al., "Chinese Maker Behind Most of World's Bitcoin Miners Has Been Focus of U.S. National Security Probe," *Bloomberg*, November 21, 2025, https://www.bloomberg.com/news/articles/2025-11-21/chinese-manufacturer-bitmain-faces-us-security-review; Andjela Radmilac, "A US Crackdown on Bitmain Will Leave Miners Scrambling as Repair Lines and Deliveries Seize Up," *CryptoSlate*, December 1, 2025 (updated December 2, 2025), https://cryptoslate.com/if-bitmain-gets-hit-what-breaks-first-in-the-us-mining-machine/.

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