Bitcoin Mining
2024 Review

TRENDS, INSIGHTS, & THE ROAD AHEAD

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Executive Summary

The Bitcoin mining industry experienced a landmark year in 2024, marked by historic achievements and significant milestones that reshaped the landscape for miners worldwide. This report provides an in-depth analysis of the sector's key developments, covering the state of the Bitcoin network, mining economics, ASIC hardware markets, and the performance of publicly traded mining companies.

2024 was a record-breaking year for the Bitcoin mining industry, marked by historic milestones and significant achievements. Bitcoin entered price discovery mode, surpassing the much-anticipated $100,000 mark and achieving a market capitalization of $2 trillion, overtaking silver. The 4th halving event was a central milestone, cutting the block subsidy in half. With over 94.3% of all Bitcoin now mined, block space demand reached unprecedented levels, occasionally filling blocks to capacity.

Miners added a record amount of hashrate to the network, nearly 300 EH/s, propelling past the 600-, 700-, and 800 EH/s thresholds for the first time. However, hashrate growth wasn't without volatility, as the network experienced periods of sharp pullbacks caused by persistently low profit margins.

The ASIC hardware market faced significant price declines for much of the year, driving previous-generation machine values to record lows. However, as Bitcoin's price rebounded in Q4, ASIC prices showed signs of recovery, suggesting the market may have bottomed out. In total, 30 new ASIC models were introduced in 2024, offering unprecedented hashrate outputs and efficiency levels. Compared to previous years, manufacturers increasingly focused on hydro-cooled systems and standardized racking designs for improved scalability.

The market capitalization of publicly traded Bitcoin mining stocks surpassed $50 billion for the first time, underscoring growing institutional interest and the industry's maturation. Public miners expanded aggressively, increasing their share of the network's total hashrate to over 35%, up from 21% the previous year. Expansion strategies included M&A activity and significant fleet upgrades.

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Despite operational growth, fewer bitcoins were mined due to the halving and intensified competition. In response, public miners adopted strategies such as increasing Bitcoin treasury holdings to capitalize on market conditions. Additionally, some miners further diversified into HPC and AI sectors, generating predictable revenue streams to buffer against mining volatility.

Looking ahead, the Bitcoin mining industry is poised for continued growth, with a focus on operational efficiency, financial sophistication, and technological innovation. As the sector matures, resilience, adaptability, and strategic diversification will remain critical drivers of success.

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STATE OF THE NETWORK

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Blocks in 2024

The Bitcoin network started 2024 at block 823,807 and ended the year at block 877,270. This totals a production of 53,463 blocks with an average block time of 9 min 83 secs. This is 512 blocks less than were produced in 2023 (total 53,975).

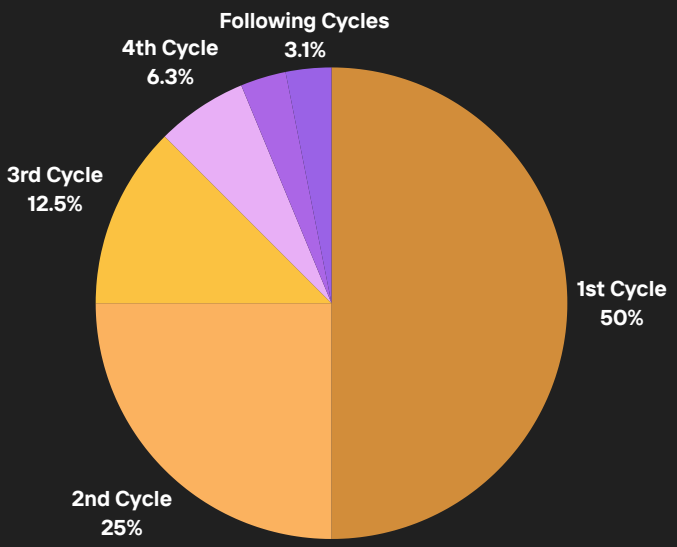
The 4th Halving Event

The Bitcoin halving is an event that takes place exactly every 210,000 blocks, which equates to roughly four years. It marks a programmed reduction in the subsidy awarded to miners for validating transactions and generating new blocks on the network.

At the launch of the Bitcoin network in 2009, miners were rewarded with 50 BTC for each block they validated. Subsequently, in 2012, the first Bitcoin halving occurred, reducing the block subsidy to 25 BTC. Another halving took place in 2016, further reducing the block subsidy to 12.5 BTC. In May 2020, decreased the subsidy to 6.25 BTC. The percentage of coins mined each halving cycle is the same as the block subsidy of that cycle. In the first cycle, the block subsidy was 50 BTC and 50% was mined; in the second cycle, 25 BTC and 25%, and so on.

BITCOIN HALVING CYCLES

Halving	Year	Block Height	Block Subsidy
0	N/A	0	50
1	2012	210,000	25
2	2016	420,000	12,5
3	2020	630,000	6,25
4	2024	840,000	3,125
5	2028	1,050,000	1,5625



Source: Digital Mining Solutions

On April 19th 2024, at block height 840,000, the 4th out of a total of 32 halvings occurred. Bitcoin's supply issuance dropped from 6.25 BTC to 3.125 per block, reducing daily production from 900 to 450 coins a day. At the 4th halving, 93.75% of all Bitcoin was mined and in this cycle 3.125% of the 21 million BTC will be mined. The network is currently in Epoch V. The last Bitcoin is estimated to be mined around the year 2140. This event is known as "Bitcoin's total supply cap." At that stage, miner revenue will rely solely on transaction fees. The total supply at January 1st was 19.8 million or 94.3% of the 21 million BTC.

ViaBTC Hits the Jackpot

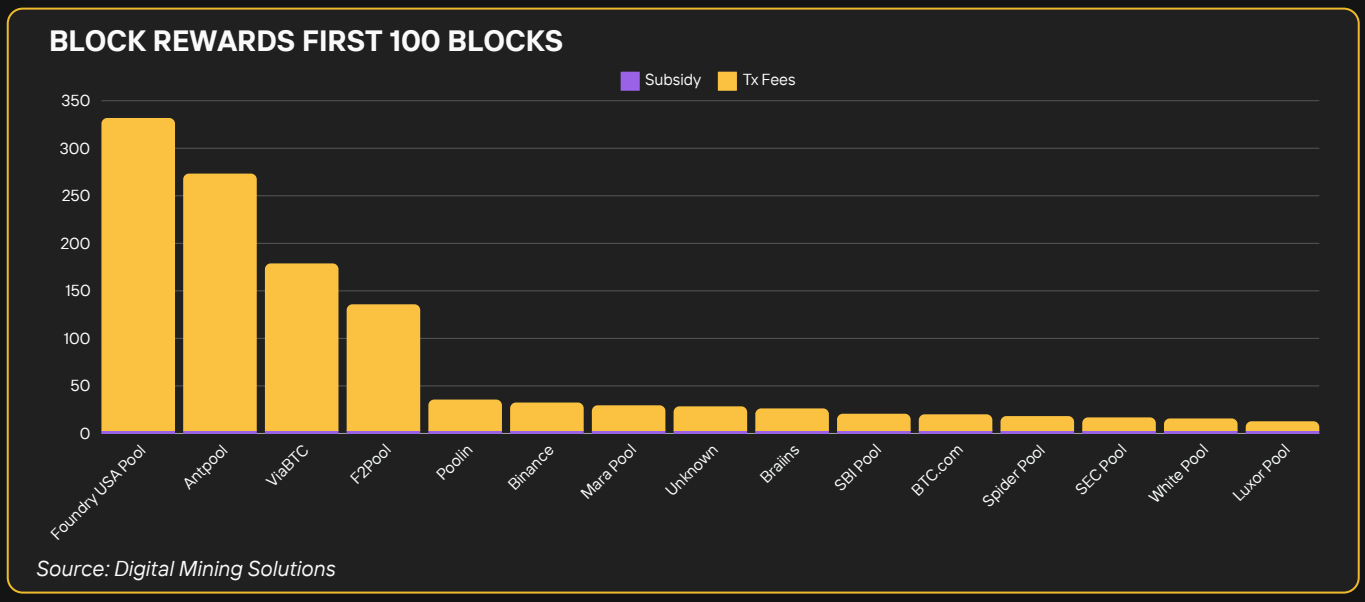
ViaBTC hit the halving block at 840,000 with a whopping 37.626 BTC in transaction fees, resulting in over 40 BTC in total block rewards. This halving block recorded the highest fees seen since May 2021. ViaBTC auctioned off the 'Epic Sat' from the halving block. An Epic Sat refers to the first satoshi mined within the initial block of a halving epoch, occurring every 210,000 blocks. These Epic Sats are deemed rare and collectible, prompting ViaBTC to put this satoshi up for auction. The pool distributed 40.75 BTC to miners, allowing ViaBTC to retain all profits from the auction. The auction concluded with the Epic Sat selling for 33.3 BTC, approximately $2,134,000.

Source: Mempool.Space

The First 100 Blocks

Although block 840,000 was impressive, it wasn't the only one with high fees. In fact, within the first 100 blocks of the new halving cycle, there was an average of 11.19 BTC in fees. The second largest block (840,005), mined by AntPool, contained 29.82 BTC in transaction fees. In total, there were seven blocks with over 20 BTC in transaction fees and 52 blocks with over 10 BTC in fees. Remarkably, all of the first 100 blocks provided a higher fee reward than block subsidy.

Foundry USA Pool emerged as the big winner of the first 100 blocks, mining 31 of them, which contained a total of 328.71 BTC in fees. AntPool secured the runner-up position with 24 blocks, totalling 270.22 BTC in transaction fees. ViaBTC claimed the bronze medal by mining 14 blocks, accumulating a total of 175.73 BTC in fees.



Source: Digital Mining Solutions

Largest-Ever Bitcoin Block

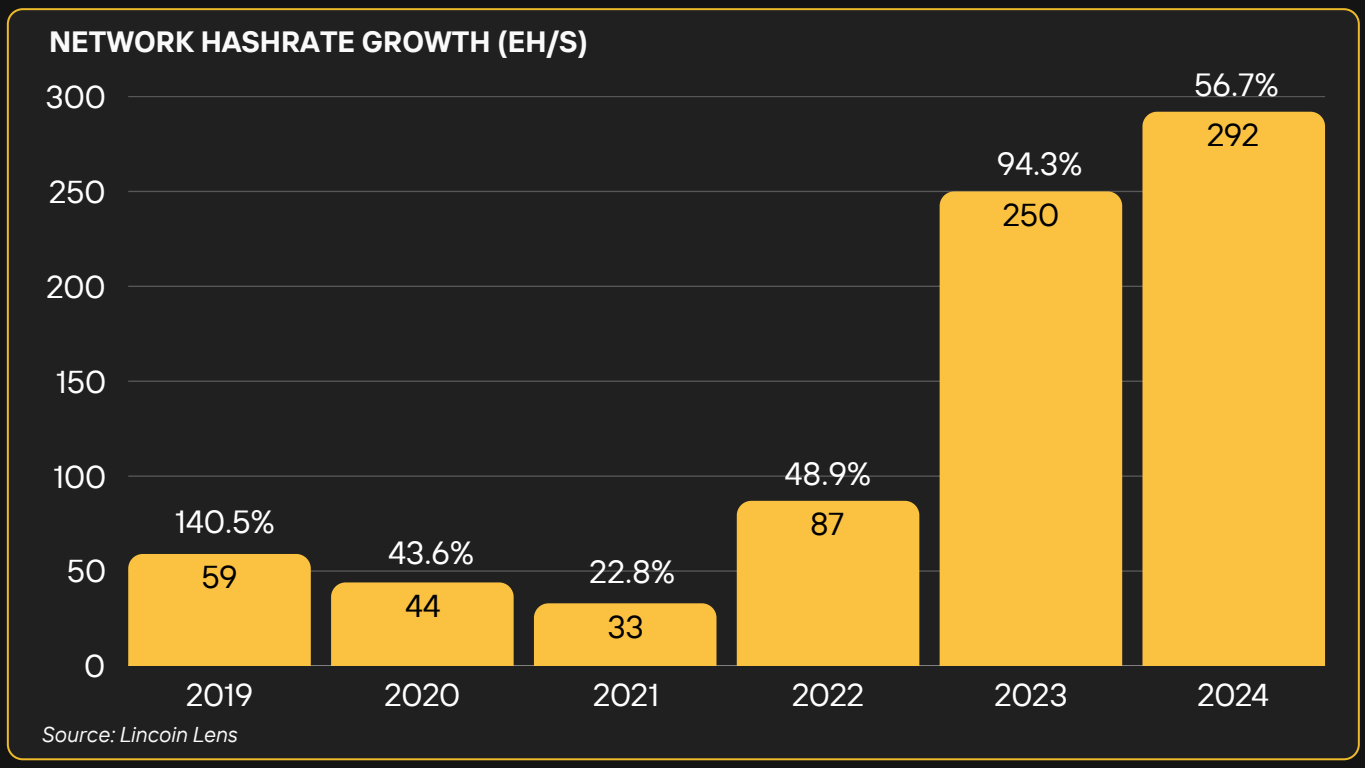
On March 2nd at block height 832,849 Marathon Digital's mining of the largest-ever Bitcoin block. This monumental achievement, accomplished through a collaboration between Marathon Digital's Slipstream and OrdinalsBot, underscores the growing interest in innovative approaches to data inscription and distribution. The block, measuring an impressive 3,990.36 kilobytes.

Network Hashrate

2024 started with a total of 515 EH/s on the 7 Daily Moving Average (DMA). On December 29th the network reached an all-time high of 808 EH/s. The year ended with 807 EH/s which comes down to a growth in hashrate of 56.7%.

Record Breaking Growth

Despite 2024 being a challenging year for miners, with the Halving putting significant pressure on margins, the growth in hashrate deployment has been remarkable. This surge was driven by new facility build-outs and miners upgrading their fleet to the latest-generation machines.



Last year, network hashrate has increased by 292 EH/s, surpassing the 250 EH/s added in 2023. 2024 goes down as a record-breaking year in terms of hashrate growth. Note: Despite a record amount of hashrate being added, the percentage growth is lower than in the previous year. As the network grows larger, each additional EH/s has a smaller impact on overall mining difficulty.

Impact Halving on Hashrate Compared to Previous Cycles

The reduction in the block subsidy, coupled with the lag in Bitcoin price appreciation following halving events, had significant implications for the mining industry. Historically, each halving has led to a decline in hashrate, indicating that miners are forced to take machines offline as they become unprofitable to operate.

Following the last halving in May 2020, there was a significant drop in hashrate. Within just 11 days, the 7-day moving average fell from 120 EH/s to 90 EH/s—a decline of 30 EH/s, or 25.3%. After the 2024 halving, the network hashrate dropped from 654 EH/s to 581 EH/s—a decrease of 73 EH/s, or 11.2%. Following this initial drop, hashrate began to recover alongside a Bitcoin price rally. However, as this price surge was short-lived. Eventually, hashrate fell even further, reaching a local bottom of 551 EH/s, 96 days after the halving. This represents a total decline of 103 EH/s, or 15.8%. While the percentage drop was smaller than in previous halvings, the nominal decline was more than double that of 2020.

NETWORK HASHRATE POST-HALVING

Halving Date	Drop in Hashrate	Days to Recover to Pre-Halving Level
November 28, 2012	-22.9%	58
July 9, 2016	-10.5%	6
May 11, 2020	-25.3%	39
April 19, 2024	-15.8%	96

Source: Digital Mining Solutions

Historical data indicates that hashrate typically recovers to previous levels relatively quickly after halving events. For example, in 2020, it took about 39 days for hashrate to rebound, while in 2016, the recovery was even faster. Following the 2024 halving, hashrate recovered within 36 days but after 2 days dropped sharply to new local lows. It was not until three months later that the network's hashrate consistently remained above pre-halving levels.

Post-Halving Decline Not the Only One

The sharp drop in hashrate following the 2024 halving was significant, but not unprecedented. Over the past year, the network hashrate experienced declines of similar magnitude on four other occasions.

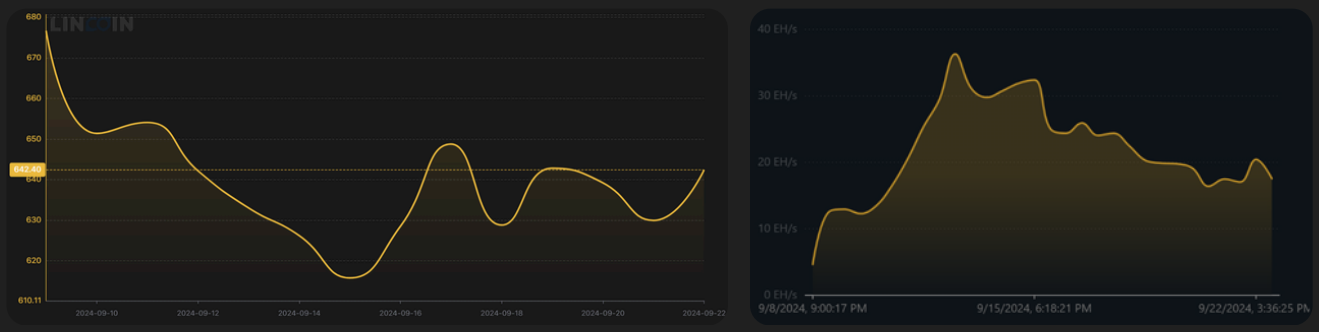
SHARP HASHRATE DECLINES IN 2024

Source: Lincoin Lens

One of the largest hashrate drop occurred in September when Fractal Bitcoin introduced *Cadence Mining*. In this method, miners merge-mine Fractal for one out of every three blocks, while the rest are mined exclusively for Fractal Bitcoin ($FB) via *Permissionless Mining*.

Shortly after the launch of the $FB token, its price surged to $38, leading miners to allocate more hashrate to Permissionless Mining. This shift caused Fractal Bitcoin's hashrate to spike by over 36 EH/s. The increase in Permissionless Mining likely contributed to a decline in Bitcoin's network hashrate, as it coincided with a local bottom in Bitcoin's hashrate.

BITCOIN HASHRATE VS PERMISSIONLESS MINING

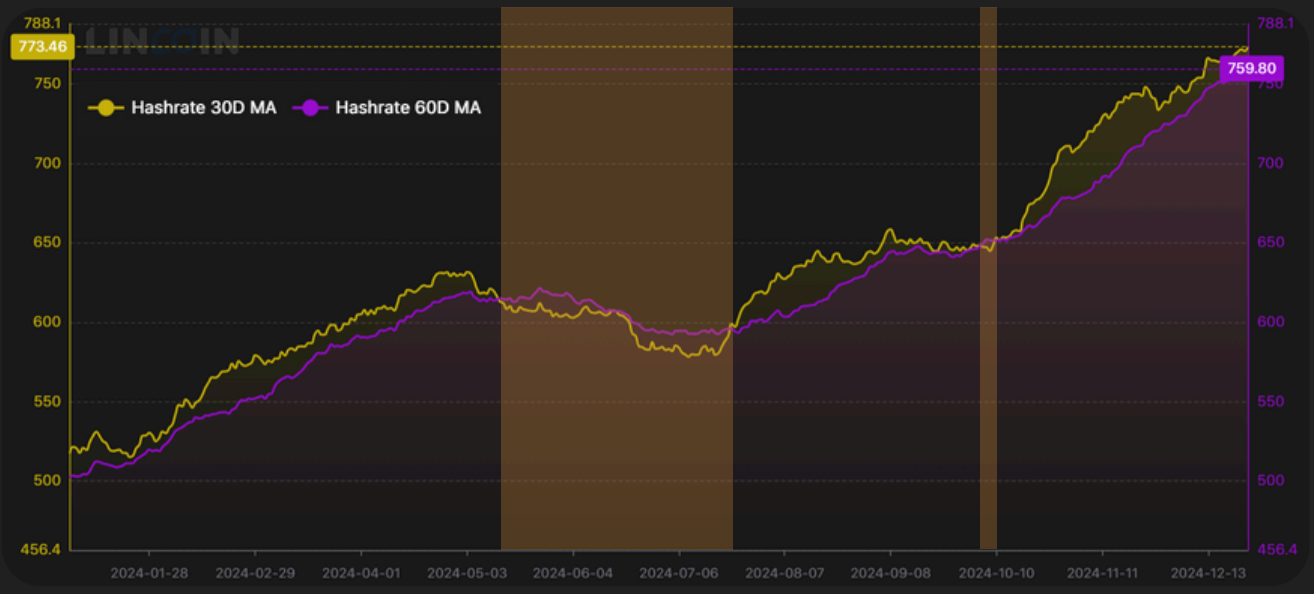


Source: Lincoin Lens & fractalecosystem

Second Largest Miner Capitulation Phase in History

The Bitcoin Hash Ribbons indicator identifies periods when miners are under stress and may be capitulating. It highlights times when mining rigs are shut down due to challenging market conditions, causing hashrate drops. When the 30-day moving average (30DMA) falls below the 60-day moving average (60DMA), it signals miner capitulation, represented by orange vertical lines.

HASH RIBBONS INDICATOR



Source: Lincoin Lens

Following the halving, a miner capitulation phase lasted 77 days—one of the longest in Bitcoin's history, surpassed only by the 2021 capitulation during the China mining ban. In October, the two averages crossed again. Although the 30DMA moved back above the 60DMA within three days, this brief capitulation reflects the prolonged tight margins miners have faced throughout the year.

Geographical Trends

The United States remains the undisputed leader in Bitcoin mining, but the global mining landscape is far from static. Emerging regions like Africa and, South America are increasingly leveraging underutilized and stranded energy resources.

AI/HPC Competes with Miners in the US

The demand for power from AI and HPC (High-Performance Computing) workloads has grown significantly in recent years. This trend is particularly pronounced in the United States, where power is abundant, the electrical grid is reliable, high-speed fibre optic infrastructure is widely available, and the regulatory environment is comparatively favourable. These factors make the U.S. an attractive hub for AI/HPC data centres, which are increasingly competing with Bitcoin miners for energy resources.

For U.S.-based miners, especially those reliant on on-grid power, the harsh mining economics and lucrative AI/HPC business tempted them to diversify into other compute. In 2024, several public Bitcoin mining companies, allocated significant portions of their power capacity to AI/HPC workloads. Some mining firms even went a step further, refurbishing existing mining facilities into higher-tier data centres to accommodate GPUs and other hardware optimized for AI applications.

CORE SCIENTIFIC FACILITY MAKEOVER

Source: Core Scientific

Despite this intensifying competition, Bitcoin's network hashrate in the U.S. has continued to grow across multiple states, highlighting the resilience and adaptability of the mining industry. Many miners in the US have been upgrading their fleet before and after the halving to stay competitive. In the US, Texas remains a mining hub with an estimated 28.5% of the US's 38% global hash rate.

Ethiopia Technological Leader in Africa

Ethiopia is quickly emerging as a major player in Bitcoin mining, contributing and estimated 2.5% of the global hashrate. With operations consuming 600 MW of power, and expected to reach 1 gigawatt within a year.

The country's ascent followed China's 2021 mining ban, which prompted companies like Bitmain-backed BitFuFu and BIT Mining to relocate to Ethiopia, drawn by its abundant hydropower and renewable energy surplus. Russian firm Bitcluster has built a 120 MW facility, while local players like Hashlabs Mining cater to global clients.

The Ethiopian government has embraced Bitcoin mining, generating over multiple millions in revenue in 2024. In the beginning of the year Ethiopian Investment Holdings (EIH) partnered with West Data Group to launch a $250 million project, positioning Ethiopia as a leader in Africa's $5.4 billion data center industry. With a planned installed capacity of 5.15 gigawatts when completed the Grand Ethiopian Renaissance Dam (GERD) will be the largest hydroelectric power plant in Africa. Bitcoin mining offers a way to monetize surplus energy while supporting electrification efforts.

Bitcoin mining could add $2–$4 billion annually to Ethiopia's GDP, serving as a blueprint for other African nations. By leveraging its energy resources, Ethiopia is paving the way for economic growth and positioning itself as a technological leader in Africa.

POWER GENERATION OF THE GRAND ETHIOPIAN RENAISSANCE DAM

Russia's Strategic Push and Regional Restrictions

In 2024 Russia solidified its position in the cryptocurrency mining and high-performance computing markets, with a focus on Bitcoin mining and AI workloads. BitRiver, the nation's largest data centre operator, has partnered with the Russian Direct Investment Fund to build mining and AI computing facilities across BRICS nations. This initiative, announced at the BRICS Business Forum in Moscow, underscores Russia's intent to lead in global computing.

BRICS—a coalition of Brazil, Russia, India, China, and South Africa, recently joined by Egypt, Ethiopia, Iran, Saudi Arabia, and the UAE—represents over 40% of the global population and a quarter of global GDP. By tapping into this alliance, Russia seeks to expand its influence in mining and technology.

THE BIGGEST MINING FACILITY IN RUSSIA - BITRIVER

Source: BitRiver

Domestically, Russia has taken decisive steps to regulate mining. A new law signed by President Vladimir Putin legalizes cryptocurrency mining but restricts participation to registered Russian entities and individuals. Small-scale mining by individuals is permitted within government-mandated energy consumption limits. Crypto mining will be banned entirely in 10 Russian regions for six years. Russian lawmakers also approved seasonal restrictions in key cryptocurrency mining regions to prevent energy blackouts.

Putin views cryptocurrency and digital assets as pivotal to Russia's economic future, urging rapid infrastructure development and regulatory clarity. With its abundant energy resources and geopolitical positioning, Russia is leveraging Bitcoin mining as a cornerstone of its broader digital economy strategy, ensuring it remains competitive in this fast-evolving sector.

Regulatory Uncertainty in Paraguay Drives Miners to Argentina and Brazil

Paraguay, the hotspot for Bitcoin miners in South America due to its low electricity costs, now faces increasing regulatory uncertainty that is pushing miners to explore neighbouring countries like Argentina and Brazil. In 2024, Paraguay implemented several measures to regulate cryptocurrency mining, focusing on combating illegal activities and enhancing energy management.

The Paraguayan Senate passed legislation imposing severe penalties on individuals who steal electricity for cryptocurrency mining. In response to ongoing issues with energy theft, the government proposed a temporary suspension of cryptocurrency mining activities for six months. Authorities intensified efforts against illegal mining, leading to significant seizures.

For legal mining operations, the government introduced a bill recognizing crypto mining as an industrial and innovative activity. This legislation requires miners to register with the Ministry of Industry and Commerce (MIC) and obtain approval from the National Electricity Administration (ANDE) for energy consumption. Alongside introducing a crypto-specific rate for new power purchase agreements, the government imposed a rate hike on existing contracts, sparking friction between legal miners and authorities.

200 MW DATA CENTER BUILD-OUT BY BITFARMS IN YGUAZU PARAGUAY

Source: Bitfarms

This uncertain environment contrasts sharply with developments in Argentina and Brazil, where Bitcoin mining is gaining traction. Argentina, in particular, has seen eye catching projects such as a state-owned energy firm YPF partnering with Genesis Digital Assets (GDA) to utilize stranded natural gas for mining. This initiative not only reduces carbon emissions by up to 63% but also monetizes gas that would otherwise go to waste, showcasing how Bitcoin mining can drive sustainability and economic value. The election of Bitcoin-friendly President Javier Milei has further bolstered Argentina's position as a Bitcoin mining hub, with the government actively supporting crypto-friendly policies. Similarly, Brazil's vast renewable energy resources and growing interest in digital assets make it an attractive destination for miners. Various off-grid sites are being developed as grid power rates in Brazil are high.

Nordics Reuse Heat to Stay Competitive

Bitcoin mining in Europe faces significant challenges due to high energy costs and stringent regulations, making conventional mining models increasingly untenable. In 2024, innovative solutions like heat recycling have emerged as the most feasible way to mine Bitcoin while aligning with regulatory and environmental priorities.

Projects in Finland and Norway demonstrate the potential of reusing heat from mining operations. Marathon Digital's projects in Finland warm nearly 80,000 residents by utilizing excess heat generated by Bitcoin mining rigs through district heating systems. Similarly, Terahash integrated hydro-cooled WhatsMiner M63S devices into Finland's heating infrastructure, delivering 70°C water for year-round heat to a town of 12,000 residents. In Norway, Sazmining's 2.6 MW facility turns mining heat into a critical resource for a remote fishing village, replacing oil boilers and aiding local fish-drying businesses.

MARATHON'S ASIC HEATING SETUP

Source: MARA

These initiatives highlight how Bitcoin mining can contribute to sustainability and community welfare. By reusing heat, miners reduce energy waste, mitigate high operational costs, and demonstrate compliance with Europe's environmental and regulatory standards.

Network Efficiency

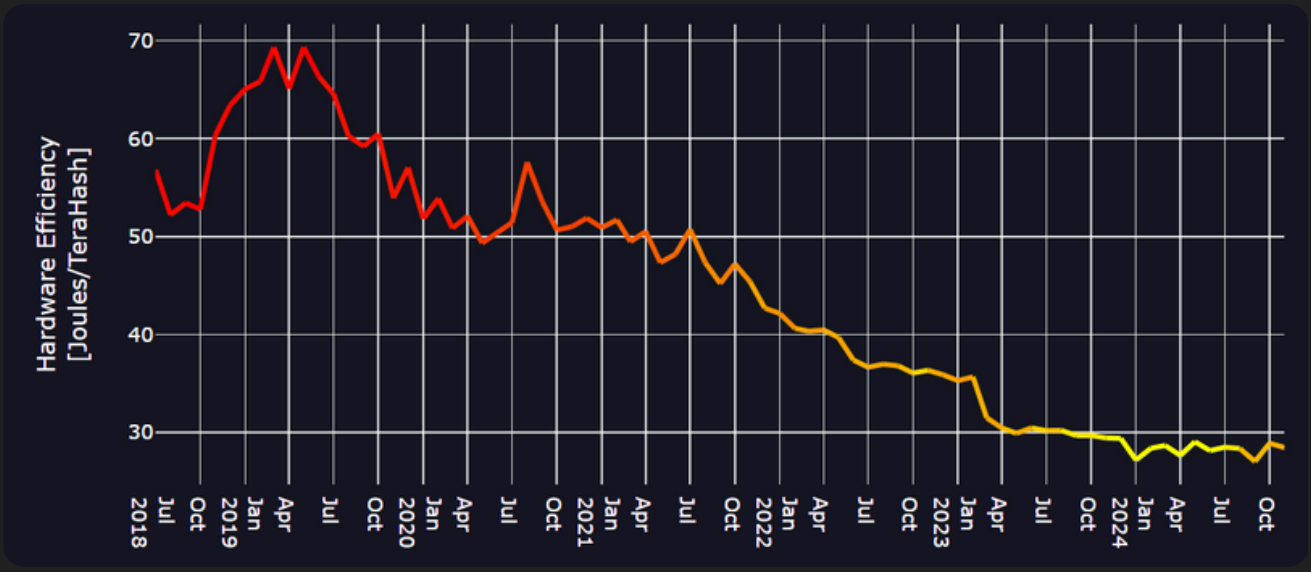
While in 2023 there was a significant improvement in the efficiency of the Bitcoin network, this was not the case for 2024. Last year showed a lot of similarity with the previous halving year. Just like in 2020, a new generation of ASIC hardware was introduced and similar to four years ago the effect of these new efficient machines on the network are not immediate.

Efficiency Stagnating

A big part of the new ASIC miners that came online in 2024 consisted of machines with improved efficiency (sub 20 J/TH). Coinmetrics measured the occurrence of each hardware model. Their data shows that the Bitmain Antminer S21 series, which was introduced in 2024, made up about 4.1% of the total network at the end of last year

The estimated average efficiency of the Bitcoin network has been leveling off over the past year as the pace of efficiency improvements at the ASIC level has slowed. The impact of the latest-generation machines on the network takes time due to the lengthy process of manufacturing and deploying new miners. For example, the S19 XP was introduced in mid-2021, but it wasn't until January of last year that the XP accounted for 20% of the network. Throughout 2024, the network's efficiency showed little improvement.

ESTIMATED BITCOIN NETWORK EFFICIENCY



Source: CoinMetrics

Considering the timeline of the S19 XP's adoption and its delayed impact, it is likely that the effects of the sub 20 J/TH generation on network efficiency will only become noticeable by late 2025 or even 2026.

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2024 Review

MINING ECONOMICS

Bitcoin Price

The price of Bitcoin is one of the most critical metrics when analyzing mining economics, as it directly impacts revenue, profitability, and overall market sentiment. From a price perspective, 2024 has been an exceptional year for Bitcoin, marking a significant milestone in its cyclical journey.

All-Time high, $100K and $2T Market Cap

Price-wise, 2024 has been an exceptional year for Bitcoin. When observing yearly candles, it's clear that Bitcoin continues to follow its historical cycle patterns. Over the past decade, there have been three bear market years, represented by red candles. Each of these was followed by three consecutive years of green candles. In line with previous cycles, Bitcoin closed the second year after a bear market in the green. On January 1st, 2024, BTC opened at $42,200 and ended the year at $93,400. This marks a 121.3% year-over-year increase.

BTC 12-MONTHS CANDLES

Source: Tradingview

2024 was a remarkable year for Bitcoin, breaking several noteworthy records. For the first time in its history, Bitcoin reached an all-time high before the halving. Although it took several months after the halving for the price to remain consistently above the previous ATH, this achievement marked a unique milestone.

Donald Trump's U.S. presidential election victory in early November propelled Bitcoin into uncharted territory in a sustained way. The Trump administration's stance is considered bullish for Bitcoin for several reasons.

Trump is committed to building a strategic Bitcoin stockpile for the U.S. government, aims to remove anti-Bitcoin figures from key positions, has pledged to protect the right to self-custody for Bitcoin holders, and vowed to block the implementation of a central bank digital currency (CBDC) under his administration. Furthermore, he has begun appointing pro-Bitcoin leaders. Additionally, favourable energy policies are expected to reduce operating costs for Bitcoin miners. With the momentum of the Trump pump, Bitcoin hit another significant milestone: $100.000.

The $100K Bitcoin was also unique because it meant Bitcoin surpassed a $2 trillion market cap. This achievement underscores Bitcoin's remarkable growth over just 15 years since its inception. For comparison, Amazon took 29 years to reach the $2 trillion mark, while Apple achieved the milestone in 42 years, hitting $2 trillion in 2020. With $1.9 trillion, Bitcoin ended 2024 as the 7th largest asset by market cap worldwide and above silver.

TOP ASSETS BY MARKET CAP JANUARY 1ST 2025

Rank	Name	Market Cap
1	Gold	$17.876 T
2	Apple	$3.785 T
3	NVIDIA	$3.288 T
4	MicroSoft	$3.133 T
5	Alphabet (Google)	$2.323 T
6	Amazon	$2.306 T
7	Bitcoin	$1.902 T
8	Saudi Aramco	$1.808 T
9	Silver	$1.676 T
10	Meta Platforms (Facebook)	$1.478 T

Source: Company Market Cap

Bitcoin Breaking ETF Records

One of the main drivers for the price increase since January has been the influx of ETF investments. The first trading week of U.S. spot Bitcoin exchange-traded funds (ETFs) was exceptionally active, with over $4.6 billion in trading volume on the first day alone. This high level of activity continued throughout the week, with a cumulative trading volume that surpassed $7.9 billion by the end of the first week.

These figures highlighted the strong investor interest and market demand for Bitcoin ETFs in the early days of their availability. These strong inflows lasted until half way March when Bitcoin surpassed the 2021 ATH. As Bitcoin traded sideways in the $55-72K range for various months, ETF demand dried up. Once price started trending upwards to the $70,000 level in October, inflows started picking up again.

The Bitcoin ETFs had an incredible election week, with November 7 setting a record for single-day net inflows at around $1.5 billion across all spot ETFs. BlackRock's ETF led the charge, contributing approximately $1.1 billion of these inflows.

TOTAL BITCOIN SPOT ETF NET INFLOW (USD) 2024

Source: Coinglass

On December 17th spot Bitcoin ETFs alone held $123.34 billion, just shy of the $125 billion in spot gold ETFs. This achievement comes less than a year after the SEC approved spot Bitcoin ETFs in January. BlackRock's iShares Bitcoin Trust leads the market with nearly $60 billion in assets, having overtaken BlackRock's iShares Gold Trust in November.

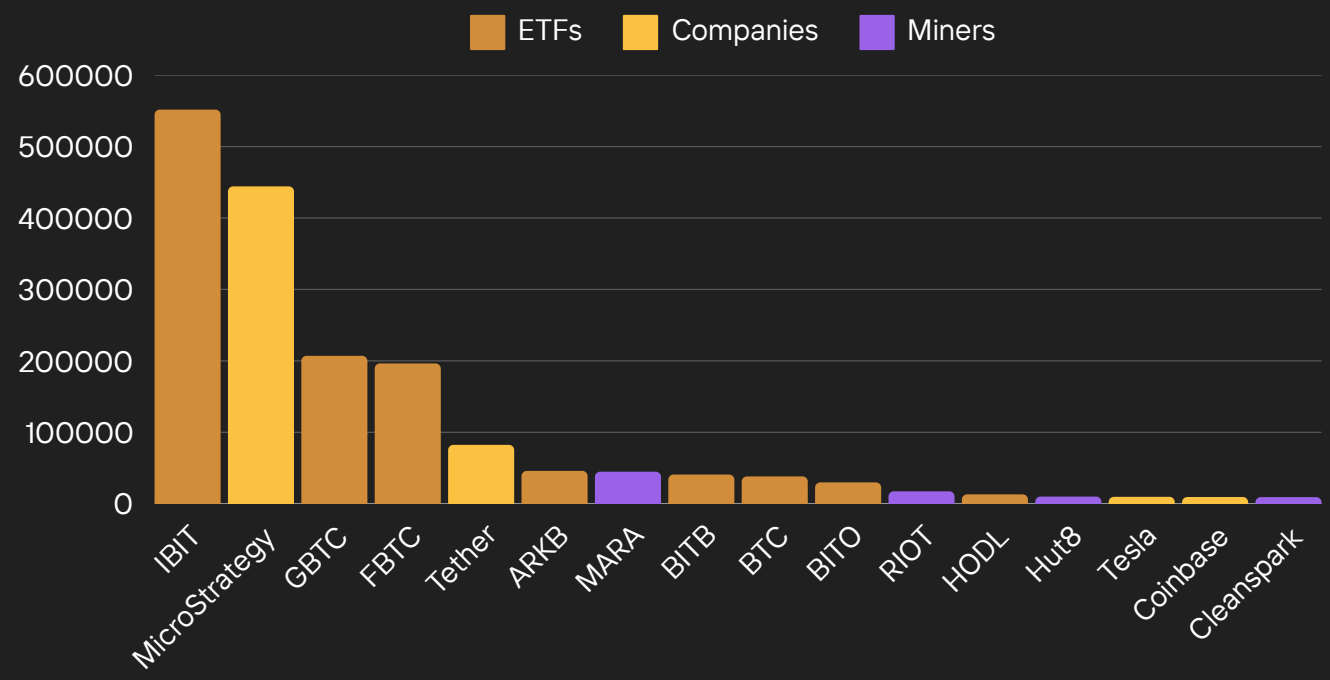
Institutional Buying, The MicroStrategy Playbook

The MicroStrategy playbook refers to the strategic approach pioneered by MicroStrategy, where the company uses Bitcoin as a primary treasury reserve asset. This involves reallocating excess cash and raising capital through debt or equity to purchase Bitcoin, viewing it as a long-term hedge against inflation and currency devaluation. The strategy relies on the belief that Bitcoin's scarcity and decentralized nature make it a superior store of value compared to traditional assets like cash or bonds. The playbook's success hinges on a strong conviction in Bitcoin's long-term price appreciation and its ability to outperform other asset classes over time.

In 2024, several companies adopted the MicroStrategy playbook. OneMedNet, a health tech company, allocated funds from its recent funding round to purchase Bitcoin. Similarly, Kontrol Technologies, a Canadian public company, invested $1 million to acquire Bitcoin. In the mining industry, various companies followed MicroStrategy's example by acquiring Bitcoin alongside mining it. Marathon Digital Holdings led the charge, raising $250 million through a debt offering to purchase additional Bitcoin. Cathedra Bitcoin, initially a self-mining firm, shifted its business model to focus on developing data centers, using profits to acquire more Bitcoin in alignment with MicroStrategy's strategy. In Q4, Hut 8 announced the launch of a $500 million at-the-market (ATM) equity program for acquiring infrastructure assets, repurchasing securities, and building a Bitcoin reserve. Riot Platforms, Inc. also revealed plans to raise $500 million through a private offering of convertible senior notes due 2030, with proceeds earmarked for Bitcoin acquisitions and general corporate purposes.

As shown in the figure below, BlackRock iShares Bitcoin Trust ($IBIT) is the biggest holder of Bitcoin, followed by MicroStrategy, Grayscale Bitcoin Trust, Fidelity Wise Origin Bitcoin Trust and Tether. The publicly traded miners combined are the 6th largest holders of BTC. MARA is the biggest holder amongst the Bitcoin miners with a total of 44,394 BTC on their balance sheet, followed by Riot Platforms (17,429 BTC), Hut 8 (10,096 BTC) and CleanSpark (9,297 BTC)

BITCOIN HOLDINGS



Source: Hodl15Capital

Exchange Reserve Hit Three-Year Low

Exchange reserves refer to the total amount of Bitcoin held in wallets or addresses controlled by exchanges. According to CryptoQuant data, exchange reserves declined steadily throughout 2024. Falling 23%, from 3M+ BTC to 2.3M, reaching a three-year low. This drop reflects a growing trend among Bitcoin investors to move away from centralized exchanges. Instead of keeping their assets on these platforms, many are turning to self-custody solutions, which provide them with direct control over their Bitcoin. This shift, driven by security concerns and a desire for greater ownership, has reduced the liquidity of Bitcoin on centralized exchanges, potentially lowering sell pressure in the market.

EXCHANGE RESERVE - ALL EXCHANGES

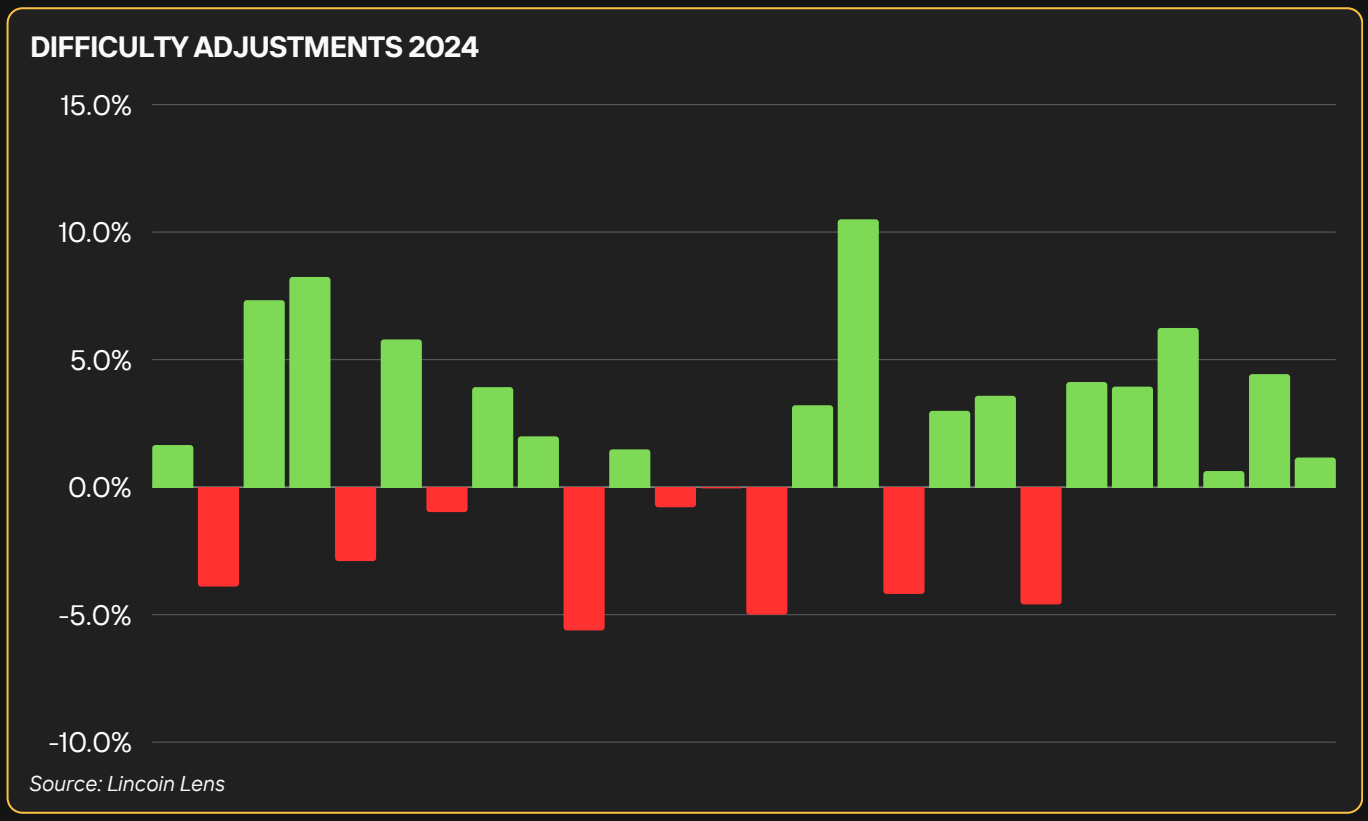
Source: CryptoQuant

Network Difficulty

Network difficulty in Bitcoin mining refers to the level of complexity or difficulty associated with finding a new block in the Bitcoin blockchain. It is a dynamic parameter that adjusts approximately every 14 days, or specifically every 2016 blocks, based on the total hashrate of the Bitcoin network.

Record Nominal Growth

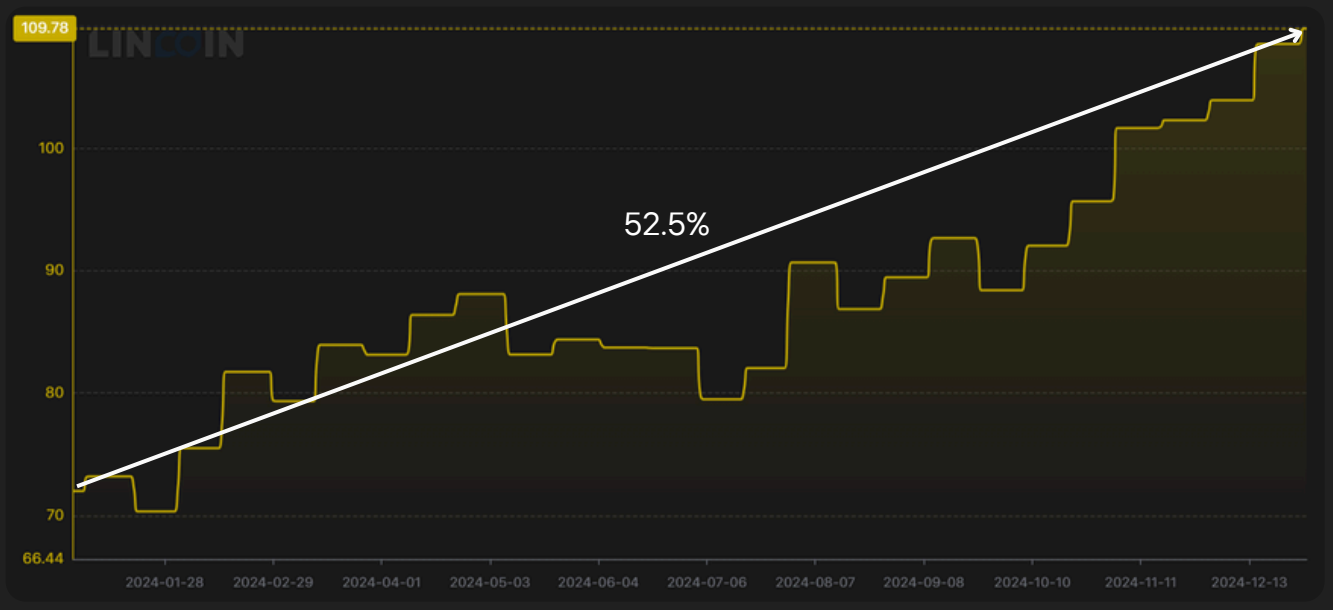
The primary purpose of adjusting network difficulty is to ensure that the average time it takes to mine a new block remains approximately 10 minutes. The 10-minute target for block creation is crucial for various reasons. It helps control the issuance rate of new bitcoins, provides a consistent rate of transactions added to the blockchain, and ensures a predictable and steady issuance of rewards to miners. If miners contribute more computational power to the network, making it easier to find blocks, the difficulty increases. Conversely, if the total hashrate decreases, the difficulty decreases.



Source: Lincoin Lens

In 2024, there were a total of 26 difficulty adjustments, including nine downward and 17 upward adjustments. The largest upward adjustment, at 10.5%, occurred on July 31st. The largest downward adjustment, at -5.62%, took place on May 9th, during the third adjustment after the halving.

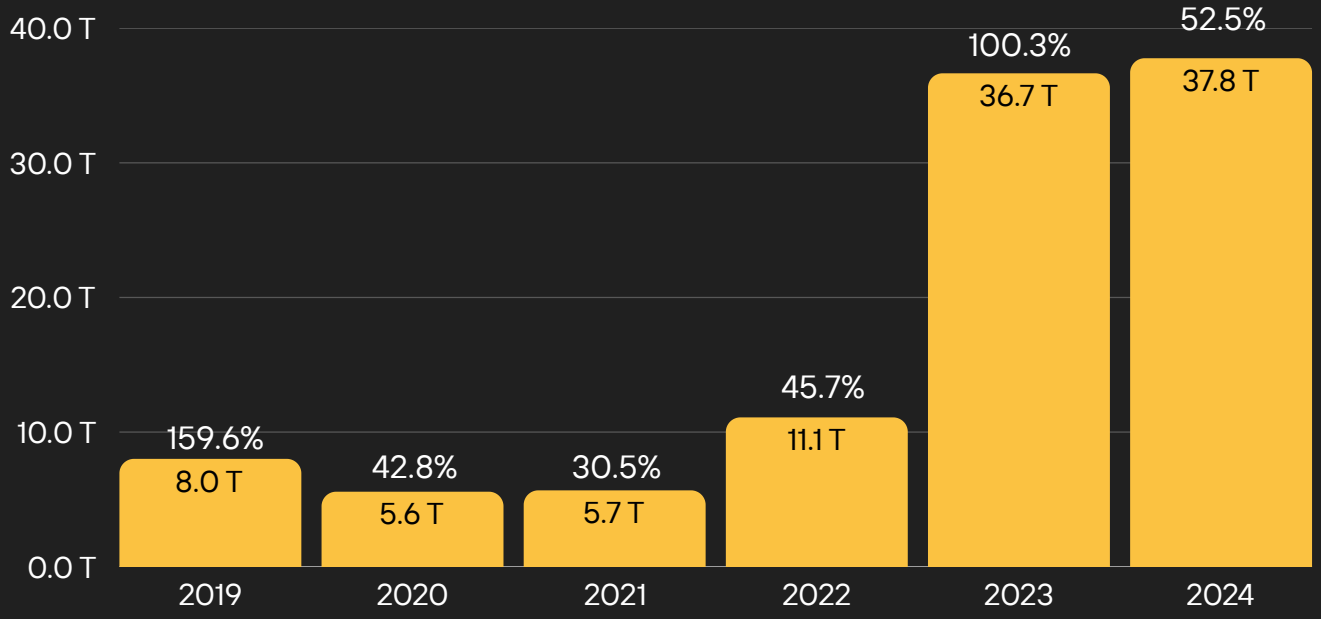
DIFFICULTY INCREASE LINE CHART



Source: Lincoin Lens

The year began with a network difficulty of 72.01 T and ended at 109.78T, marking a 52.5% increase. While the nominal increase in difficulty was slightly higher than in 2023, the percentage increase in 2024 wasabout half of that in the previous year.

DIFFICULTY INCREASE LINE CHART



Source: Lincoin Lens

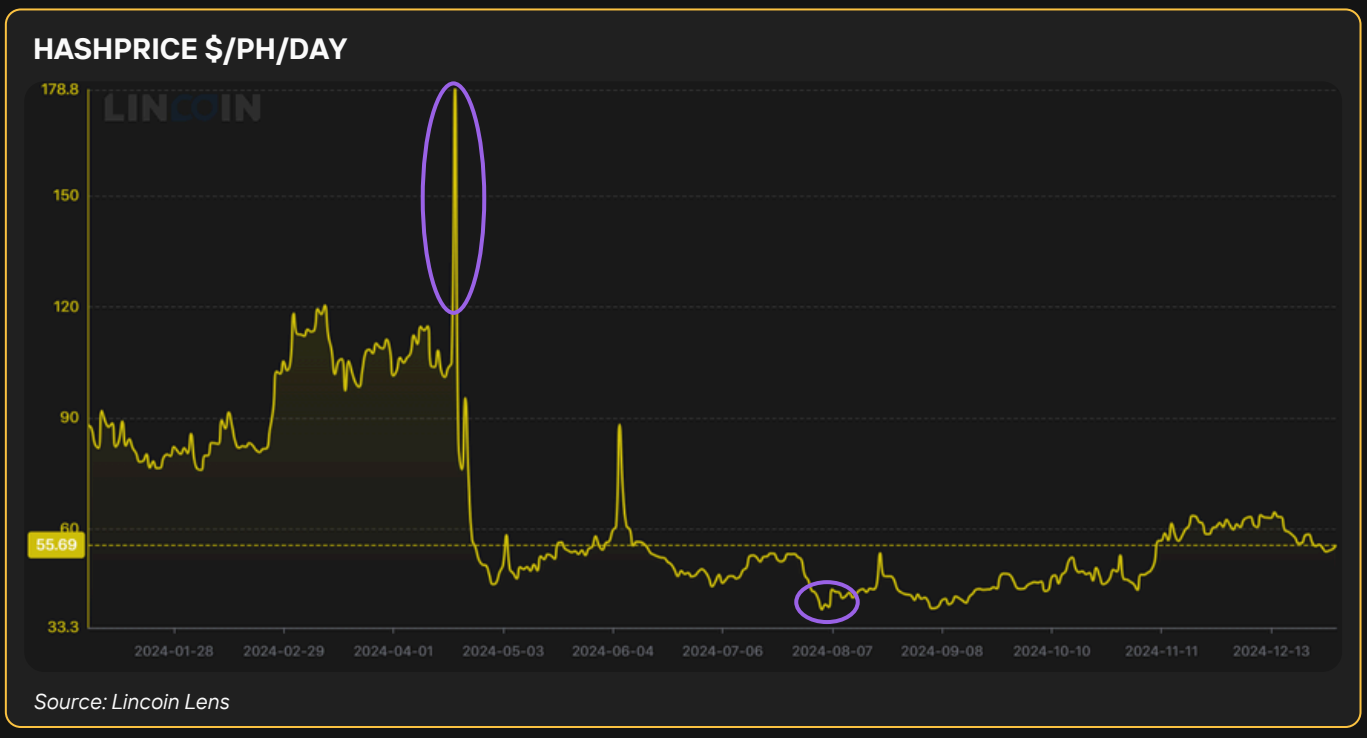
Hashprice

Hashprice is determined by network difficulty, block subsidy, transaction fees, and Bitcoin's price. It represents the expected earnings for a miner in USD ($) per Petahash (PH/s) of computing power per day. In 2024, the Halving event had a significant impact as block subsidy was sliced in half, hashprice tumbled to record lows.

Historic Lows

The computational power of an individual ASIC miner is typically measured in Terahashes per second (TH/s), while a fleet of miners is often measured in Petahashes (PH/s), where 1 PH/s equals 1,000 TH/s. On a larger scale, the total computing power of the Bitcoin network is measured in Exahashes (EH/s), equivalent to one million TH/s.

Until the halving, hashprice fluctuated between $75 and $120/PH/day. Around the halving event, transaction fees spiked, driving hashprice to $179/PH/day—the highest level in 2024 and a price not seen in two years. Unsurprisingly, the halving of the block subsidy had a significant impact on hashprice, causing it to plummet to a historic low of $38/PH/day on August 4th. Hashprice started the year at $91/PH/day and ended 2024 at $55/PH/day, a 39.6% decline, but up 44.7% from the record low of $38/PH/day.



Source: Lincoin Lens

Analyzing the Impact of the 2020 vs. 2024 Bitcoin Halvings

Following the 2020 halving, hashprice experienced a significant decline, falling from $160/PH/day to $70/PH/day—a 56.3% drop. This post-halving low occurred 69 days after the halving. Hashprice remained subdued for approximately six months but eventually rebounded to pre-halving levels as Bitcoin's price surged to new all-time highs toward the end of 2020. Hashprice fully recovered after 220 days after the halving.

During the 2024 halving, transaction fees spiked, temporarily driving hashprice up by 71% to levels last seen in April 2022. However, excluding this fee-driven surge, hashprice was $103/PH/day before the halving and dropped to $38/PH/day—a 63.1% decrease. It took 107 days to reach this record low.

As of the time of publication, Bitcoin is over 250 days into the current halving epoch. Despite bullish BTC price action, hashprice has yet to recover to pre-halving levels. At the current network difficulty, Bitcoin would need to reach $178,200 to restore hashprice to $103/PH/day.

POST HALVING HASHPRICE 2020 VS. 2024

Source: Lincoin Lens

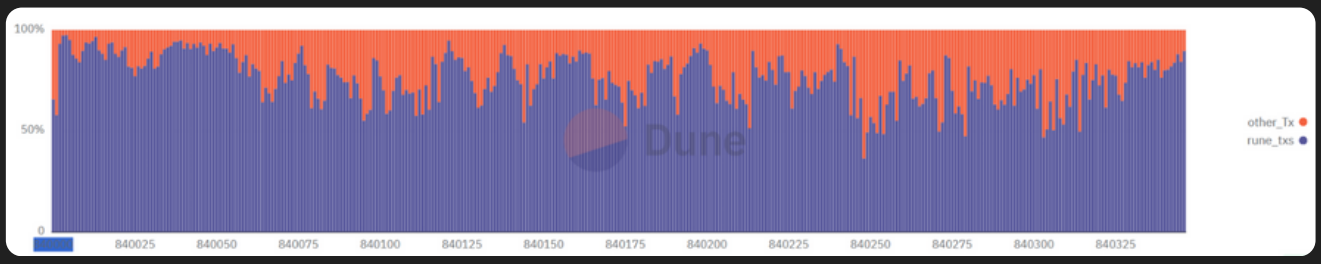
Transaction Fees

At the start of 2024, transaction fees remained elevated following the 2023 Ordinal inscriptions boom. The surge in interest for creating and trading these digital assets and tokens led to substantial demand and increased competition for block space. While this peaked in December 2023, it continued to result in relatively high transaction fees during Q1 2024.

Inscriptions and Tokens

One of the most noteworthy event with regards to transaction fees, was the launch of the Runes fungible token protocol at the halving (block 840,000). This token standard on Bitcoin offers users a more efficient way to create fungible tokens. There was a significant spike in transaction fees around the halving, driven by the excitement surrounding the Runes protocol. In fact, the Runes protocol dominated transactions in the first 100 blocks of the new cycle, accounting for as much as 97.5% of total block transactions and consistently staying above 55%.

RUNES TX FEES AS A PERCENTAGE OF TOTAL BITCOIN FEES



Source: Lincoin Lens

Halving Block Worth Over 40BTC

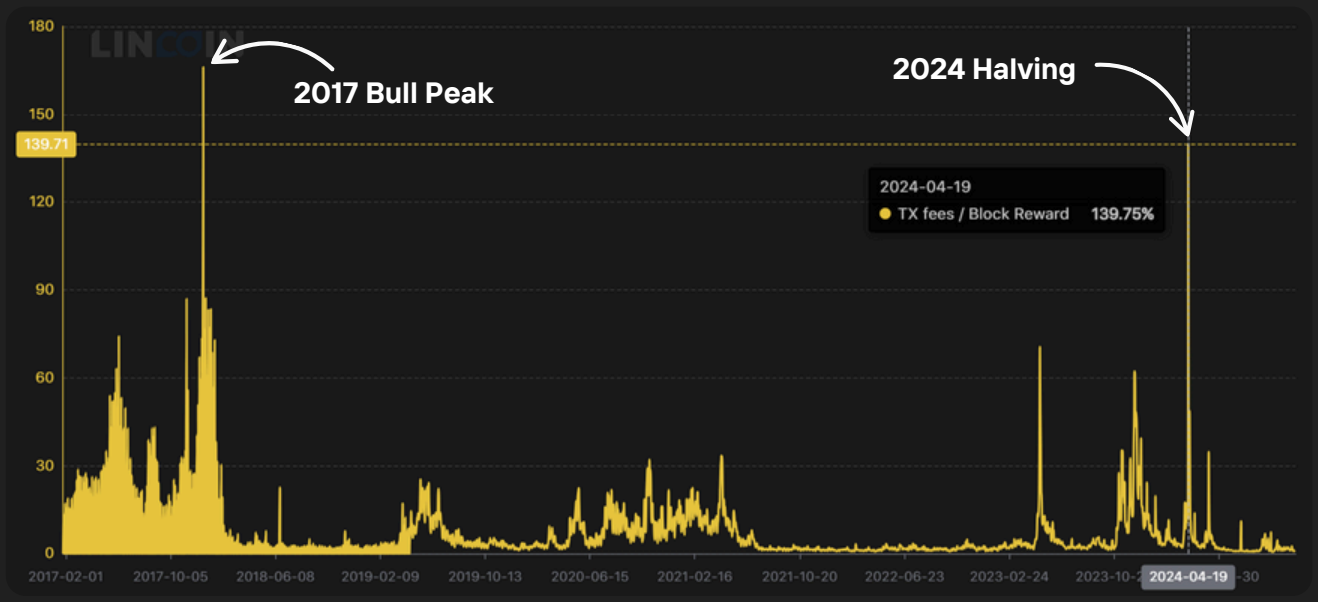
ViaBTC mined the halving block at 840,000 with a remarkable 37.626 BTC in transaction fees, resulting in over 40 BTC in total block rewards. This halving block recorded the highest fees seen since May 2021. The first 100 blocks of the new halving cycle averaged 11.19 BTC in fees, with the second largest block (840,005), mined by AntPool, containing 29.82 BTC in transaction fees. In total, there were seven blocks with over 20 BTC in transaction fees and 52 blocks with over 10 BTC in fees. Remarkably, all of the first 100 blocks provided a higher fee reward than the block subsidy. The elevated transaction fees only lasted about ten days.

Transaction Fees > Block Subsidy

With transaction fees spiking at the halving, there was a significant surge in transaction fees as a percentage of the total block reward. This figure reached as high as 139.8% on the day.

The highest level since 2017. However, unlike in 2017, when higher fees were more sustained, this time the percentage of transaction fees dropped below 30% within a day. The average transaction fees fell from $90 at the peak to less than $3.

TX FEES / BLOCK REWARDS



Source: Lincoin Lens

OKX Bidding Against Itself

On June 7, miners experienced another surge in transaction fees. Several blocks contained transaction fees in BTC that exceeded the block subsidy. This marked the first time since the launch of the Runes project that this occurred. Much of the activity came from the OKX exchange, primarily related to internal transactions aimed at consolidating outputs. Exchanges periodically perform these consolidation actions for wallet management purposes. However, OKX's faulty transaction fee estimation code led the exchange to inadvertently bid up fees on its own transactions, creating a feedback loop that drove up the fee rate for its UTXO (Unspent Transaction Output) consolidation.

BTC Locked in Babylon Staking Protocol

The last surge in Bitcoin transaction fees in 2024 was driven by users rushing to lock their BTC into a staking protocol called Babylon. This protocol allows users to lock their Bitcoin in designated addresses to gain voting power in a proof-of-stake (PoS) system and earn staking rewards. Babylon offers a thrustless, self-custodial script for locking funds for a set period in exchange for PoS voting rights. The mainnet launched with an initial cap of 1,000 BTC and a per-transaction limit of 0.05 BTC, resulting in intense fee competition as users hurried to participate.

According to Mempool.space, medium-priority fees spiked as high as 1,557 sat/vB—approximately $1,286—at the protocol's launch. During this fee surge, seven blocks contained more transaction fees than block subsidies, with total fees in these blocks exceeding 67 BTC (about $4 million).

TX FEES / BLOCK REWARDS

Source: Mempool.space

Premium For Selling Hashpower at NiceHash Marketplace

NiceHash offers a cryptocurrency mining marketplace where users can buy or sell hashing power. Miners can rent out their hashrate or buy hashing power to mine coins like Bitcoin, without owning the hardware. The platform supports multiple algorithms.

The pricing is based on supply and demand. NiceHash works with a Real-Time Pay-Per-Share (RTPPS) system, allowing miners to earn in real time based on the spot price of hashrate. Unlike traditional pay-per-share models, RTPPS calculates the price of shares every minute, driven by buyer demand. Often, this price surpasses the regular PPS or FPPS rates, enabling miners to earn a premium on their computational power.

PREMIUM FOR SELLING HASHRATE ON THE NICEHASH MARKETPLACE

Source: NiceHash

In September, the benefits of selling hashrate on the NiceHash marketplace became clear as the premium saw a huge surge. While hashprice—the revenue per petahash (PH) per day—was hovering around historic lows, miners selling their hashrate on the NiceHash marketplace saw a significant surge in profitability. On September 11th, the pay rate on NiceHash spiked to 0.0019931 BTC/PH/Day due to high demand, compared to the regular block rewards of 0.0007145 BTC/PH/Day. This jump reflected a hashprice of $116/PH/Day, a massive 205% increase over the market rate of $38/PH/Day at the time. Although the pay rate calmed down afterwards, it remained significantly up for a sustained period of time.

In September, the Fractal Bitcoin team introduced a merge mining method called Cadence Mining. With this method, miners produce one out of every three blocks by merge mining with Bitcoin, while the remaining blocks are mined by miners focused on Fractal. The launch of Cadence Mining has been an important driver that increased demand for rented hashrate to mine Fractal, presenting a lucrative opportunity for hashrate sellers to take advantage of the demand related to the newly launched $FB token.

Bitcoin Mining
2024 Review

ASIC HARDWARE MARKET

SPONSORED BY: nicehash

Price Dynamics

Unlike the previous four years, which saw significant price surges and declines, the ASIC market in 2024 was relatively uneventful. Prices across all tiers continued to decline steadily until Q4, when bullish Bitcoin price action appeared to establish a market bottom.

The Price Floor Likely Reached

The ASIC Price Index by Luxor Technologies provides the current USD price per terahash ($/TH) for various Bitcoin mining ASICs. The hardware is divided into three efficiency tiers, or "generations," based on their energy consumption, measured in joules per terahash (J/TH).

- **Under 19 J/TH** represents the latest generation of ASIC miners, featuring highly efficient models such as Bitmain's Antminer S21, S21Pro, S21 XP and MicroBT's Whatsminer M66S Immersion, M63S Hydro, M60S.
- The **19–25 J/TH** category includes Whatsminers M66 Immersion, M63 Hydro, M60, Antminer S19K Pro and Canaan Avalonminer A1466, A1366.
- The **25–38 J/TH** tier represents features mid-generation machines, such as the popular Antminer S19 series (S19, S19a, S19i, S19j Pro, S19j Pro+), T19 series and Whatsminer M30, M50, M53 series.

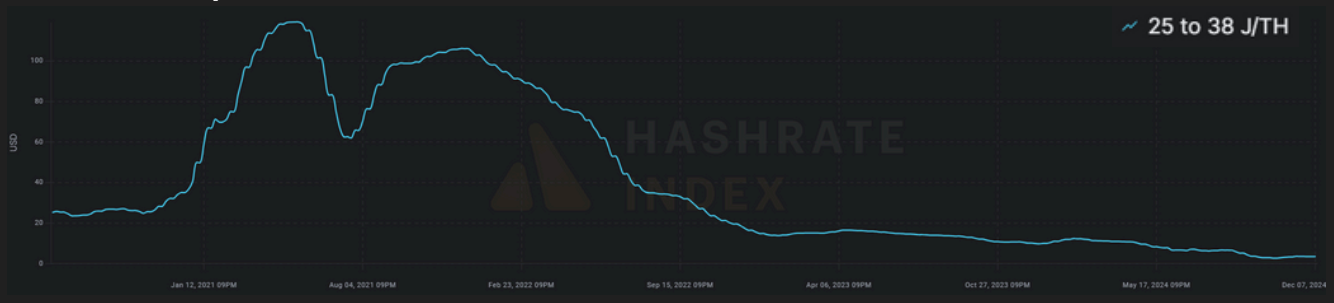
Source: HashrateIndex

Prices across all tiers continued to decline steadily until Q4, when bullish Bitcoin price action appeared to establish a market bottom. As a result, prices began to rise gradually heading into the new year.

Mid-Gen Hardware Experienced 97.5% Price Drop

The 25–38 joules/TH machines experienced the sharpest decline in value, as many models were barely breaking even after the halving, especially for miners relying on hosting services. At the beginning of the year, these machines were priced slightly above $10/TH, but at their lowest point, they fell below $3/TH. For context, the same machines were selling for nearly $120/TH during the 2021 bull run.

25–38 JOULES/TH HARDWARE LOOSING 97.5% OF VALUE



Source: HashrateIndex

Key Hashprice Threshold for Mid-Gen Hardware Broken

Towards the end of 2024 hashprice recovered back above $60/PH/day—a critical level where it spent most of 2023. This threshold is particularly significant for miners using 30+ J/TH ASICs, as it often serves as a key profitability benchmark. If hashprice can stay above this profitability floor for a sustained period, it spark a potential revival of mid-gen mining hardware that has been sidelined. This scenario would further boost network hashrate. However, the ultimate impact will depend on hashprice trends and available rackspace with low enough operating expenses.

DAILY PROFIT S19J PRO 104 TH/S

	Hashprice $/PH/Day								
kWh	$40	$45	$50	$55	$60	$65	$70	$75	$80
$0.040	$1.21	$1.73	$2.25	$2.77	$3.29	$3.81	$4.33	$4.85	$5.37
$0.045	$0.85	$1.37	$1.89	$2.41	$2.93	$3.45	$3.97	$4.49	$5.01
$0.050	$0.48	$1.00	$1.52	$2.04	$2.56	$3.08	$3.60	$4.12	$4.64
$0.055	$0.11	$0.63	$1.15	$1.67	$2.19	$2.71	$3.23	$3.75	$4.27
$0.060	-$0.26	$0.26	$0.78	$1.30	$1.82	$2.34	$2.86	$3.38	$3.90
$0.065	-$0.63	-$0.11	$0.41	$0.93	$1.45	$1.97	$2.49	$3.01	$3.53
$0.070	-$0.99	-$0.47	$0.05	$0.57	$1.09	$1.61	$2.13	$2.65	$3.17
$0.075	-$1.36	-$0.84	-$0.32	$0.20	$0.72	$1.24	$1.76	$2.28	$2.80
$0.080	-$1.73	-$1.21	-$0.69	-$0.17	$0.35	$0.87	$1.39	$1.91	$2.43

Source: Digital Mining Solutions

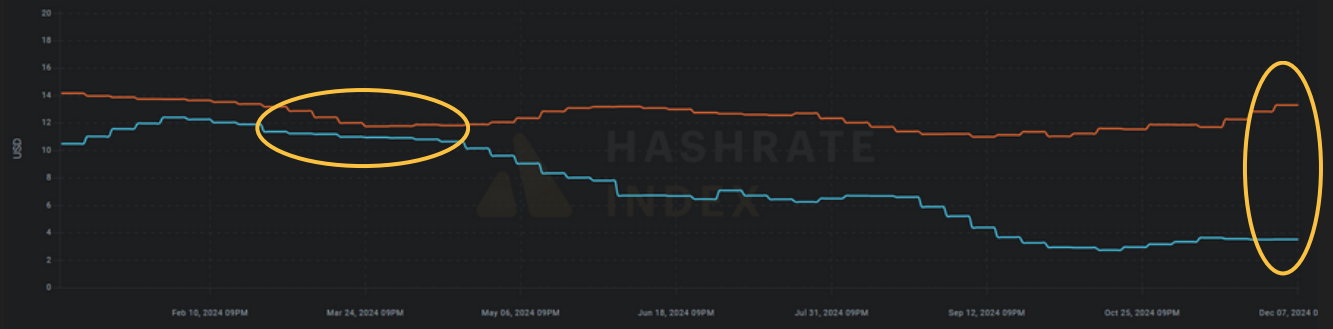
Continued De-Coupling of BTC and ASIC Prices

From 2020 to 2022, ASIC prices were closely correlated with Bitcoin's price movements. However, this correlation began to break in 2023, as Bitcoin's price started to rise while ASIC prices continued to decline. The primary driver of this decoupling were a significant influx of machines into U.S. secondary markets, fuelled by defaults on equipment loans, asset liquidations, and corporate bankruptcies. Additionally, because of the suppressed margins throughout 2024 the market was not able to absorb all this supply. The trend of decoupled pricing persisted into 2024. Despite Bitcoin experiencing a price increase well over 100%, all ASIC generations price stayed relatively suppressed.

Premium on Efficient Machines

The premium of the latest generation ASICs compared to the 19–25 J/TH tier remained relatively stable throughout the year. In contrast, the 25–38 J/TH generation experienced a significant price drop post halving, further widening the premium gap between the mid-gen machines and the more efficient tiers. Such a steep discount on the 25–38 J/TH machines can be interesting for miners looking for a fast ROI, as the lower upfront cost may offset their reduced efficiency, particularly for those with cheap electricity.

PREMIUM ON EFFICIENT MACHINES INCREASED THROUGHOUT 2024



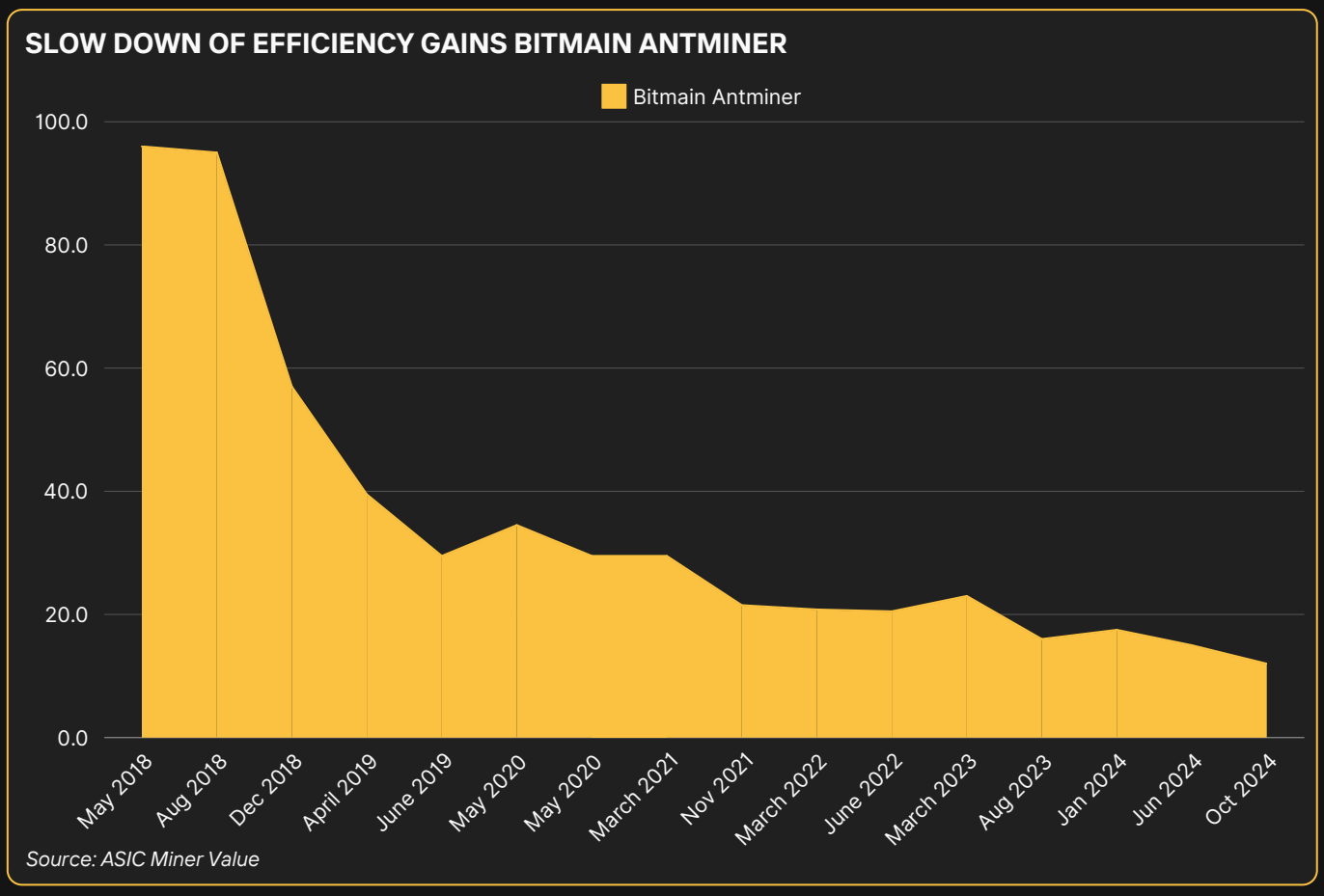
Source: HashrateIndex

Hardware Trends

In 2012, the world's first ASIC miner, the Avalon ASIC V1, was introduced, capable of mining over 25 BTC per day! While a typical desktop computer could earn just a few dollars' worth of Bitcoin daily, the Avalon ASIC V1, priced at $1,500 (payable exclusively in Bitcoin), generated $200–$300 per day. Over the past decade, Bitcoin mining hardware has evolved dramatically.

Race to the Efficiency Bottom

Energy efficiency in Bitcoin mining is measured in joules per terahash (J/TH), a metric that has seen remarkable improvements over time. The Avalon ASIC V1, introduced in 2012, operated at a speed of 65 gigahashes per second (0.065 TH/s) while consuming 500 watts of electricity, resulting in an efficiency of 7,692 J/TH. By 2024, the first ASIC miner with an efficiency below 20 J/TH entered the market, marking an astonishing 99.8% improvement in mining efficiency. Over the past decade, ASIC miners have drastically reduced their power consumption per terahash. However, it's worth noting that the rate of efficiency gains has slowed in recent years.



The improvements in efficiency have primarily been driven by advancements in semiconductor technology, particularly the shift to smaller nanometer processes. These innovations allow more transistors to be packed onto a chip, resulting in higher performance and efficiency. Companies like TSMC, which supplies chip wafers to Bitmain, have been instrumental in this progress with the introduction of 7-nanometer (nm) and 5nm chip technologies. These developments have played a crucial role in significantly improving energy efficiency for ASIC miners.

MicroBT utilizes 3nm chips from Samsung, while earlier models from Bitmain used much larger 55nm chips, which are over 18 times larger. Currently, the smallest chips being developed are 2nm in size. IBM has introduced this chip, but it is still in the testing phase and has not yet been commercialized. It remains uncertain whether ASIC miner manufacturers will adopt these chips. The tiny size of these chips presents manufacturing challenges due to their heightened sensitivity to errors, which could significantly impact production yields.

DECREASE IN CHIPSIZE PER ANTMINER GENERATION

Model	Year	Chip Size	Hashrate	Hashrate Increase	Efficiency	Efficiency Improvement
Antminer S1	2013	55nm	0.18 TH/s	-	2000 J/TH	-
Antminer S3	2014	28nm	0.48 TH/s	167%	762.5 J/TH	-62%
Antminer S5	2014	28nm	1.16 TH/s	142%	508.6 J/TH	-33%
Antminer S7	2015	28nm	4.73 TH/s	308%	273.4 J/TH	-46%
Antminer S9	2016	16nm	11.5 TH/s	143%	98.0 J/TH	-64%
Antminer S11	2018	16nm	21 TH/s	83%	72.9 J/TH	-26%
Antminer S15	2018	7nm	28 TH/s	33%	57.0 J/TH	-22%
Antminer S17	2019	7nm	56 TH/s	100%	45.0 J/TH	-21%
Antminer S19j Pro	2020	7nm	110 TH/s	96%	29.5 J/TH	-34%
Antminer S19 XP	2022	5nm	140 TH/s	27%	21.5 J/TH	-27%
Antminer S21	2024	5nm	200 TH/s	43%	17.5 J/TH	-19%

Source: ASIC Miner Value

Dynamic Mining Options

As the Bitcoin mining industry has evolved, miners have adopted more sophisticated strategies to optimize operations. Depending on market conditions, they prioritize either maximum hashrate output or improved energy efficiency. While stock firmware often imposes limitations, customized firmware has enabled miners to overclock and underclock their machines. In response, ASIC hardware manufacturers have introduced miners with built-in power configuration options, such as Normal Efficiency Mode (NEM) and High Efficiency Mode (HEM). These options provide operators with greater flexibility to balance performance and energy consumption. In NEM, the miner delivers maximum hashrate for peak performance but consumes more power. HEM, by contrast, reduces hashrate slightly while achieving a lower joules per terahash (J/TH) ratio, enhancing energy efficiency.

In 2024, several air-cooled and immersion-cooled models from Bitmain, MicroBT, Canaan, and Auradine included this feature. NEM and HEM allow miners to adapt dynamically to fluctuating electricity costs and Bitcoin prices, maximizing profitability and operational control.

Standardization Hardware Design

In 2024, several Bitcoin mining hardware manufacturers, including Bitmain, MicroBT and Bitdeer, introduced ASIC models in the U2 and U3 form factors. These models reflect the growing trend toward industrial-scale mining in professionally managed facilities, where compatibility with standardized racks, cooling systems, and power delivery infrastructure is crucial.

IThe U2 and U3 form factors represent a shift toward standardized hardware design in the Bitcoin mining industry, offering dimensions and configurations compatible with traditional data center infrastructure. This design enables Bitcoin ASIC miners to be seamlessly integrated into existing data center racks alongside other IT equipment, reducing the need for custom solutions. This move toward standardization simplifies deployment in traditional data centers, as it aligns miners with the hardware design principles used in high-performance computing (HPC) and cloud environments.

By adopting U2 and U3 form factors, the industry is closing the gap between specialized Bitcoin mining infrastructure and mainstream data center designs, facilitating broader adoption and reducing barriers for enterprise-level operators to enter the mining space.

U2 FORM FACTOR HARDWARE AND CABINETS

Source: MicroBT, Bitdeer and LIANLI

The Mini Miner Revolution

The trend of mini Bitcoin miners has gained traction in last year as manufacturers seek to cater to home miners while promoting the ethos of a decentralized network. These compact miners offer lower entry costs, reduced power consumption, and the ability to mine Bitcoin in environments with space constraints, such as homes or offices. In 2024, several companies have launched mini miners that bring the power of traditional ASIC miners into smaller, more accessible units.

Last year, the BitAxe army took the internet by storm. BitAxe is a fully open-source Bitcoin ASIC miner, with all project details available on GitHub. There, you can explore its design files, firmware, and software, enabling full transparency and fostering a collaborative community where improvements and innovations are freely shared. Assembled BitAxe miners are available for purchase from various webshops, and for those who enjoy hands-on projects, BitAxe DIY Kits are also an option. BitAxe launched various models, using diffent chips and producing a hashrate output ranging between 400 GH/s to 1.2 TH/s.

VARIOUS BITAXE MODELS AND SPECIFICATIONS

BitAxe Model Series	ASIC Chip	Used On	Hashrate Range
Bitaxe Max - 100	1 x BM1397	Antminer S17	400 - 450 GH/s
Bitaxe Ultra - 200	1 x BM1366	Antminer S19 XP & S19k Pro	500 - 550 GH/s
Bitaxe Hex - 300	6 x BM1366	Antminer S19 XP & S19k Pro	3.0 - 3.3 TH/s
Bitaxe Supra - 400	1 x BM1368	Antminer S21	600 - 700GH/s
Bitaxe Gamma - 600	1 x BM1370	Antminer S21 Pro	1.2 TH/s

Source: Open Source Miners United

Other examples of mini miners are:

The NerdMiner, developed by BitMaker, is a compact device designed for solo Bitcoin mining using minimal power with a USB-C power cable. The NerdMiner T Display S3 operates at just ~1 watt, costing approximately $2 per year, while achieving a hashrate of over 78 Kh/s.

Braiins, renowned for its open-source mining firmware, has introduced the **Braiins Mini Miner**, a compact device that pairs their high-performance software with a miniaturized design. The BMM 100 features low power consumption at just 40W, delivering a hashrate of 1 Th/s, and seamlessly integrates with their existing software.

ASIC hardware manufacturer Canaan introduced the **Avalon Nano 3**, offering a portable small heater that can generates 4 TH/s available in a variety of colors.

This trend towards mini Bitcoin miners reflects a shift in the industry towards democratizing access to mining, making it more accessible to a broader audience while maintaining efficiency and scalability.

MINI MINERS

Source: BitcoinMerch, Braiins and Canaan

New ASIC Models

As demand in the ASIC market failed to keep pace with Bitcoin's bullish price sentiment, manufacturers continued to launch new machines to spark interest and drive sales. These efforts also allowed them to meet contractual obligations with the foundries supplying chip wafers.

Bitmain Offering a Broad Variety of Antminers S21

Much like the 2020 Bitcoin halving year, which saw the introduction of the Antminer S19 series that would dominate the next epoch, 2024 welcomed a new generation of ASICs, led by the Antminer S21 series. In 2024, market leader Bitmain introduced the Antminer S21 series, all featuring an efficiency of less than 20 J/TH.

Antminer S21

The S21 came to market first and is available in three variants—200 TH/s, 195 TH/s, and 188 TH/s—each with an efficiency of 17.5 J/TH. The 200 TH/s model operates at 3500 W. A significant upgrade for this model was the P13-C20 power cord, which supports voltages between 220V and 277V.

Antminer T21

The T21 model delivers a hashrate of 190 TH/s with an efficiency of 19 J/TH, consuming 3610 W and requiring a higher voltage range of 380V to 415V. Its 3-phase power supply ensures automatic phase balancing. The T21's higher voltage requirements and specific PDU interface may pose challenges for miners without access to industrial-grade power setups. Unique to the T21 is the HEM mode, which, under optimal conditions (temperatures below 30°C), boosts the hashrate to 233 TH/s while increasing efficiency to 22 J/TH. This mode requires 5500 W, supplied by its 3-phase power system.

Antminer S21 Pro

Just seven months after the launch of the S21, Bitmain announced the Antminer S21 Pro, a significant upgrade in both power and efficiency. The Pro features 234 TH/s with an energy efficiency of 15.0 J/TH.

ANNOUNCEMENT OF THE S21 PRO AT WDMS 2024

Source: Bitmain

Antminer S21XP

The Antminer S21 XP also debuted in 2024, available in air-, immersion-, and hydro-cooled models. The hydro-cooled unit stands out with impressive specifications: a hashrate of 473 TH/s at 5676 W, achieving an efficiency of 12 J/TH.

Antminer S21+

Looking ahead to 2025, Bitmain is set to release new models in the Antminer S21 product line: The Antminer S21+ air-cooled unit with a hashrate of 216 TH/s and an efficiency of 16.5 J/TH. The S21+ Hydro offering 319 TH/s with an efficiency of 15 J/TH. These S21+ machines are set for Q1/Q2 2025.

U3S19XPH and U3S21EXPH

The most exciting announcements for 2025 include models with direct liquid-to-chip cooling in a U-form factor. The U3S19XPH is expected to deliver a hashrate of 470–514 TH/s with power usage of 10,599 W, resulting in an efficiency of 20.8 J/TH. The U3S21EXPH will offer an unprecedented hashrate of 860 TH/s with an efficiency of 13 J/TH—nearly double the hashrate of the S21 XP Hydro (473 TH/s). Hut 8 will deploy an initial 15 EH/s of U3S21EXPH units.

THE U3S21EXPH

Source: Bitmain

MicroBT Introduces the M60 series

Whatsminer M60 and M60s

At the beginning of 2024, MicroBT released two air-cooled miners, the M60 and M60s. The Whatsminer M60 series has the same form factor as the M50 and M30. The M60 series includes models with hash rate ratings ranging from 156-172 TH/s. The 162 TH/s machine runs at 3104 W with an efficiency of 19.2 J/TH.

In comparison to earlier models within the WhatsMiner series, the M60S distinguishes itself in the transition to 5nm chip technology. This advancement marks a substantial upgrade over the 7nm chips in many previous models. The Whatsminer M60S offers a hashrate output, ranging from 170-186 TH/s. Moreover, the M60S achieves an efficiency of 18.5 J/TH. According to factory specifications, the 186 TH/s version uses 3441 W. The M66S immersion cooled miner can even reach an efficiency of 17 J/TH when run in low power mode.

WhatsMiner M6XS++

At the Bitcoin MENA 2024 Conference in Abu Dhabi, MicroBT introduced the latest WhatsMiner M6XS++ series with various cooling technologies. The air-cooled M60S++ delivers a hashrate of up to 226 TH/s with a power efficiency of 15.5 J/T, while the hydro-cooled M63S++ reaches a remarkable 478 TH/s with the same efficiency. For immersion cooling, the M66S++ offers a hashrate of 356 TH/s at 15.5 J/T.

The line-up also includes the air-cooled M61S+, providing a hashrate of up to 236 TH/s with a power efficiency of 17 J/T. On the hydro-cooled front, the M64S+ and M65S+ achieve hashrates of 236 TH/s and 440 TH/s, respectively, both maintaining a power efficiency of 17 J/T. Notably, the hydro-cooled models feature an outlet water temperature of up to 80°C, making it an ideal miner for heat reuse projects.

WHATSMINER M6XS++ SERIES

Source: MicroBT

Canaan Joins the Efficiency Race

Avalon A15 series

In 2024, Canaan introduced its Avalon Miner A15 series, showcasing advancements in both performance and efficiency across multiple models. The Avalon Miner A1566 offers a hashrate of 185 TH/s with a power consumption of 3420 W, resulting in an efficiency of 18.5 J/TH. The A1566I version is designed for immersion cooling, this miner delivers a powerful hashrate of 249 TH/s. The Avalon Miner A15Pro, with a hashrate of 218 TH/s and efficiency of 16.8 J/TH, is their most energy efficiency air-cooled model to date.

The air-cooled Avalon Miner A15XP features a hashrate of 206 TH/s with a power consumption of 3667 W, achieving an efficiency of 17.8 J/TH. Another air-cooled option, the Avalon Miner A15 offers a hashrate of 194 TH/s, consuming 3647 W and delivering an efficiency of 18.8 J/TH. The A15XP and A15 models are scheduled to begin shipping in Q1 2025, further expanding the A15 series line-up.

Auradine Commercially Selling

Auradine is a Silicon Valley-based company, aiming to offer North American Bitcoin mining operators an alternative to "foreign ASICs," competing against Chinese manufacturing giants Bitmain, MicroBT, and Canaan. Publicly traded Bitcoin mining company Marathon Digital Holdings (MARA) was among the backers of Auradine's first funding round.

In Q2 2024 the company brought their AT2880 air-cooled miner to market. The machine is capable of achieving an output of up to 260 TH/s using 4160 W and efficiency of 16 J/TH. Another model that they started shipping in 2024 was the Teraflux AI3680. This immersion-cooled Bitcoin miner is capable of achieving an output of up to 375 TH/s at 15 J/TH.

The TeraFlux miners feature EnergyTune, a program that allows you to quickly power up or down without rebooting the system. You can adjust both the power and hashrate to the desired target, and the system will automatically tune itself. This feature enables rapid demand response.

AURADINE TERAFLUX SERIES

Source: Auradine

Bitdeer's SEALMINER Making a Splash

Bitdeer is the sixth-largest publicly traded Bitcoin mining company, offering a range of digital asset mining services, including cloud mining, mining farms, and integrated mining operations. Founded by Jihan Wu, one of the co-founders of Bitmain, Bitdeer initially relied heavily on Bitmain equipment. However, in 2024, Bitdeer diversified its operations by acquiring ASIC manufacturer Desiweminer and launching its own mining hardware under the SEALMINER brand.

SEALMINER A1

The SEAL01 chip, developed using advanced 4-nanometer process technology, marked a significant milestone for Bitdeer. The first batch of SEALMINER A1 machines was mass-produced and delivered in Q4 2024, offering an efficiency of 20–23 J/TH. Bitdeer announced that the A1 model would add 3.4 EH/s of proprietary hashrate to its fleet, deployed in Texas, USA, and Tydal, Norway, by early Q1 2025.

SEALMINER A2

Later in 2024, Bitdeer introduced the SEALMINER A2, delivering 226 TH/s with an efficiency of 16.5 J/TH. Following this air-cooled model, Bitdeer unveiled the SEALMINER A2Hyd, a hydro-cooled mining rig boasting an impressive hashrate of 446 TH/s.

The output of the SEALMINER A2 is second only to the Bitmain Antminer S21 XP Hyd, which delivers 473 TH/s. Remarkably, the A2Hyd achieves nearly double the hashrate of its air-cooled counterpart while maintaining the same energy efficiency of 16.5 J/TH. Designed for seamless deployment, the 2U-standard server integrates effortlessly with MicroBT Whatsminer's hydro-cooling infrastructure.

Mass production of the A2 began late 2024, with an expected capacity to generate approximately 18 EH/s for both third-party sales and Bitdeer's proprietary mining operations. By producing its own ASIC hardware, Bitdeer gains strategic flexibility, enabling the company to use the miners for its operations or sell them to third parties. This dual approach allows Bitdeer to either access hardware at production cost for in-house mining or achieve high margins through hardware sales, depending on market conditions.

SEALMINER A2 SERIES

Source: Bitdeer

Overview of 2024 ASIC Hardware Launches

Examining the specifications of ASIC miners released in 2024 reveals a clear trend: hydro-cooled and immersion-cooled machines significantly outperform their air-cooled counterparts in terms of power efficiency.

The key distinction between hydro-cooled and immersion-cooled systems lies in their hashrate output. Hydro-cooled machines can accommodate and cool a greater number of chips within a single unit. This advantage is particularly evident in ASIC miners utilizing the U2 and U3 form factors, which enable high chip density per miner.

2024 ASIC HARDWARE LAUNCHES

ASIC Hardware Model	Date	Hashrate	Power	Efficiency
Bitdeer SealMiner A2 Hyd	Feb/25	446Th/s	7,360W	16.5 J/TH
Bitdeer SealMiner A2	Feb/25	226Th/s	3,730W	16.5 J/TH
Bitmain Antminer S21+	Feb/25	216Th/s	3,564W	16.5 J/TH
Bitmain Antminer S21+ Hyd	Feb/25	319Th/s	4,785W	15.0 J/TH
Bitmain Antminer S19 XP Hyd 3U	Jan/25	512Th/s	10,600W	20.7 J/TH
Bitmain Antminer S21e XP Hyd 3U	Jan/25	860Th/s	11,180W	13.0 J/TH
Canaan Avalon A15-194T	Dec/24	194Th/s	3,647W	18.8 J/TH
Canaan Avalon A15XP-206T	Dec/24	206Th/s	3,667W	17.8 J/TH
Bitmain Antminer S21 Immersion	Dec/24	301Th/s	5,569W	18.5 J/TH
MicroBT WhatsMiner M66S++	Dec/24	356Th/s	5,518W	15.5 J/TH
MicroBT WhatsMiner M60S++	Dec/24	226Th/s	3,600W	15.9 J/TH
MicroBT WhatsMiner M63S++	Dec/24	478Th/s	10,000W	20.9 J/TH
Bitmain Antminer S21e XP Hyd	Nov/24	430Th/s	5,590W	13.0 J/TH
Bitmain Antminer S21 XP Hyd	Oct/24	473Th/s	5,676W	12.0 J/TH
Canaan Avalon A1566	Sep/24	185Th/s	3,420W	18.5 J/TH
Bitmain Antminer S21 XP Immersion	Sep/24	300Th/s	4,050W	13.5 J/TH
Bitmain Antminer S21 XP	Sep/24	270Th/s	3,645W	13.5 J/TH
MicroBT WhatsMiner M66S+	Aug/24	318Th/s	5,406W	17.0 J/TH
Bitmain Antminer S19 Pro++	Aug/24	125Th/s	3,250W	26.0 J/TH
MicroBT WhatsMiner M63S+	Aug/24	424Th/s	7,208W	17.0 J/TH
MicroBT WhatsMiner M60S+	Jul/24	212Th/s	3,600W	17.0 J/TH
Canaan Avalon A1566I	Jul/24	249Th/s	4,500W	18.1 J/TH
Bitmain Antminer S21 Pro	Jun/24	234Th/s	3,531W	15.1 J/TH
Bitmain Antminer S19j XP	Jun/24	151Th/s	3,247W	21.5 J/TH
Bitmain Antminer T19 Pro Hyd	Feb/24	235Th/s	5,170W	22.0 J/TH
Bitmain Antminer S21	Jan/24	200Th/s	3,550W	17.8 J/TH
Bitmain Antminer T21 (190Th)	Jan/24	190Th/s	3,610W	19.0 J/TH
MicroBT WhatsMiner M60	Jan/24	172Th/s	3,422W	19.9 J/TH
MicroBT WhatsMiner M60S	Jan/24	186Th/s	3,441W	18.5 J/TH
Bitmain Antminer S21 Hyd	Jan/24	335Th/s	5,360W	16.0 J/TH

Source: ASIC Miner Value

ASIC Dominance

CoinMetrics conducts extensive research to analyze the types of ASIC models contributing to the Bitcoin network's hashrate.

Bitmain Still Dominates the Network

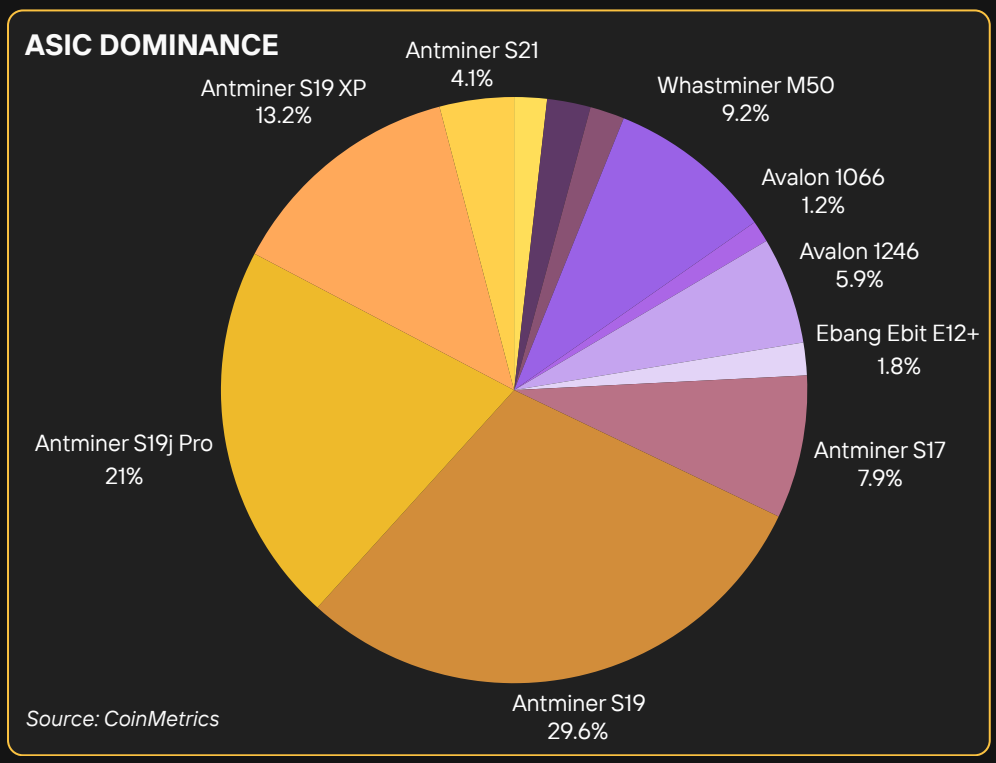
Bitmain's dominance in the Bitcoin mining hardware market remains unparalleled, with its models collectively contributing a staggering 77.6% of the network's total hashrate, including the Antminer S21, S19XP, S19j Pro, S19, S17, and even the older S9. MicroBT, Bitmain's closest competitor, holds a distant second place with a 13.5% share, reflecting the significant market gap between the two manufacturers.

The S19 and S19j Pro models stand out as the workhorses of the network. Together, these two models alone account for slightly over 50% of the total hashrate. These machines have become the backbone of many mining farms,.

The growth trajectories of newer Bitmain models also paint a clear picture in market adoption trends. The S19XP, launched in June 2022, took approximately 30 months to secure a 13.2% share of the market, showcasing its steady adoption rate. In comparison, the S21, introduced just 10 months ago, has already captured a 4.1% share. The rapid uptake of the S21 suggests a pattern similar to the S19XP.

Despite being considered outdated by modern standards, the Antminer S9 remains a notable presence in the network. Once the industry leader, the S9 has seen a significant decline in its contribution since its peak in 2019.

However, it continues to contribute to the global hashrate, demonstrating the resilience and longevity of this iconic ASIC model. The enduring presence of the S9 serves as a testament to its original design and the adaptability of miners who continue to find value in its operation, often in regions with extremely low electricity costs or as part of smaller-scale mining projects.



Bitcoin Mining
2024 Review

PUBLIC MINING COMPANIES

Initial Public Offerings

The highly competitive nature of Bitcoin mining, combined with significant capital requirements, often drives companies to pursue IPOs for easier access to funding. In 2024, amid favourable Bitcoin price action, several companies made noteworthy attempts to go public

Successful IPOs

GRIID Infrastructure On January 29, GRIID Infrastructure, a Cincinnati-based Bitcoin mining firm, commenced trading on Nasdaq under the ticker GRID. Founded in 2018, GRIID operates facilities in New York and Tennessee, boasting a combined capacity of approximately 447 PH/s. Later in the year, on June 27, CleanSpark (CLSK) announced its agreement to acquire GRIID for $155 million in an all-stock transaction. The acquisition concluded on October 31, leading to GRIID's delisting from Nasdaq.

BitFuFu: On March 1, Singapore-based cloud mining service provider BitFuFu began trading on Nasdaq after completing a long-delayed merger with Arisz Acquisition Corp. Initially valued at $1.5 billion in January 2022, BitFuFu's IPO faced repeated delays due to the "crypto winter." As of the end of December, BitFuFu ranked 14th among publicly listed Bitcoin miners by market capitalization.

LISTING BITFUFU ON NASDAQ

Credit: Ben Hider

Relistings

Core Scientific: On January 20, Core Scientific returned to Nasdaq under the ticker CORZ after restructuring from its December 2022 Chapter 11 bankruptcy filing. The company, now focusing on developing sustainable and predictable revenue streams from the HPC/AI sector. The partnership with CoreWeave is expected to generate $6.7 billion over 12 years. Core Scientific delivered one of the best YTD stock performances among public miners in 2024.

Cathedra Bitcoin: On August 8, Vancouver-based Cathedra Bitcoin resumed trading on the TSX Venture Exchange under the ticker "CBIT" after a successful merger with Kungsleden. In November, Cathedra began trading on the OTCQB Venture Market under the ticker CBTTF. This move shall enhance its visibility and accessibility for U.S. investors.

Canceled IPOs

Swan Bitcoin: On January 26, Swan Bitcoin unveiled its mining operations and plans for a public listing within 12 months. However, by July, the company ceased its mining activities and shelved IPO plans due to the absence of a significant financing partner. Reports of internal disputes and legal actions against former executives further complicated the situation putting the IPO plans on hold.

Pending IPO Updates

Northern Data AG: Frankfurt-listed Northern Data AG (ticker: NB2) was reported exploring a U.S. public listing in July, targeting a Nasdaq debut in early 2025 with a valuation between $10 billion and $16 billion. Its computing services firm's U.S. bitcoin mining unit, Peak Mining, has nearly 700 megawatts of mining centers in development. However, the company announced in October its intention to divest its crypto mining unit, Peak Mining, to focus on AI solutions. Whether Northern Data proceeds with the divestment or the IPO will determine its relevance to the Bitcoin mining sector and our continued tracking.

Genesis Digital Assets: Backed by the now-defunct Alameda Research, Genesis Digital Assets was once valued at $5.5 billion after a $1.15 billion investment. Operating over 20 mining facilities globally with a total power capacity of 500 MW, the company has not provided any IPO updates since July.

GDA'S HYDRO-POWERED FACILITY IN SWEDEN

Credit: Genesis Digital Assets

Ionic Digital: After acquiring all of the mining assets of bankrupt lender Celsius', Ionic Digital in August announced plans for an IPO. These plans were delayed following the resignation of its CEO and auditor. In October, with the appointment of a new auditor, Ionic resumed IPO preparations. With an average hash rate of 9.4 EH/s as of September 30, Ionic Digital could rank among the top 15 public miners by mining capacity, if listed.

Surprise- Unexpected New Public Miner

Cango: A Chinese automotive service provider listed on the NYSE, announced on November 15 that it had completed the acquisition of crypto mining machines from Bitmain. The purchase, valued at $256 million in cash, added a total hashrate of 32 EH/s, making Cango one of the largest public miners by hashrate.

This development surprised many in the industry, as Cango had no prior involvement in Bitcoin mining. According to its November operational updates, the company is now mining approximately 18.85 Bitcoin per day and holds 363.9 Bitcoin on its balance sheet.

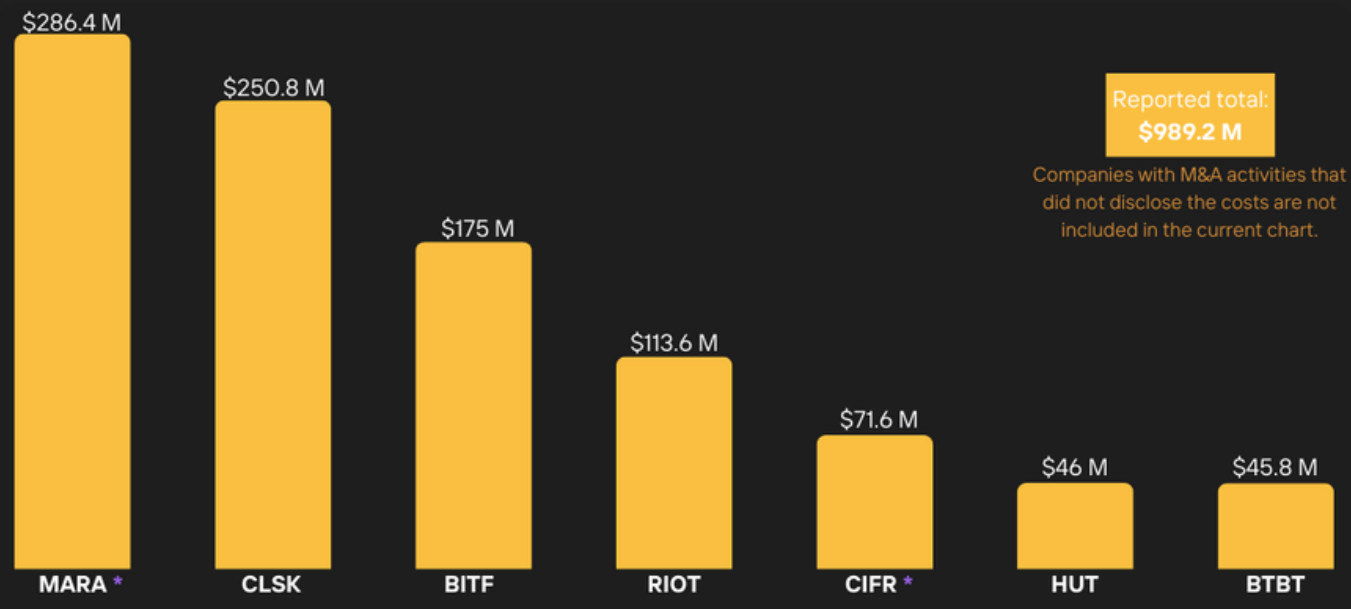
Given the fact that this company now operates on a significant scale, it can't be ignored as a major player in the industry. Looking ahead, we may see more publicly listed companies in traditional businesses pivoting to Bitcoin mining through strategic acquisitions, signaling a dynamic and transformative phase for the sector.

Mergers & Acquisitions

In 2024, we saw numerous M&A deals from publicly listed miners, particularly the larger ones accelerating their expansion plans by acquiring operational facilities. 11 out of the largest 15 U.S.-listed miners (by market cap) were involved in M&A deals during the year.

While most of the reported M&A deals focused on Bitcoin mining data centers, there were also acquisitions in HPC data centers and other sectors, which reflects different business strategies. The following are details about the M&A deals of these companies (as of Q3 2024 reports):

REPORTED VALUES OF M&A ACTIVITIES *(AS OF Q3 2024 PUBLIC FILINGS)*



*Data source: SEC Fillings (*company has other M&A activities for which the costs were not disclosed, total actual value might be higher than shown on the bar chart).*

MARA Holdings

In 2024, MARA transitioned from a assets-light model (relying on 3rd party hosting) to a focus on self-mining, evident in its frequent acquisition deals. As one of the most well-known public miners, MARA leveraged its strong access to capital through various financial tools to fund these transactions. These acquisitions, on the other hand, enhanced MARA's operational efficiency and significantly boosted its mining capacity. The integration of these facilities aligned with MARA's strategy to achieve a hash rate of 50.0 EH/s by the end of 2024.

1. GC Data Center Equity Holdings, LLC Acquisition (January 2024)
   - **Cost**: $189.6 million (includes $175.7 million initial cash consideration and $13.9 million for other liabilities).
   - **Capacity Acquired:** Two operational sites in Granbury, Texas, and Kearney, Nebraska, totaling 390 MW.
   - **Impact**: Enhanced efficiencies, self-mining capacity, and integration into MARA's technology stack.

2. Garden City Acquisition (April 2024)
- **Cost:** $96.8 million (includes $92.0 million initial cash consideration).
- **Capacity Acquired**: Operational mining site in Garden City, Texas, with 132 MW operational and 200 MW nameplate capacity.
- **Impact**: Improved operational efficiency and synergy with MARA's existing infrastructure.

3. Hannibal and Hopedale, Ohio (November 2024)
- **Details**: Two operational data centers acquired with 222 MW of capacity and interconnect approval for an additional 100 MW.
- **Impact:** Expansion of MARA's infrastructure and operational capacity.

4. Hansford County, Texas Wind Farm Acquisition (December 2024)
- **Details:** a wind farm with 240 MW of interconnection capacity and 114 MW of nameplate wind capacity.
- **Impact**: Convert underutilized sustainable resources into economic value, achieve near-zero energy cost, and enable broader renewable energy deployment

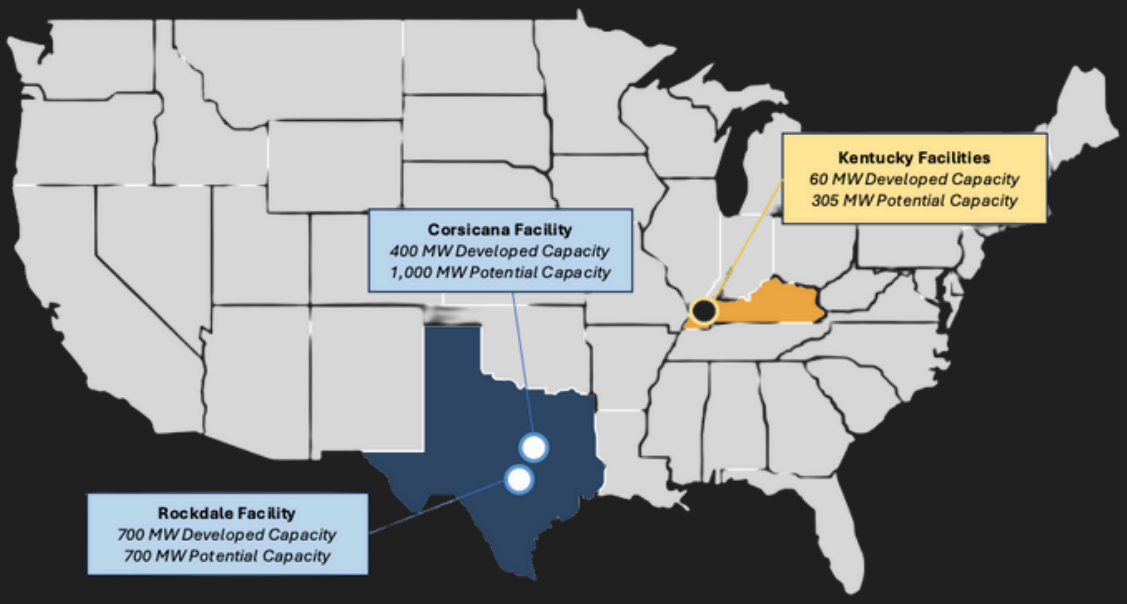
TEXAS WIND FARM

Credit: MARA Holdings

RIOT Platforms

Unlike MARA, Riot focused its efforts on acquiring another public miner—Bitfarms, eyeing becoming the largest publicly listed Bitcoin miner. Despite multiple attempts, the acquisition did not come through due to Bitfarms' defensive measures. However, when the dust finally settled in September, Riot emerged as the largest shareholder of Bitfarms' common stock. In the same year, Riot still managed to complete the acquisition of a private operational miner.

RIOT'S POWER CAPACITY ACROSS SITES



Source: Riot Platform

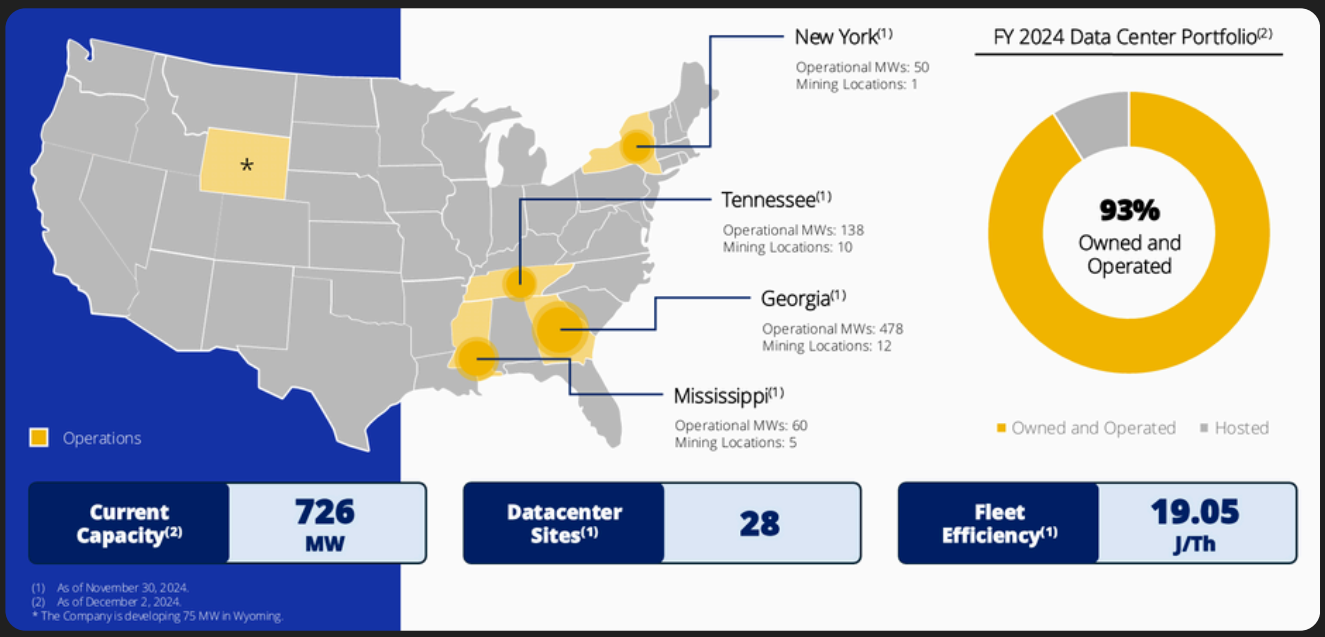
1. Acquisition of Block Mining, Inc. (July 2024)
- **Cost:**
  - $13.5 million in cash.
  - $74.0 million in Riot common stock (7.2 million shares issued).
  - $26.1 million contingent purchase price (linked to milestones achievable by December 31, 2025, with a potential earn-out of $32.5 million).

- **Assets Acquired:**
  - **Two operational sites** in Kentucky with 60 MW combined operational capacity.
  - Greenfield expansion site adjacent to an existing substation, offering potential for an additional 60 MW to 150 MW capacity.
- **Impact:**
  - Immediate increase in operational hash rate.
  - Diversification of energy markets outside Texas (including Paducah Power Systems, TVA, and Big Rivers Electric Corporation).
  - Enhanced vertically integrated strategy.

CleanSpark

Similar to Riot, CleanSpark also made efforts to acquire a rival public miner, and they successfully closed the deal at the end of October. Throughout the year, CleanSpark aggressively expanded by acquiring several private miners. Beginning the year with a hash rate of 10.8 EH/s in January, CleanSpark reached 31.3 EH/s by November 30.

CLEANSPARK'S DATA CENTER OVERVIEW



Source: CleanSpark

1. Acquisition of Dalton Property (February, 2024):

- **Cost**: $3.57 million
- **Assets Acquired**:
  - Early-stage data center property in Dalton, Georgia.
  - Includes concrete foundation and electrical infrastructure under development.
- **Impact**:
  - Expansion potential for CleanSpark's mining operations.
  - New facility began bitcoin mining operations on April 4, 2024.

2. Acquisition of Mississippi Locations (February, 2024):

- **Cost**: $19.8 million.
- **Assets Acquired**: (three bitcoin mining facilities) in Mississippi Real estate, buildings, and operational infrastructure.

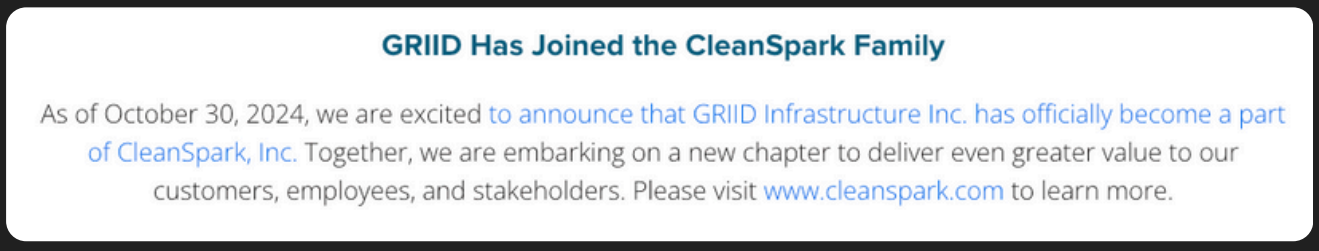
- **Impact**:
  - Expanded geographic footprint for mining operations.
  - Immediate increase in operational hash rate (+2.4 EH/s once fully loaded with S21s)

3. Acquisition of Wyoming Sites (Cheyenne, May 2024)
- **Cost**: $18.75 million
- **Assets Acquired**: Two bitcoin mining facilities with a total capacity of 75 MW.
- **Impact**:
  - Adds over 4 EH/s upon full operation, with the potential to exceed 7 EH/s after expansion.
  - Establishes Wyoming as the third state in CleanSpark's portfolio of owned-and-operated mining facilities.

4. Acquisition of LN Energy LLC Facilities (Georgia, June 2024):
- **Cost**: $26.18 million
- **Assets Acquired**:
  - Six bitcoin mining data centers in Georgia.
  - Includes real property leases and a power agreement.
  - Building improvements, infrastructure, and lease rights.
- **Impact**:
  - Significant increase in CleanSpark's operational capacity (+3.7EH/s upon full installation of S21 Pro miners).
  - Fully equipped mining facilities added to the portfolio.

5. Acquisition of GRIID Infrastructure Inc. (October 30, 2024)
- **Cost**: $155 million minus liabilities, converted to CleanSpark stock based on exchange ratio
- **Assets Acquired**: Includes GRIID's equity, infrastructure, and operational capacity.
- **Impact**:
  - Expansion of CleanSpark's mining capacity and strategic presence in the market.
  - Enhanced hosting services and capacity utilization.
  - Improved ability to scale mining operations using GRIID's facilities and capabilities.

GRIID ANNOUNCING THEY GOT ACQUIRED



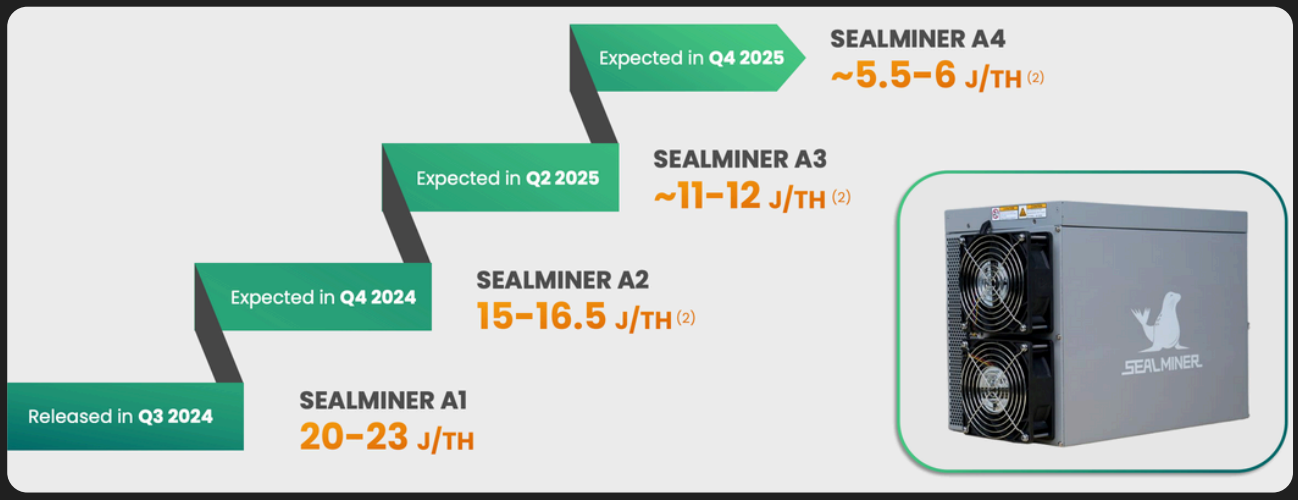
Source: GRIID

6. Acquisition of Tennessee Facilities (September 2024)
- **Cost:** $27.5 million
- **Assets Acquired:**
  - Seven Bitcoin mining facilities totaling 85 MW of capacity (each facility ranges from 10 MW to 20 MW each).
  - Associated land near Knoxville, TN.
- **Impact:**
  - Adds 5 EH/s to CleanSpark's operational hashrate, increasing capacity by over 22%.
  - Contributes to CleanSpark's goal of achieving 37 EH/s by the end of 2024.

Bitdeer

A bit different from miners mentioned above, Bitdeer focused on seeking companies that could enhance their technology stack, which aligns with its vertical growth strategy and ASIC development.

BITDEER SEALMINER TECHNOLOGY ROADMAP



Source: Bitdeer

1. Acquisition of FreeChain Inc. (Desiweminer) (June 2024):
   - **Cost:** Acquisition of all issued shares of Desiweminer for 20 million Class A ordinary shares of Bitdeer.
   - **Assets Acquired:**
     - ASIC chip designs optimized for 4nm and below semiconductor processes.
     - Desiweminer's engineering team and supply chain expertise (critical for SEAL02 chip development and mining rig production)..
     - Nearly 30,000 ready-to-ship ASICs.
   - **Impact:**
     - Strengthened technological infrastructure for self-mining operations.
     - Enhanced capacity to innovate in mining equipment, particularly for the SEALMINER series.
     - Diversified revenue streams by leveraging cutting-edge technologies for internal use and potential external sales.

Hut 8

Hut 8's acquisition strategy prioritized power infrastructure that supports both digital asset mining and HPC applications. What makes this acquisition particularly significant is its partnership with Macquarie Group, a diversified financial institution managing A$916.8 billion in assets, providing substantial financial expertise and backing to the deal.

GAS POWER PLANTS IN CANADA 310 (MW)

Source: Hut 8

1. Acquisition of 80.01% Far North in partnership with Macquarie Group Limited (February 2024):

- **Cost:**
  - $46.0 million total consideration:
    - $7.7 million cash.
    - $24.6 million loan assumed (restructured as a sale-leaseback agreement for Iroquois Falls power plant).
    - $8.2 million credit for existing equipment investments.
- **Assets Acquired:**
  - Four natural gas power plants in Ontario, Canada:
    - Kingston (110 MW), Iroquois Falls (120 MW), Kapuskasing (40 MW), North Bay (40 MW).
  - Mining and electrical equipment at the North Bay Bitcoin mine.
- **Impact:**
  - Expanded energy portfolio by adding 310 MW of power capacity.
  - Integrated mining capabilities at the North Bay site.
  - Strengthened ability to manage energy infrastructure for digital asset mining and other workloads.

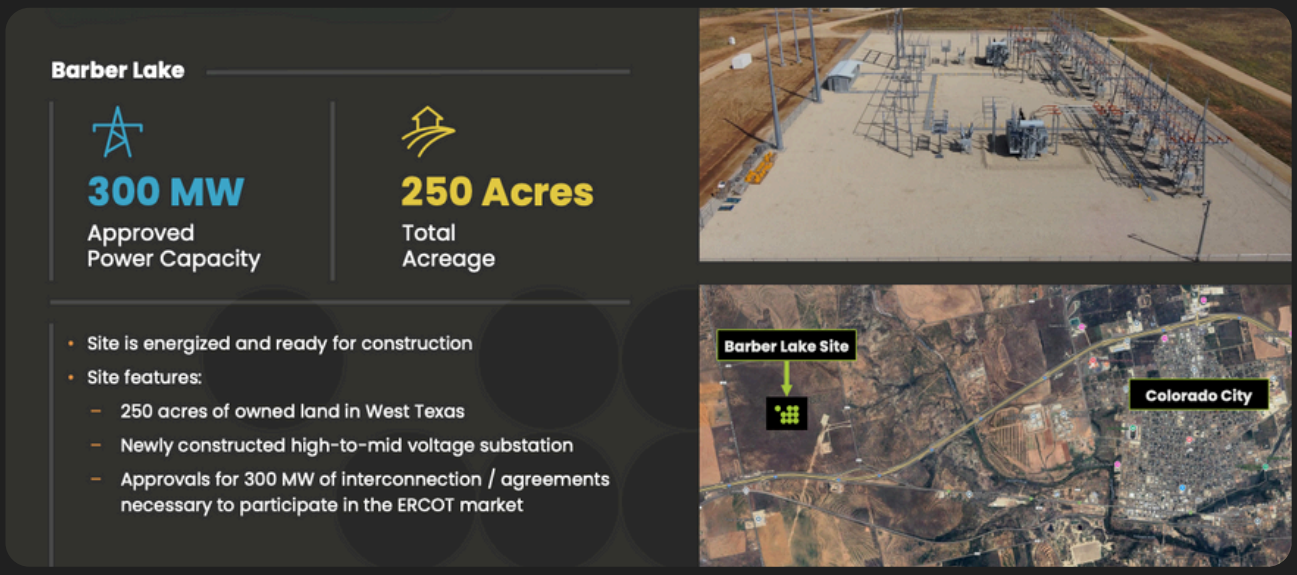
Cipher Mining

When it comes to acquisitions, Cipher sought facilities that offer flexibility to support both Bitcoin mining operations and HPC hosting. As a result, the company strategically selected targets with advantageous locations and reliable power access.

1. Acquisition of Barber Lake Facility (September 2024):

- **Cost:** $67.5 million in cash plus an assumed liability of $8.3 million.
- **Assets Acquired:**
  - 250-acre site in West Texas with 300 MW of front-of-the-meter capacity.
  - Newly constructed, fully energized high-to-mid voltage substation.
- **Impact:**
  - Expanded Cipher's portfolio to over 2.5 GW across 10 sites.
  - Strengthened Cipher's ability to support bitcoin mining and HPC hosting in Texas.

BARBER LAKE



Source: Cipher Mining

2. Purchase of Site Options (October 2024):

- **Cost**: Details not specified.
- **Assets Acquired:**
  - Options to acquire three sites in Texas with a cumulative power capacity of up to 1.5 GW.
  - 580 acres of land for lease or purchase, located adjacent to transmission assets.
  - Sites are suitable for both HPC and Bitcoin mining data centers.
- **Impact:**
  - Added 1.5 GW of potential capacity to Cipher's development pipeline.
  - Strategic flexibility to scale operations based on market conditions and demand.

3. Acquisition of West Texas Site (November 2024)

- **Cost:**
  - $4.1 million cash payment.
  - Variable fee of $1.5/MWh for the first five years after energization.
- **Assets Acquired:**
  - 250-acre site called Stingray, with approvals for up to 100 MW of power capacity.
  - Front-of-the-meter capacity and regulatory approvals.
  - Completed facility extension agreement with ONCOR.
- **Impact:**
  - Expanded Cipher's development pipeline to 2.6 GW across 11 sites.
  - Enhanced Cipher's capacity for high-performance computing and Bitcoin mining operations

Applied Digital

Compared with other public miners, Applied Digital adopted a unique approach to M&A by selling its mining site instead of acquisition. This move reflects a strategic shift toward reallocating resources to its HPC-focused business model, signaling a departure from traditional hosting. By the next market cycle, it's possible to see that Applied Digital totally exits mining operations.

APPLIED DIGITAL FACILITIES

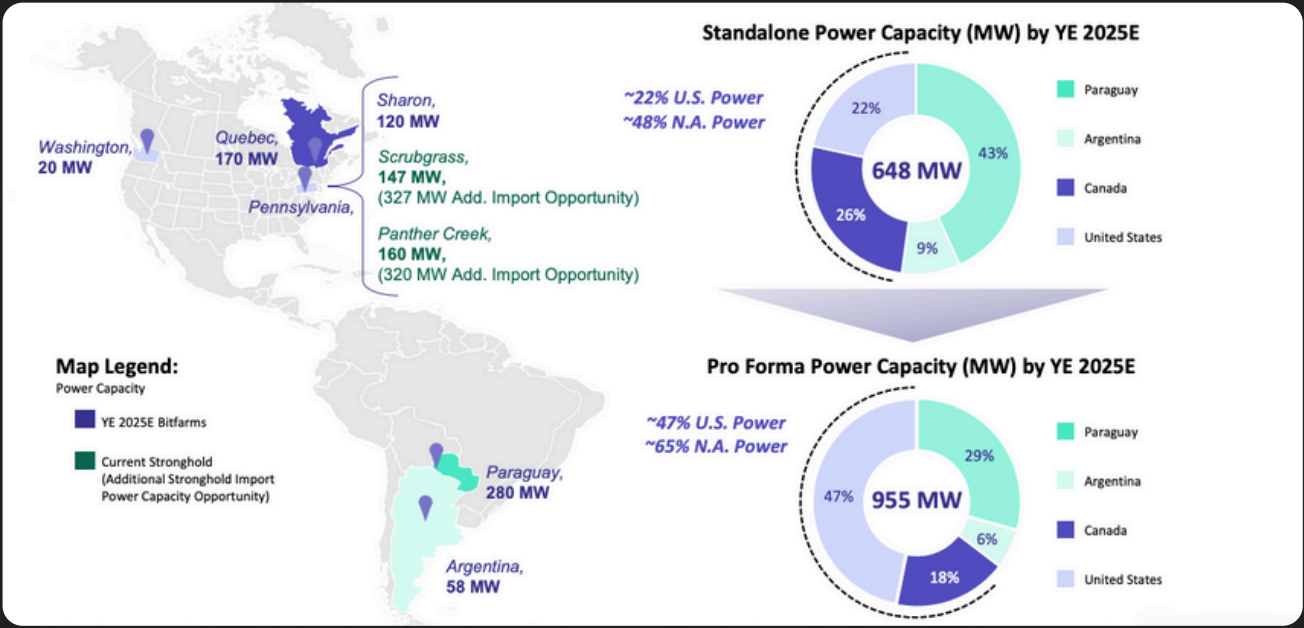
Credit: Applied Digital

1. Sale of Garden City Hosting Facility (agreement executed during Q3 2024):
   - **Buyer:** Marathon Digital Holdings, Inc.
   - **Proceeds:** Up to $87.3 million (gross purchase price $97.3 million after adjustments).
   - **Assets Sold:**
     - 200 MW Garden City hosting facility, including all associated operational infrastructure.
   - **Impact:**
     - Reduced operational complexity and reallocated resources toward its HPC-focused data center strategy in North Dakota.
     - Strengthened the company's balance sheet for long-term growth and operational excellence.

Bitfarms

Similar to CleanSpark, Bitfarms' acquisition strategy emphasizes expanding its operational footprint and increasing mining capacity by utilizing existing infrastructure.

BITFARMS' POST-ACQUISITION ENERGY PORTFOLIO WITH 300+ MW OF US POWER



Source: Bitfarms

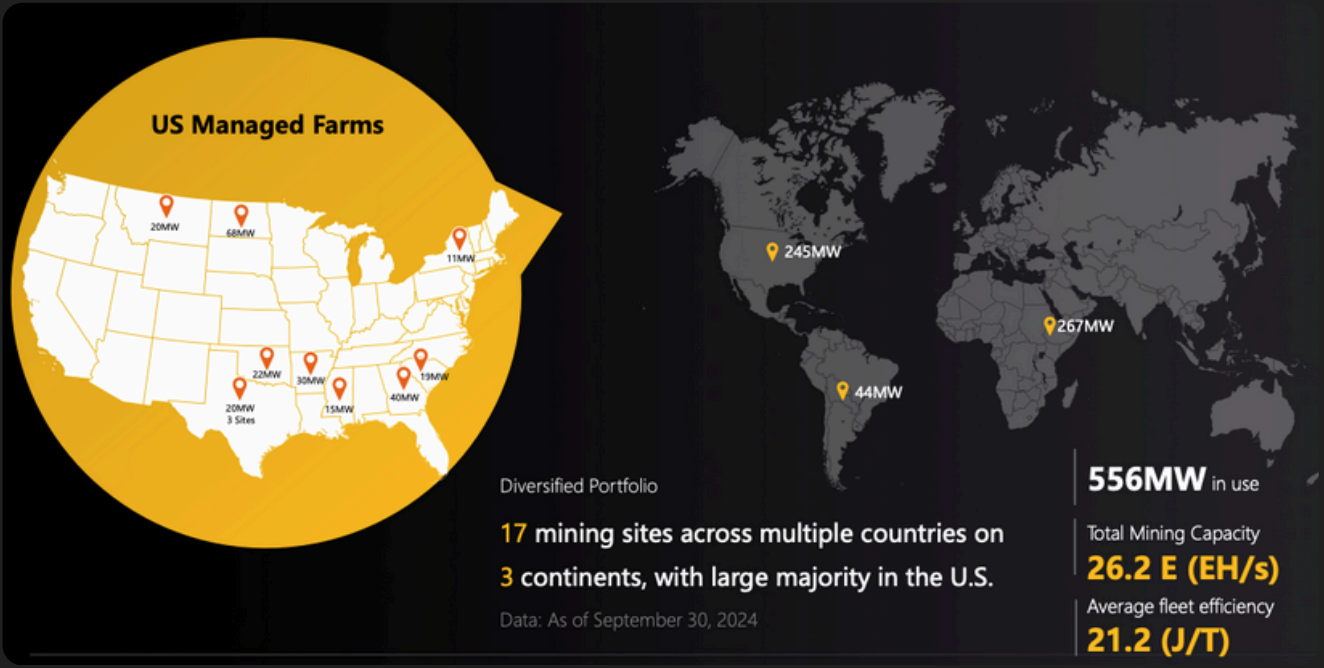
1. Proposed Acquisition of Stronghold Digital Mining, Inc. (Announced on August 21, 2024):
   - **Cost:** $125 million in equity plus assumption of $50 million in debt.
   - **Assets Acquired:**
     - Two merchant power plants (Scrubgrass and Panther Creek) in Pennsylvania, providing 165 MW of nameplate power capacity.
     - 4.0 EH/s of existing hashrate, with potential to reach 10 EH/s after fleet upgrades.
     - 142 MW of current PJM import capacity with long-term expansion potential up to 790 MW.
     - Over 750 acres of land with options for an additional 1,100 acres.
     - Access to the PJM grid, the largest wholesale electricity market in the U.S.
   - **Impact:**
     - Expands Bitfarms' energy portfolio to 950 MW by the end of 2025, with 50% in the U.S., up from 6%.

- Provides visibility on multi-year expansion to 1.6 GW, with 66% in the U.S.
- Adds significant opportunities for carbon capture projects and HPC/AI expansion alongside Bitcoin mining.
- Achieves an estimated $10 million in annual cost synergies.

BitFuFu

While other public miners focus on opportunities in the U.S., BitFuFu has shifted its focus to an emerging destination—Africa.

BITFUFU'S POST-ACQUISITION HASHRATE PORTFOLIO



Source: BitFuFu

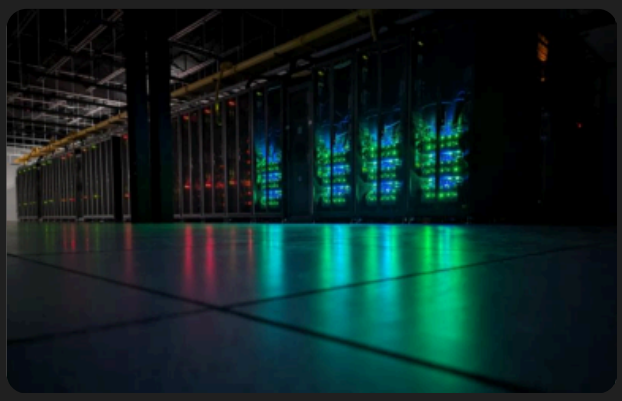
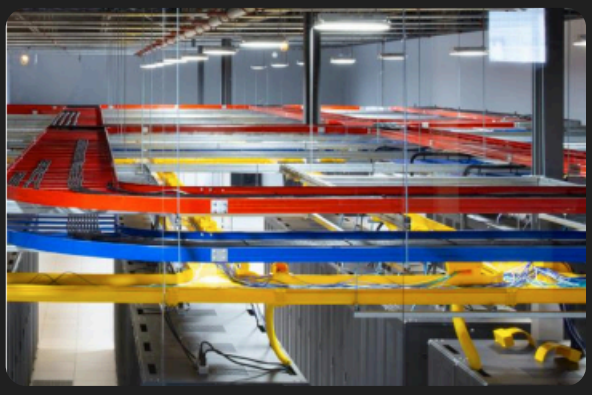
1. Acquisition of 51.25% Stake in Bitcoin Mining Facility in Ethiopia (October 2024):
   - Cost: Not disclosed.
   - Assets Acquired:
     - 51.25% ownership of an 80 MW operational Bitcoin mining facility in Ethiopia.
     - Access to energy costs averaging below $0.04 per kilowatt-hour.
   - Impact:
     - Increased BitFuFu's hosting capacity to over 600 MW, with 13% now owned and operated by the company.
     - Expanded geographical footprint, reducing reliance on U.S.-based infrastructure.
     - Adds potential for 4.6 EH/s mining capacity using Bitmain S21-series miners.

Bit Digital

Instead of expanding its hash rate capacity, Bit Digital focused on revenue generation from business activities it excels at. With its team's strong connections and a lineup of clients ready for HPC services, it was no surprise that the company acquired a Tier-3 data center to develop its business verticals and enhance profit margins.

1. **Acquisition of Enovum Data Centers (October 11, 2024):**
   - **Cost:** Approximately CAD $62.8 million (USD $46 million).
   - **Assets Acquired:**
     - Fully operational 4MW Tier 3 datacenter in Montreal, powered by renewable hydroelectricity.
     - An expansion pipeline of over 280 MW for future development.
     - Expansion pipeline of 288 MW, including 93 MW under LOI, with plans for 8 MW online by 2Q 2025.
   - **Impact:**
     - Vertically integrated Bit Digital's HPC operations.
     - Positioned for further expansion, with 8 MW planned to come online by mid-2025 and 20 MW by the end of 2025.
     - Enhanced revenue potential, with colocation EBITDA expected to reach $13 million annually by mid-2025, excluding additional revenue from internal GPU deployment.

ENOVUM DATA CENTER IN MONTREAL, CANADA


Source: Bit Digital

Hashrate Growth

Public Bitcoin mining companies have aggressively expanded in 2024 by upgrading ASIC fleets, increasing data center capacity, and pursuing strategic acquisitions.

Miners Meeting and Exceeding Hashrate Targets

Iris Energy, CleanSpark, and Riot Platforms led in year-over-year hashrate growth, recording increases of 400%, 234.33%, and 148.39% respectively. Meanwhile, companies like MARA Holdings, CleanSpark, and Iris Energy met or exceeded their ambitious expansion targets of 50EH/s, 37 EH/s and 31 EH/s , respectively.

CLEANSPARK ANNOUNCEMENT EXCEEDING 37 WH/S

Source: CleanSpark

A major factor in this surge is the ready access to capital that public listing provides. Through at-the-market (ATM) offerings, convertible notes, and secondary stock issuances, these companies can rapidly secure funds for next-generation ASIC hardware, lock in favourable power contracts, and make acquisitions that boost operational capacity. Altogether resulting in economies of scale and improved efficiency.

Although disclosures vary among public miners, and some do not share operational figures at all, available data indicates they collectively account for more than 35.26% of the Bitcoin network's total hash rate (with the actual figure likely higher when missing data is included). This represents a significant rise from approximately 21% in 2023.

While many public miners will likely continue increasing their hash rate, others are exploring high-performance computing (HPC) or artificial intelligence (AI) workloads to diversify revenue. By repurposing a portion of their capacity, these firms can hedge against Bitcoin price volatility and mitigate the effects of rising mining difficulty. Consequently, some public miners may shift to HPC computing and maintain or scale back their hash rate, while others opt to further expand their Bitcoin mining operations.

For the latest updates on the hash rate growth of public miners, you can visit bitcoinminingstock.io/hashrate.

Fleets Upgrades

In 2024, we witnessed the 4th Bitcoin halving. Driven by Satoshi Nakamoto's ingenious Bitcoin mechanism and historical trends, public miners have been actively upgrading their fleets to newer ASIC models.

The table below provides a summary of ASIC purchase records from the top 15 U.S.-listed public Bitcoin miners, ranked by market capitalization, in 2024.

PUBLIC MINERS ASIC PURCHASE RECORDS

Company	Models	No./ Sizes	Total Purchase Price (as of Q3 2024)
MARA	-		$240.3 M in advances to vendors
CORZ	Antminer S19J XP Antminer S21	S19J XP: ~28,400 units (4.1EH/s) S21: ~12,900 units (2.5 EH/s)	$120 M
RIOT	WhatsMiner (Air-cooled)	~31,500 units (5.9 EH/s)	$96.7 M
CLSK	Antminer S21 Pro	100,000 units	-
BTDR	SEALMINER A1	3.7 EH/s	-
WULF	Antminer S21 Antminer S21 Pro	S21: 5,000 + 5,000 units S21 Pro: 10600 (S21 pro)	5,000 S21 for $17.5 M Call Option: $9.6 M for 5,000 S21 Pro miners for an additional $16.8 M 10,600 S21 Pro miners for $35.7 M. Grand total: $79.6 M (paid)
IREN	Antminer T21/S21 Antminer S21 Pro	T21/S21: 5 EH/sAmended Purchase Options (up to 11 EH/s): Antminer T21 or S21 Pro (Option : Extended to March 2025) Antminer S21 Pro: 12 EH/s Options: Antminer S21 Pro: 12 EH/s	T21: $14.0/TH S21 Pro: $18.9/TH S21Pro: $15.1/TH (with an additional $3.8/TH payable 9 months post-delivery). Options:S21 Pro: 18.9 TH/s
HUT	Antminer S21+	31,145 units	$15.00 /TH
CIFR	-	7.1 EH/s (Bitmain) + 1.25 EH/s (Canaan)	Bitmain: $97.5 M (paid) + $26.9 M (remaining). Canaan: $13.1 M (paid) + $3.3 M (remaining)
BITF	Antminer T21 Antminer S21 Antminer S21 Hydro	T21: 19,280 units S21: 3,888 units S21 Hydro: 740 unitsTotal: Approx. 8.6 EH/s	T21: $51.3 M S21: $13.6 M S21 Hydro: $4.3 million
CAN	A14 SeriesA15 Series		
BTBT	Antminer S19 Pro Antminer S19K Pro	S19 Pro: 2,350 unitsS19K Pro: 1,146 units	
HIVE	Antminer S19k Pro	4,700 units	

Sources: SEC filings and company presentations. (Companies that did not disclose any information about their new ASIC orders are excluded from this table.)

The majority of companies still favored Bitmain's models, especially the newer and more efficient **Antminer S21 Series**. However, there is some diversification in procurement strategies, with Riot placing orders from **MicroBT**, Cipher Mining allocating approximately 15% of its hash rate to Canaan, and Bitdeer leveraging its own in-house developed **SEALMINER**.

A substantial portion of the newly acquired machines were deployed in 2024, with additional deployments planned for 2025. This trend is reflected in the consistent growth in hashrate throughout the year. **Two notable patterns** have emerged: 1) miners are increasingly prioritizing cost-per-terahash efficiency in their acquisitions, as seen with Hut 8 and Cipher Mining; and 2) miners are introducing flexibility into their agreements by including options to purchase additional units or upgrade to newer models, depending on market dynamics and performance benchmarks.

Overall, public miners have been proactive in upgrading their fleets, prioritizing greater efficiency and increased capacity. These upgrades position them to navigate the challenges and seize the opportunities brought by the 2024 Bitcoin halving and beyond.

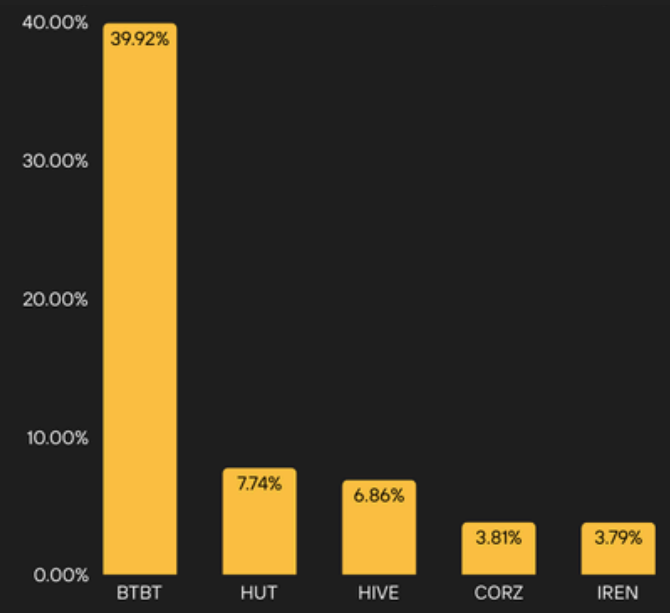
AI / HPC

With AI emerging as one of the most prominent topics in technology and investment circles, it's no surprise that Bitcoin miners are embracing this trend to diversify their revenue streams, particularly as they navigate challenges of the post-halving era.

Reported AI/HPC Revenue

While many public Bitcoin miners announced Artificial Intelligence (AI) and High Performance Computing (HPC) initiatives in 2024, only a handful reported revenue from these ventures as of Q3 2024. In this section, we will focus on publicly listed companies with market capitalizations exceeding $100 million.

AI/HPC REVENUE CONTRIBUTION (Q1-Q3, 2024)



Company	HPC/AI Revenue	Total Revenue
BTBT	$32.71M	$81.95M
CORZ	$15.86M	$417.75M
HUT	$10.11M	$130.69M
IREN	$6.3M	$166.1M
HIVE	$6.29M	$91.77M

(WULF, CIFR, BTDR, BITF, APLD, MIGI, and SLNH have also allocated resources to AI/HPC but reported no revenue from this segment as of Q3 2024)

Source: SEC Fillings & Company Presentations

Core Scientific

Core's pivot to HPC and AI hosting has garnered significant attention, largely driven by its multi-year partnership with CoreWeave. Their HPC hosting services encompass colocation, power delivery, physical security, and routine maintenance for CoreWeave's GPU-based cloud compute workloads.

The partnership began with an initial agreement for 16 MW of infrastructure, which became operational in Q2 2024. Since then, CoreWeave has exercised its options through a series of long-term contracts, committing to approximately 500 MW of infrastructure.

CORE SCIENTIFIC & COREWAVE HPC HOSTING DEALS

Date	Size (in MW)	Delivery Time
February 29	16 MW	Q2, 2024
June 3	200 MW	H1, 2025
June 25	70 MW	H2, 2025
August 6	112 MW	H2, 2025
October 22	120 MW	H2. 2026

Source: Core Scientific

Core Scientific began generating revenue from its HPC hosting segment in Q2 2024 and is projected to earn over $8.7 billion from these agreements over the next 12 years. As the company plans to allocate more of its current and future data centers to high-value compute applications, revenue from this segment is expected to grow steadily. Consequently, revenue from traditional mining hosting will decline significantly as a share of the overall revenue mix

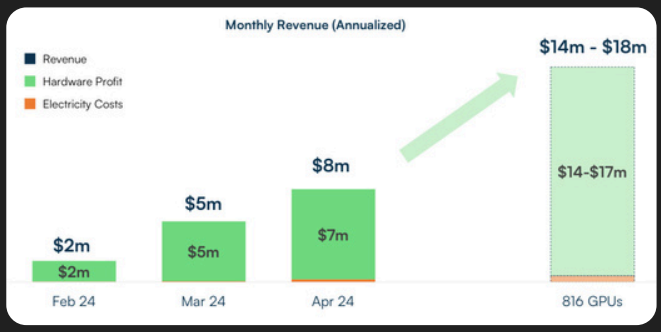
Iris Energy

Iris Energy is another Bitcoin miner making waves in the HPC/AI sector, leveraging its existing infrastructure to expand into high-value compute services. Unlike Core Scientific, which hosts third-party GPUs, Iris Energy provides AI cloud services using its own data centers and GPUs. This approach offers users greater flexibility, enabling both on-demand usage and reserved services tailored to their needs. Notably, the hardware profit margin for these services can reach as high as 98%, underscoring the efficiency of their operations.

In its FY 2024 results, Iris Energy highlighted growth in its AI cloud services as a key strategic priority. According to the company's latest quarterly business presentation (Q1 FY25), it now reports 1,896 NVIDIA H100 and H200 GPUs installed and actively serving multiple customers. While this segment accounted for only 3.84% of total revenue during the first nine months of 2024, its growth potential is substantial.

To put this into perspective, the company previously demonstrated that 816 GPUs could generate approximately $14 million to $18 million in annual revenue when fully utilized. With the current deployment of 1,896 GPUs, Iris Energy's AI cloud services have the potential to contribute an estimated $34 million to $44 million per year in revenue. This projection highlights the scalability of their AI business and its growing importance in their revenue mix.

AI CLOUD SERVICE REVENUE PROJECTION



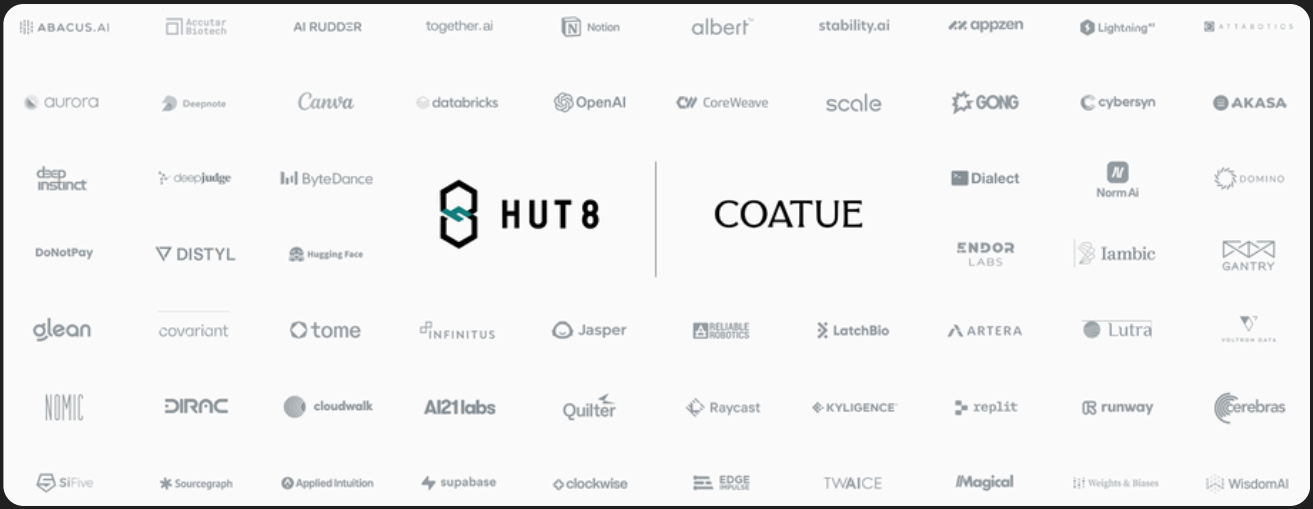
Source: Iris Energy

Hut 8

Hut 8 is another public Bitcoin miner making significant strides into the HPC and AI sectors. The company currently offers colocation, cloud, and connectivity services through its geo-diverse data centers across Canada. These services cater to a wide range of industries, including machine learning, AI, and visual effects.

In the first nine months of 2024, Hut 8 reported $10.11 million in revenue from its HPC segment, accounting for 7.74% of the company's total revenue. While this contribution remains relatively modest, the segment's growth potential is substantial, especially following a $150 million investment from Coatue Management—a renowned technology-focused firm with a strong track record in GPU infrastructure and AI ventures.

HUT 8 JOINS COATUE'S EXTENSIVE AI PORTFOLIO



Source: Hut 8

This partnership enables Hut 8 to scale its GPU-as-a-Service vertical, integrating advanced NVIDIA H100 GPUs into its offerings. Beyond financial backing, Coatue brings valuable industry expertise and market insights, further strengthening Hut 8's competitive positioning in the AI and HPC markets.

Bit Digital

Bit Digital may be relatively smaller in terms of hash rate size (2.51 EH), but it has emerged as a leader (revenue wise) among public miners in the HPC and AI sectors. The company offers advanced HPC services, including GPU-based compute power, to support AI and machine learning applications.

BIT DIGITAL'S KEY HPC DEALS

Date	GPUs	Projected Revenue	Notes
Nov 2023	2048	$50 million/year	Initial customer agreement
Jan 2024	2048	$92 million/year	Expansion of initial customer agreement
Oct 2024	300	$4.6 million over 5 years	Boosteroid (Customer 1)
Nov 2024	16	$320,000 over 6 months	New Customer (Customer 2)
Nov 2024	512	$5 million over 6 months	Customer 3
Nov 2024	576	$10.1 million over 12 months	Customer 4
Nov 2024	64	$1.2 million/year	Customer 5

Source: Bit Digital

Bit Digital launched its AI business line in Q4 2023, marking its entry into the rapidly growing HPC sector. For the first nine months of 2024, the company reported $32.7 million in revenue from its HPC services. In its Q3 report, Bit Digital reaffirmed confidence in reaching a $100 million annual run-rate revenue target for HPC by the end of 2024, supported by a key partnership with Boosteroid, a global cloud gaming provider.

Under the Master Services and Lease Agreement signed with Boosteroid, an initial deployment of 300 GPUs is projected to generate $4.6 million in revenue over five years. Additionally, the agreement includes the potential to scale up to 50,000 servers. If fully realized, this partnership could represent a substantial $700 million revenue opportunity.

In the same month, Bit Digital achieved a significant milestone with the acquisition of Enovum. This 4 MW facility, with the potential to expand up to 288 MW, marks Bit Digital's first owned data center. The acquisition reduces the company's reliance on third-party hosting and is expected to improve margins. In addition, the deal brings an experienced team skilled in operating Tier-3 data centers, further enabling Bit Digital to offer a comprehensive GPU cloud solution in a market with rapidly growing demand.

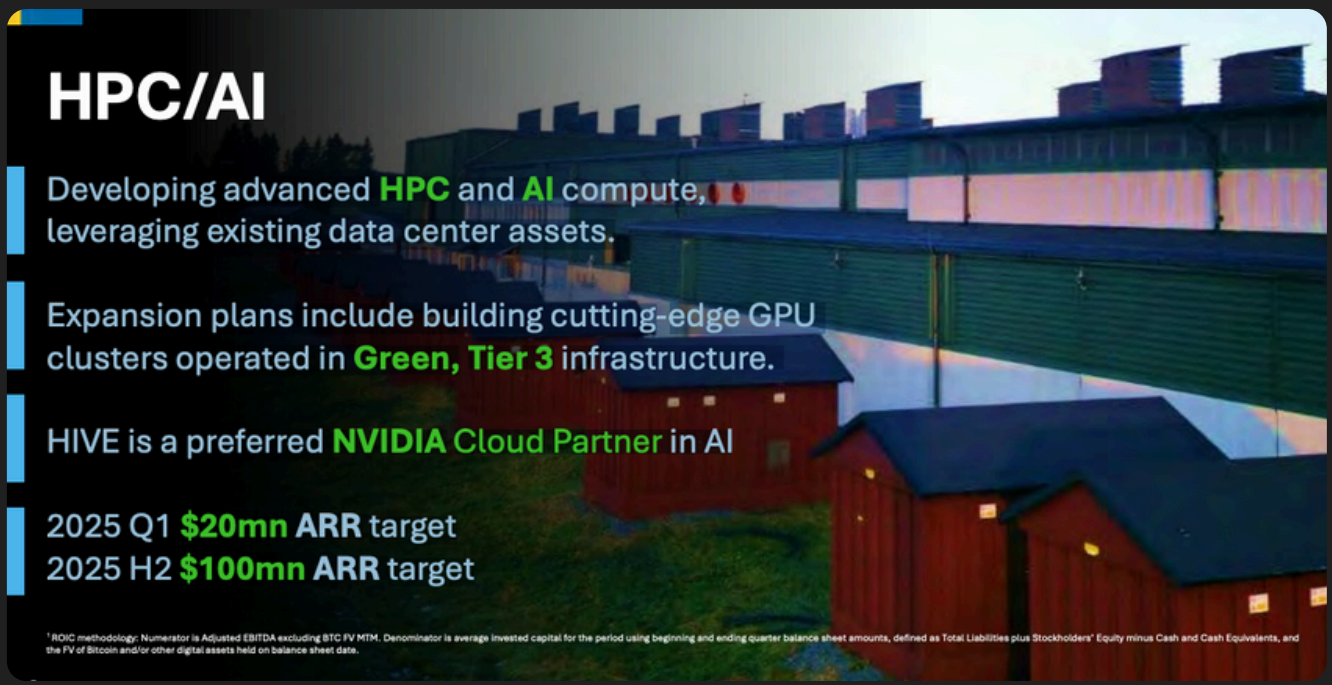
Hive

Hive is a pioneer among Bitcoin miners when it comes to HPC hosting. The company has strategically transitioned its GPU fleet, previously used for Ethereum mining, into enterprise-grade servers to deliver advanced HPC and cloud solutions.

As a preferred NVIDIA Cloud Partner, Hive leverages its cutting-edge infrastructure and strategic partnerships to develop advanced GPU clusters. These clusters feature GPUs such as NVIDIA A4000, A5000, A40, and the newly acquired H100, positioning the company as a competitive player in the rapidly growing AI and HPC markets.

In the first nine months of 2024, Hive reported $6.29 million in revenue from its HPC services. Looking ahead, the company has set ambitious annual recurring revenue (ARR) targets for its HPC business: $20 million ARR by Q1 2025 and $100 million ARR by H2 2025.

HIVE'S HPC/AI REVENUE TARGET



Source: Hive

TeraWulf

As of its Q3 2024 filing, TeraWulf had not yet reported revenue from the HPC/AI sector. However, on December 23, 2024, the company announced a significant long-term data center lease agreement with Core42. This 10-year agreement, with two five-year extension options, is fully guaranteed by Core42's parent company, G42. The latter is controlled by the UAE Sovereign Wealth Fund, which also holds a $1.5 billion AI Cloud agreement with Microsoft—further underscoring its credibility.

The deal includes an initial delivery of 72.5 MW of gross capacity in 2025, with Core42 retaining an option to expand by an additional 135 MW, potentially bringing the total capacity to over 207 MW. TeraWulf projects $1.5 million in annual revenue per MW, with a 70% margin, and has already received a 12-month prepayment from Core42 to fund the development of additional capacity. This partnership positions TeraWulf to generate substantial revenue (~$3.11 billion if 207.5MW fully executed) while expanding its footprint in the HPC and AI hosting sectors.

TERAWULF'S DATA CENTER CAMPUS ON LAKE ONTARIO

Source: TeraWulf

Other Companies

Other public miners, including Bitdeer, Cipher, Applied Digital, Bitfarms, Mawson Infrastructure, and Soluna, have all announced their AI/HPC initiatives. However, as of their Q3 2024 public filings, none of these companies have reported revenue from these ventures. It will be important to monitor how revenue from these initiatives evolves and integrates into their broader business strategies, especially as diverse AI/HPC business models may lead to significantly different financial outcomes.

Miner Revenue

Bitcoin mining production declined in 2024 compared to the previous year, primarily due to the Bitcoin halving event. However, an improved Bitcoin price helped partially offset the impact of reduced output.

Revenue Growth

As shown in the table below, all of the 15 largest miners by market cap experienced revenue growth during the first nine months of the year. In general, the companies with the highest revenue growth were those that significantly expanded their hashrate. However, there were notable exceptions, such as Riot, Bitfarms, and Bit Digital.

PUBLIC MINERS REVENUE GROWTH

Company	Revenue 2023 9 months ended on Sep 30	Revenue 2024 9 months ended on Sep 30	Revenue Growth
MARA Holdings (MARA)	$230.74M	$441.98M	91.55%
Core Scientific (CORZ)	$360.47M	$415.75M	15.34%
Riot Platforms (RIOT)	$201.87M	$234.10M	15.97%
CleanSpark (CLSK)	$115.66M	$289.69M	150.47%
Bitdeer (BTDR)	$253.71M	$280.76M	10.66%
TeraWulf (WULF)	$45.94M	$105.07M	128.71%
Irish Energy (IREN)*	$81.90M	$188.80M	130.53%
Hut 8 Corp (HUT)	$57.88M	$130.69M	125.79%
Cipher Mining (CIFR)	$83.42M	$109.05M	30.72%
Applied Digital (APLD)*	$36.32M	$60.70M	67.13%
Bitfarms (BITF)	$100.13M	$136.72M	36.54%
BitFuFu (FUFU)	$195.53M	$364.17M	86.25%
Canaan (CAN)	$162.40M	$180.56M	11.18%
Bit Digital (BTBT)	$28.86M	$81.95M	183.96%
HIVE Digital (HIVE)*	$46.33M	$54.89M	18.48%

Source: SEC filings and company presentations.

** Data for IREN, Applied Digital, and Hive do not fully cover the first nine months of 2024 due to their home-country reporting formats. Foreign issuers listed on U.S. exchanges are not generally required to file quarterly reports.*

Riot (RIOT) and **Bitfarms (BITF)** achieved impressive hashrate growth of 148.39% and 100%, respectively. However, their revenue growth lagged behind these figures due to rising operational costs and M&A activities, which constrained profitability.

In contrast, **Bit Digital**'s **(BTBT)** performance tells a different story. Despite only an 11.56% increase in hash rate by November 30, 2024, the company achieved an impressive 183.96% YoY growth during the first nine months, making it the fastest-growing company in terms of revenue. The primary driver behind Bit Digital's revenue surge was its HPC/AI hosting operations, which will be explored further in the chapter dedicated to HPC/AI.

Gross Margins

With gross margins there was a mix of improvements and challenges for companies included in the report. Several miners demonstrated significant improvements in gross margins, signalling operational efficiencies and better cost management. For example, **CleanSpark (CLSK)** led the pack with a jump from 45.37% in 2023 to 62.59% in 2024, reflecting its ability to control costs and capitalize on higher Bitcoin prices. Similarly, **Hut 8 Corp (HUT)** and **Cipher Mining (CIFR)** also achieved notable improvements in their gross margins.

PUBLIC MINERS GROSS MARGINS

Company	Gross Margin 2023	Gross Margin 2024	Notes
MARA Holdings (MARA)	-11.29%	-24.11%	
Core Scientific (CORZ)	23.35%	27.98%	
Riot Platforms (RIOT)	-48.22%	-14.78%	
CleanSpark (CLSK)	45.37%	62.59%	
Bitdeer (BTDR)	20.01%	21.83%	
TeraWulf (WULF)	59.99%	59.08%	
Iris Energy (IREN)	2%	29%	Financial Year (July 1, 2023- June 30, 2024)
Hut 8 Corp (HUT)	41.22%	49.24%	
Cipher Mining (CIFR)	55.62%	59.50%	
Applied Digital (APLD)	30.56%	-0.59%	3 months ended on Aug 31
Bitfarms (BITF)	-23.22%	-24.68%	
BitFuFu (FUFU)	5.50%	9.23%	
Canaan (CAN)	-114.98%	-43.18%	
Bit Digital (BTBT)	31.98%	42.90%	
HIVE Digital (HIVE)			6 months ended on Sep 30

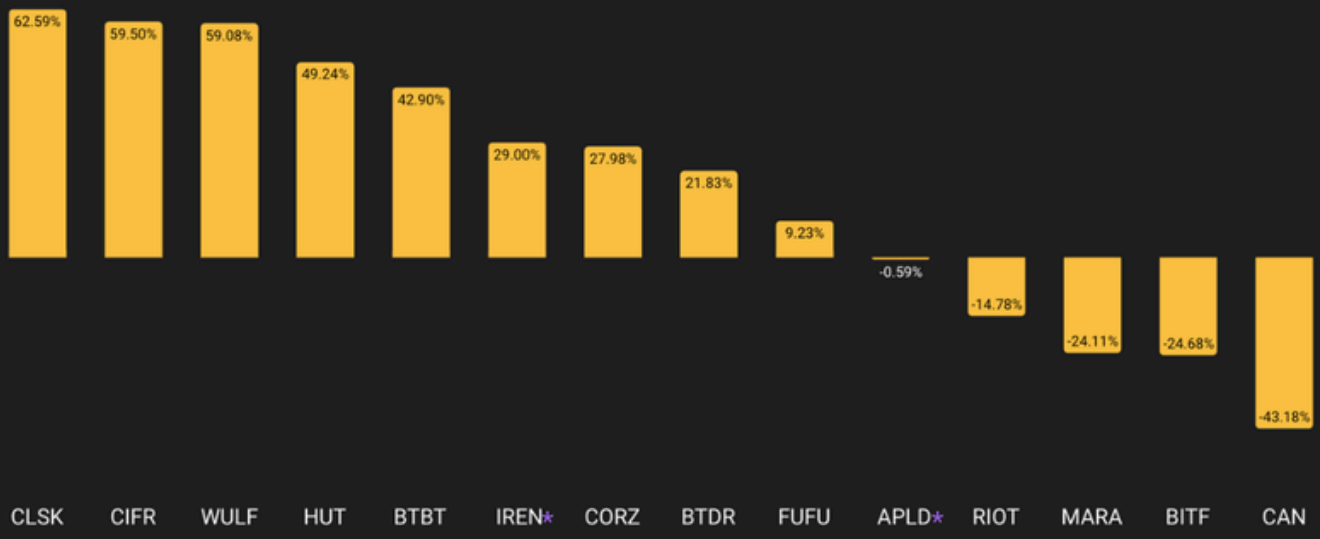
Source: SEC filings and company presentations.
Data reflect the first nine months ended September 30, unless noted otherwise.

On the other hand, some companies continued to face challenges, with negative gross margins highlighting operational inefficiencies or persistent cost pressures. **MARA Holdings (MARA)** and **Riot Platforms (RIOT)**, despite improving their gross margins compared to 2023, still reported negative figures at -24.11% and -14.78%, respectively. This underscores the difficulty these companies face in managing costs relative to revenue, even in a more favourable Bitcoin price environment. **Bitfarms (BITF)** and **Canaan (CAN)** also struggled with negative gross margins. While Canaan showed significant improvement, it remained deeply in the red at -43.18%

In contrast, companies like **TeraWulf (WULF)** and **Bit Digital (BTBT)** maintained relatively stable or improving gross margins, reflecting consistent operational performance.

Overall, while some miners have successfully leveraged operational efficiencies and market opportunities to achieve robust margin growth, others continue to grapple with cost pressures and operational challenges. This serves as a clear reminder of the importance of strategic investing and cost management to remain competitive in the ever-evolving Bitcoin mining landscape.

Bitcoin Miners' gross margins *(First 9 Months Ended Sept 30, 2024)*



Source: SEC filings and company presentations.
*IREN's numbers are based on FY 2024, while APLD's numbers are based on data for the 3 months ended September 30, 2024

Bitcoin Treasury Strategies

In 2024, a notable shift emerged among Bitcoin miners, with many opting to retain a larger portion of their mined Bitcoin or refraining from selling altogether. This trend extends beyond just holding mined coins —several public miners, including MARA, Riot, and Hut 8, purchased additional Bitcoin using funds raised through financial instruments.

Bitcoin Treasury Strategies

Bitcoin Treasury Strategies, reflects a broader adoption of Bitcoin as a strategic asset on corporate balance sheets. One of the most prominent advocates of Bitcoin Treasury Strategies is Michael J. Saylor, whose company, MicroStrategy, has set the benchmark for this approach. By the end of 2024, MicroStrategy's success was undeniable: its stock delivered a staggering year-to-date (YTD) return of 322.68%, outperforming even tech giants like Nvidia, which achieved a 178.78% YTD return. MicroStrategy's playbook—raising capital through equity and debt to accumulate Bitcoin—has not only solidified its position as a market leader but also inspired others, particularly in the Bitcoin mining sector.

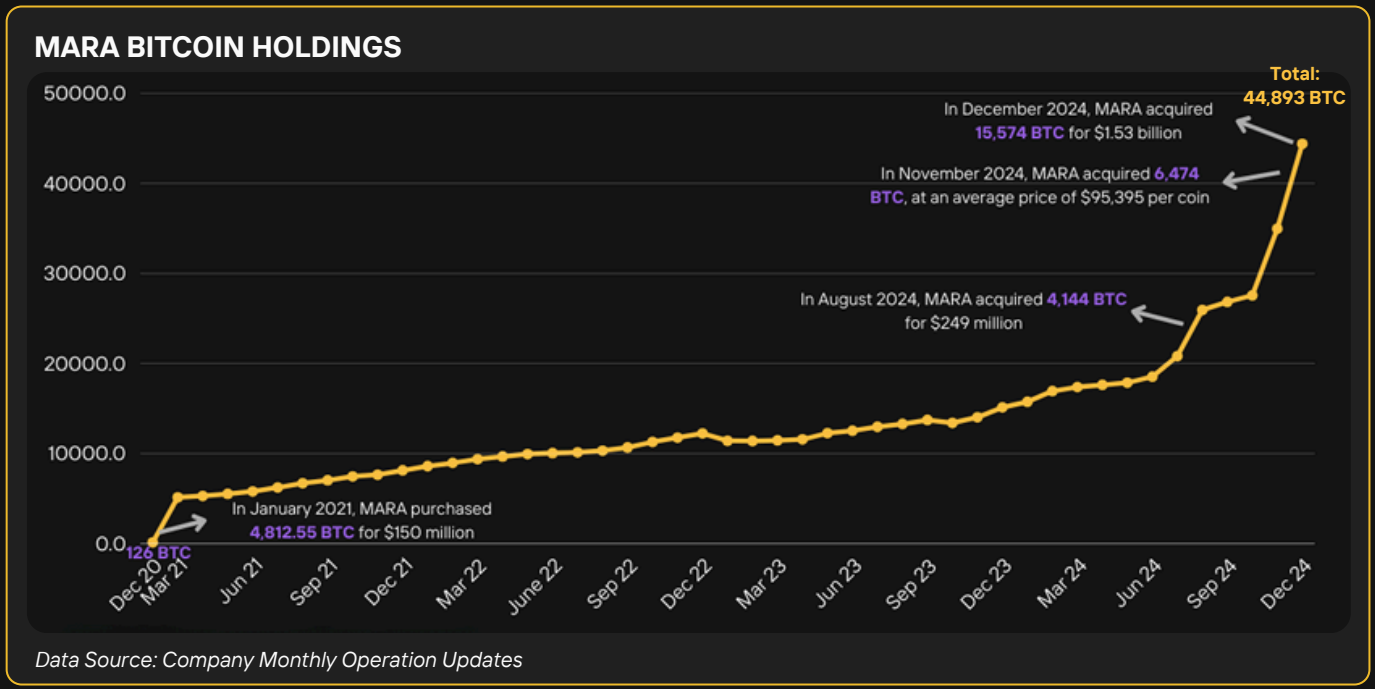
BITCOIN HOLDINGS OF PUBLIC MINERS

#	Company	Bitcoin Holdings	1M %	6M %	YoY %	Value	Sats/Share
1	MARA Holdings, Inc. MARA	34,959 BTC	26.84%	95.77%	149.26%	$3,275,327,937	10,300.78
2	Riot Platforms, Inc. RIOT	11,425 BTC	4.55%	25.77%	55.27%	$1,070,414,534	3,321.93
3	CleanSpark, Inc. CLSK	9,297 BTC	6.85%	51.07%	261.05%	$871,041,043	3,177.79
4	Hut 8 Corp. HUT	9,122 BTC	0.13%	0.21%	-0.08%	$854,645,197	9,737.54
5	HIVE Digital Technologies Ltd. HIVE	2,713 BTC	3.39%	10.69%	66.75%	$254,182,462	2,102.42
6	BitFuFu, Inc. FUFU	1,663 BTC				$155,807,385	1,020.86
7	Cipher Mining, Inc. CIFR	1,383 BTC	-3.15%	-35.43%	147.85%	$129,574,031	397.64
8	Bitfarms Ltd. BITF	870 BTC	-26.77%	2.35%	8.48%	$81,510,779	184.13
9	Bit Digital, Inc. BTBT	813 BTC	4.07%	-21.71%	47.34%	$76,170,417	529.61
10	Bitdeer Technologies Group BTDR	443 BTC	19.09%		1065.79%	$41,504,914	316.92
11	DMG Blockchain Solutions, Inc. DMGI	423 BTC	6.02%	-5.79%	-1.40%	$39,631,103	208.27
12	Gryphon Digital Mining, Inc. GRYP	18.367 BTC		8.04%		$1,720,814	35.45
13	Argo Blockchain PLC ARBK	3 BTC	50.00%	-72.73%	-85.71%	$281,072	4.71

Data: November updates from BitcoinMiningStock.io

MARA Hodlings

Among Bitcoin miners, MARA Holdings has actively embraced this strategy, raising capital through convertible notes with exceptionally low interest rates relative to Bitcoin's inherent volatility. This financial manoeuvring has allowed MARA to significantly increase its Bitcoin holdings, positioning itself as **the miner with the largest Bitcoin reserves** at year-end 2024.



Data Source: Company Monthly Operation Updates

Notably, MARA also leads in **Bitcoin per share** (BTC/share), a critical metric for investors who favor MicroStrategy's strategy. The BTC/share metric is essential because as Bitcoin's value appreciates, companies with substantial Bitcoin reserves experience an increase in their book value per share, ultimately enhancing shareholder value. For investors, this underscores the dual benefit of exposure to Bitcoin's price movements alongside equity appreciation. This dynamic often leads such companies to trade at a premium to their net asset value (NAV) in Bitcoin, making them attractive to those seeking both growth and a hedge against fiat depreciation.

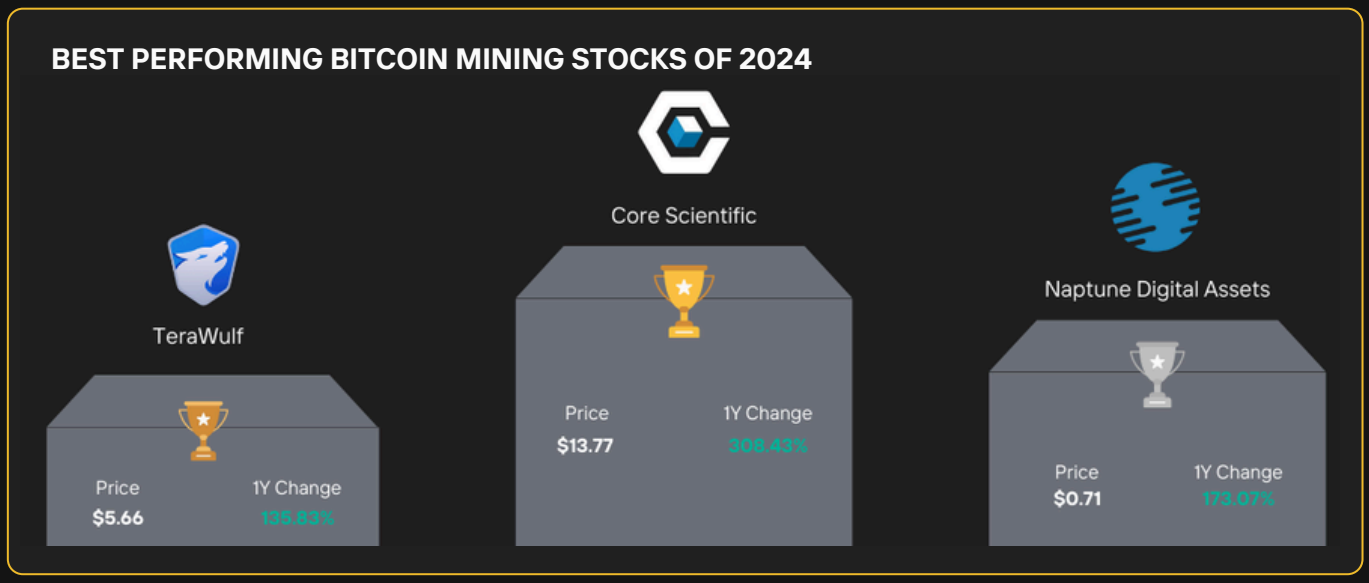
Source: BitcoinMiningStocks.io

Stock Performance

Key milestones in 2024 like the approval of spot Bitcoin ETFs, the fourth Bitcoin halving, and new all-time highs generated significant positive momentum, boosting investor confidence across the industry.

Larger Bitcoin Miners Outperform Smaller Rivals

Publicly listed Bitcoin miners, often viewed as a proxy for Bitcoin, experienced mixed outcomes. While some successfully capitalized on favourable market conditions, others struggled with operational challenges and declining stock prices.



While multiple miners performed exceptionally well, the following analysis focuses on companies that adopted notable strategies, which intended to provide inspiration for the broader mining sector.

Top Gainers

1. Core Scientific (CORZ)

With a current market cap of $3.92 billion, Core Scientific has achieved an impressive **308.43% growth** in its share price during the year. The company was relisted in late January 2024 after emerging from Chapter 11 bankruptcy in 2022. Despite its financial struggles during that period, Core Scientific continued to operate large-scale Bitcoin mining with a hashrate capacity of 20.3 EH/s. However, what truly reignited investor interest was its HPC/AI hosting deal, capitalizing on the growing demand for computing power in the AI industry.

The standout deal is a 12-year contract with CoreWeave, expected to generate $8.7 billion in revenue over its lifetime. This is the largest HPC/AI contract among public miners and has garnered significant attention from Wall Street analysts and investors. Such deals offer stable, predictable revenues, helping to offset the volatility and risks associated with Bitcoin mining, especially during bear markets. Core Scientific's ability to secure this ground-breaking HPC/AI agreement exemplifies its 'winning' strategy.

2. TeraWulf (WULF)

TeraWulf has a market cap of $2.18 billion and saw its share price **rise by 135.83%** in 2024. While its hash rate of 8.4 EH/s is respectable, the company's exceptional performance can largely be attributed to the expertise of its management team, which brings extensive experience in finance and energy. TeraWulf treats Bitcoin mining as a traditional commodity business, focusing on minimizing marginal costs per unit. This strategy has resulted in one of the lowest mining costs per Bitcoin in the sector.

By providing clear and transparent cost metrics, TeraWulf reduces uncertainty for both institutional and retail investors, showcasing its competitive edge. Additionally, its prudent management approach, which emphasizes shareholder value, has further instilled confidence among investors. This combination of operational efficiency and strategic focus is TeraWulf's "winning" strategy.

3. Bitdeer (BTDR)

Bitdeer recorded a **119.77% increase** in its share price in 2024 ending with a market cap of $3.02 billion,. Despite its extensive global operations, with a total of 20.7 EH/s under management, the company's stock had underperformed for much of the year, trading below its initial offering price of $10. Investor sentiment shifted dramatically in late November 2024, following two key developments: Bitdeer's breakthrough in ASIC development and a private placement of $360 million in convertible senior notes to fund further data center expansion and ASIC development.

These moves boosted investor confidence, particularly with the launch of SEALMINER ASICs to the public. If these specifications deliver as promised, Bitdeer could position itself as the most vertically integrated Bitcoin miner in the market. Vertical integration is Bitdeer's competitive advantage.

BITDEER FACILITY IN THE US

Source: Bitdeer

Underperformers

As noted earlier, the majority of miners with smaller market caps (< $1 billion) faced a challenging year. However, attention is drawn to the larger miners whose performance dipped, as their strategies may offer invaluable lessons.

1. MARA Holdings (MARA)

With a market cap of $5.69 billion, MARA saw its share price **decline by 28.60%** in 2024. As the largest public miner in terms of both market cap and hash rate, MARA underperformed and lagged behind its peers despite favourable market conditions. This raises the question: what went wrong?

MARA undertook several promising **initiatives**, such as transitioning away from hosting to reduce costs, forming a joint venture in Abu Dhabi with ADQ (one of the largest sovereign wealth funds), and exploring innovations like methane emissions capture and heat reuse to warm 80,000 Finnish homes. Moreover, MARA holds the second-largest Bitcoin treasury (after MicroStrategy) among all publicly listed companies, not just in the mining sector.

MARA MITIGATING METHANE EMISSONS AT A LANDFILL

Source: Nodal Power

The core issue appears to be a **lack of operational focus**. While these initiatives are impressive, they have not translated into improved financial performance. Investors ultimately prioritize tangible metrics like revenue growth and profitability. In MARA's case, operational costs continue to exceed revenues, as highlighted in its quarterly reports. Without a clear path to cost reduction and efficiency, these initiatives risk being viewed as distractions rather than value drivers.

Shareholder dilution is another critical challenge. The weighted average of diluted common stock increased from 169 million shares in 2023 to over 321 million in 2024. This dilution erodes shareholder value and undermines investor confidence. At the same time, MARA's pivot toward a MicroStrategy-like strategy—borrowing long-term to purchase Bitcoin—raises questions about its core business model. For investors drawn to this approach, MicroStrategy (MSTR) may be a better choice, given its lower borrowing costs and lack of mining-specific challenges, such as depreciation.

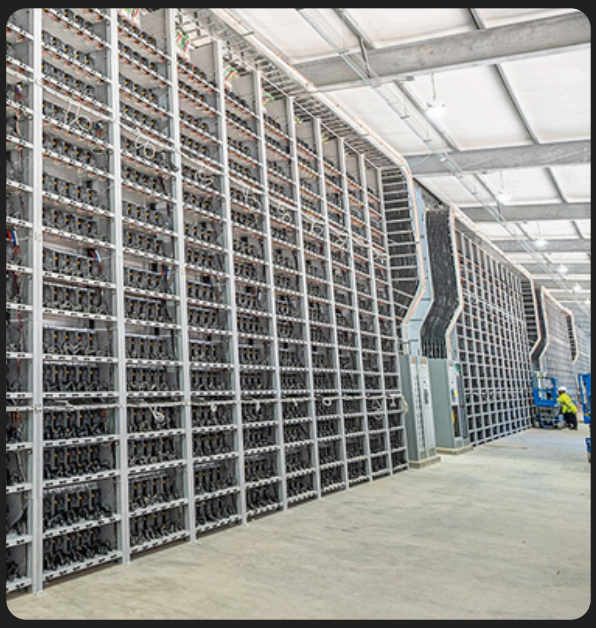
Ultimately, MARA's current operational model faces clear challenges. While Bitcoin has a capped supply, the same cannot be said for MARA's shares. Operational inefficiencies and shareholder dilution appear to be the major factors contributing to the company's underwhelming stock performance in 2024.

2. Riot Platforms (RIOT)

With a market cap of $3.51 billion, RIOT experienced a share price **decline by 34.00%** in 2024. Similar to Marathon Holdings (MARA), Riot's cost of revenue continued to exceed its revenues, reflecting **fundamental challenges** in its core Bitcoin mining operations. This ongoing unprofitability has been a key factor influencing investor sentiment.

Riot's non-mining revenue stream-- power-curtailment strategy, has been a differentiator in previous years. However, as the Texas grid stabilizes with large-scale battery adoption, the profitability of this strategy appears to be diminishing. This is evident from a decline in curtailment credits, which fell from $49.6 million in Q3 2023 to $12.4 million in Q3 2024. While the strategy still provides value, its reduced contribution has added pressure to Riot's financials.

RIOT PLATFORMS BITCOIN MINING FACILITIES



Source: Riot Platforms

The company also faced a **significant increase in selling, general, and administrative (SG&A) expenses**, which rose by 130% year-over-year. Stock-based compensation was a key driver, growing from $14.7 million in the first nine months of 2023 to $94.7 million in the same period of 2024. While stock-based compensation is a common practice in the mining industry, such disproportionate growth raises concerns among some investors who perceive these rewards as misaligned with the company's financial performance. Additionally, $4.2 million in advisory fees and $3 million in litigation expenses further contributed to higher SG&A costs.

Legal disputes added complexity to Riot's financial picture. The company is involved in multiple cases. In addition, Riot's hostile takeover attempts of Bitfarms also introduced additional costs without achieving the desired outcome.

Overall, Riot's 2024 performance highlights several areas for reflection. While the company remains a key player in the Bitcoin mining industry, challenges related to cost management and legal complexities have impacted its stock performance.

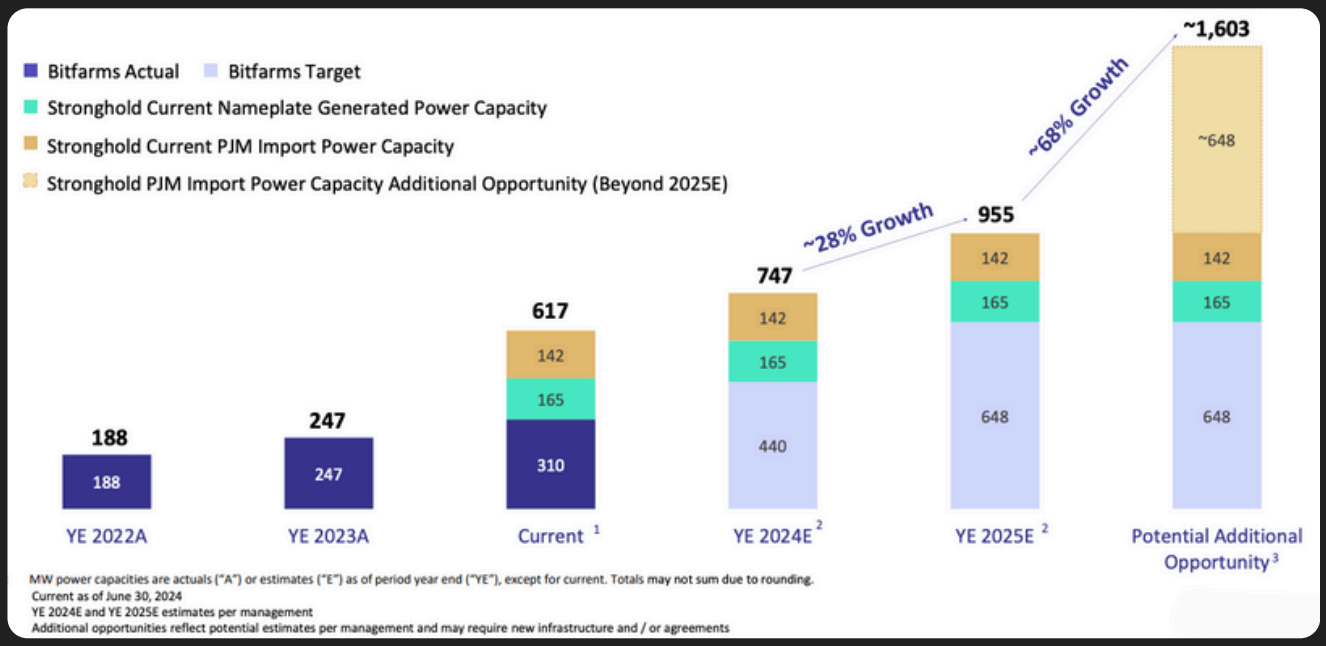
3. Bitfarms (BITF)

With a market cap of $704.02 million, Bitfarms experienced a significant **48.79% decline** in its share price in 2024. The company, dual-listed on the Toronto Stock Exchange (TSE) and NASDAQ, faced multiple challenges.

One of the key issues was Bitfarms' **failure to meet its hash rate target**. Originally aiming for 21 EH/s by the end of 2024, the company delayed (around November) this goal to June 30, 2025. At the end of 2024, its hash rate stood at 12.8 EH/s—a notable improvement of 96.92% compared to 2023, but still far below its original target. This significant delay damages investor confidence big times.

Another factor weighing on Bitfarms' stock performance was **its involvement in mergers and acquisitions (M&A) activities**. Facing a hostile takeover attempt, the company implemented defensive strategies (referred to as a "red pill"). These moves led to management reshuffling and lawsuits involving former executives, which created further uncertainty for investors. Another defensive move Bitfarms took was to acquire Stronghold Digital, a deal valued at $125 million in equity along with the assumption of $50 million in debt. While the acquisition is expected to add 4.0 EH/s of Stronghold Digital's existing hash rate to Bitfarms' portfolio (with the potential to reach 10 EH/s after fleet upgrades), the 71% premium paid for the deal raised concerns among investors. Questions linger about whether the anticipated synergies justify the price tag.

BITFARMS' POWER CAPACITY AFTER ACQUISITION



Source: Bitfarms

Now that its disputes with Riot have been settled, Bitfarms faces **the challenge of rebuilding momentum** under new leadership. The company will need time to regain its footing and align its performance with market expectations. If anything, Bitfarms' 2024 challenges underscore the importance of managing investor expectations. A clear focus on execution and strategic planning will be critical for future success.

For the latest updates on top gainers and losers, bitcoinminingstock.io offers real-time data with adjustable timeframes, including 5-day, 1-month, and year-to-date. Additional options, such as 6-month, 1-year, and 5-year timeframes, will be available soon.

Miner Stocks vs BTC

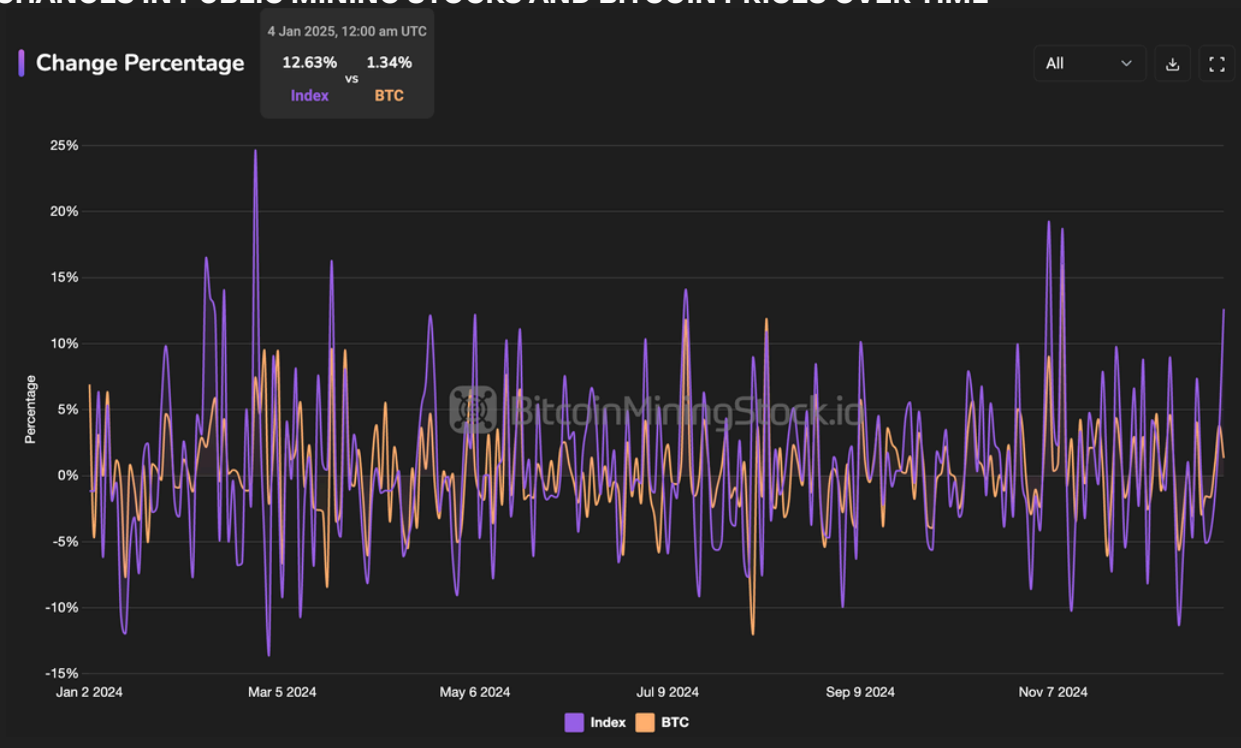
For years, Bitcoin mining stocks have been seen as a proxy for Bitcoin. But with Bitcoin hitting a new all-time high in 2024, many are now asking whether this correlation still holds and how these mining stocks stack up against BTC itself.

Examining the Correlations

Bitcoin mining stocks have long been viewed as proxies for Bitcoin, especially before Bitcoin ETFs became available. In this section, we analyze the mining stock performance by drawing the charts of the Bitcoin Mining Stock Index from BitcoinMiningStock.io. This index tracks publicly traded Bitcoin mining companies listed in the United States (excluding OTC markets), capturing roughly 82% of the global Bitcoin mining stock market capitalization. Companies within the index are weighted by size, meaning larger players have a greater influence. The index updates daily, excluding weekends and other non-trading days.

When examining the percentage-change charts, the strong correlation between mining stocks and Bitcoin becomes clear. This affirms their role as a "Bitcoin proxy." In other words, Bitcoin mining stocks remain an attractive option for investors seeking exposure to Bitcoin's growth potential without holding the underlying asset.

CHANGES IN PUBLIC MINING STOCKS AND BITCOIN PRICES OVER TIME



Source: BitcoinMiningStock.io

2024 Performance Comparison

To evaluate overall performance, consider a scenario starting on January 1, 2024, where you invest the equivalent of 1 BTC (valued at $44,957.97) in Bitcoin, and an equal amount in the hypothetical "Bitcoin Mining Stock Index." During the first half of 2024, the index underperformed Bitcoin—likely due to market uncertainties surrounding the upcoming Bitcoin halving. However, as mining operations expand and hash rates increase, confidence in these stocks appears to be steadily recovering.

RETURNS OF THE BITCOIN MINING INDEX AND BITCOIN OVER TIME

Source: BitcoinMiningStock.io

While it is impractical for individual investors to replicate the index on a daily basis, this benchmark still offers a valuable perspective on how a broad basket of Bitcoin mining stocks perform compared to Bitcoin itself. Looking ahead, if historical trends hold, Bitcoin mining stocks may again outpace Bitcoin in 2025. Nonetheless, this projection is speculative and should not be treated as investment advice.

Investor Sentiment

To assess market sentiment toward Bitcoin mining stocks, institutional holdings are analyzed. Large organizations, such as hedge funds, mutual funds, pension funds, and exchange-traded funds (ETFs), are required to submit quarterly disclosures of their equity holdings via SEC filings if they manage over $100 million in assets. In many ways, institutional holdings serve as a proxy for market confidence.

Growing Institutional Interest

In 2024, institutional interest in Bitcoin mining stocks grew significantly, signalling the industry's increasing acceptance within mainstream portfolios. This trend is evident in both the rising number of institutions holding shares and the overall growth in the value of their holdings.

Among Bitcoin miners, **MARA Holdings (MARA)** leads the sector with 678 institutional owners and $5.21 billion in institutional value, reinforcing its position as a market leader. **Riot Platforms (RIOT)** and **CleanSpark (CLSK)** follow with 511 and 480 institutional owners, respectively.

Source: Fintel (Chart includes only miners with market cap > $100M on Dec 31, 2024. GLXY and CAN are excluded due to lack of data).

Shifts in ownership patterns reveal additional dynamics. **Core Scientific (CORZ)** recorded the largest increase in institutional ownership, adding 188 new owners. Meanwhile, Riot Platforms experienced a decline of 31 owners but still saw its institutional value grow by $36.2 million, indicating increased stakes from remaining investors or valuation gains. Other miners like **Bitdeer Technologies Group (BTDR)** and **Hut 8 Corp. (HUT)** also gained traction, adding 43 and 92 new institutional owners, respectively, showcasing growing interest in emerging players.

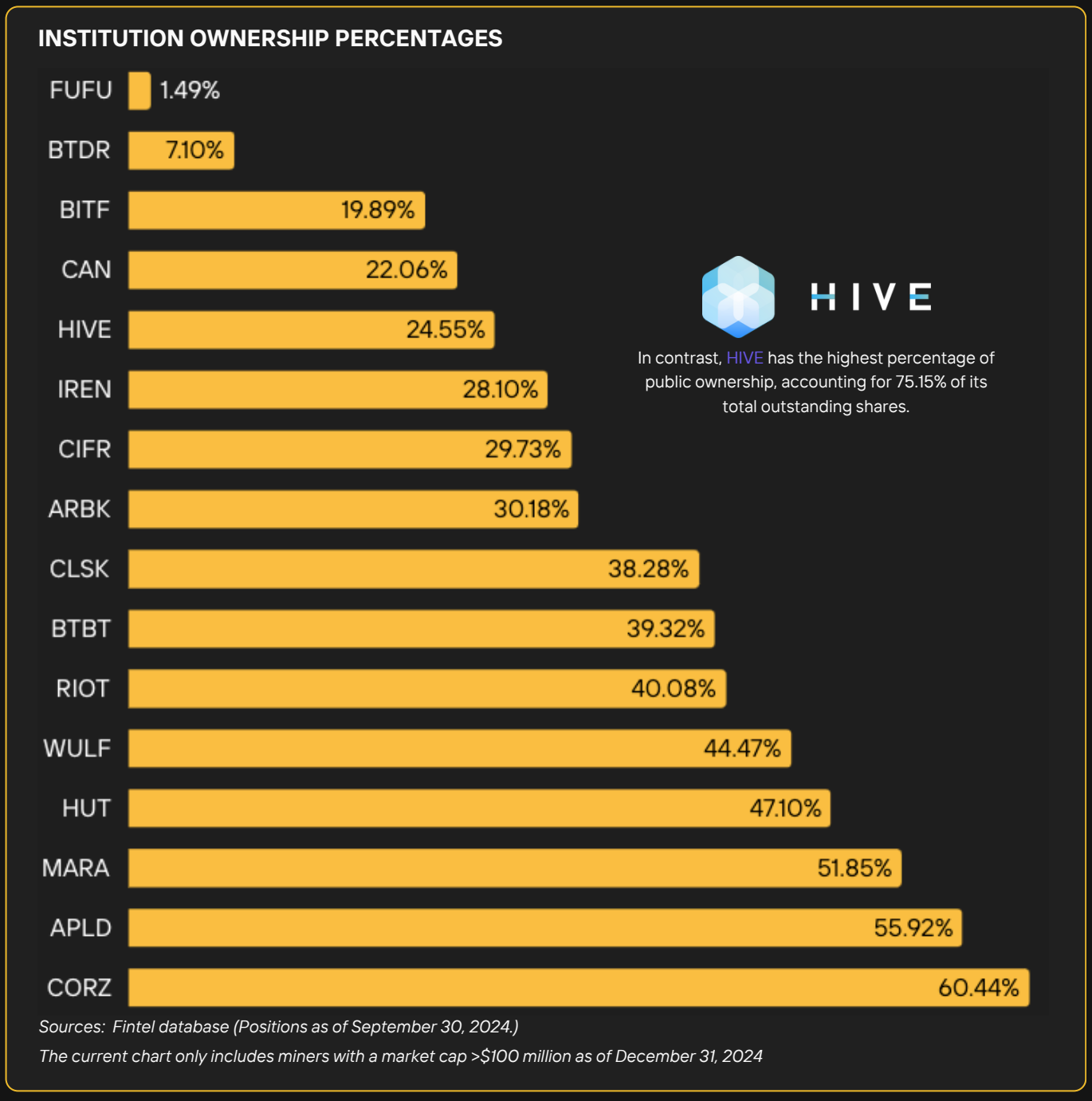
Larger miners (by market cap) remain the **preferred choice for institutions** due to their established reputations, broader analyst coverage, and higher trading liquidity. Companies with triple-digit institutional ownership include MARA, RIOT, CLSK, CORZ, WULF, CIFR, APLD, HUT, BTBT, IREN, BITF, BTDR, and HIVE. In contrast, miners with market cap< $100m generally have fewer than 50 institutional owners. These stocks remain niche investments and attract institutions that are willing to take on higher risks for potentially higher returns.

CHANGE IN INSTITUTIONAL OWNERSHIP AND VALUE

Security	Current Owners	Change in Owners	Current Value	Change in Value
MARA	678	25	$5,210,817,128	$59,195,478
CORZ	430	188	$2,703,264,626	$115,100,773
RIOT	511	-31	$1,738,575,428	$36,217,854
BTDR	130	43	$183,205,100	$17,823,816
CLSK	480	-9	$1,814,434,945	$30,272,609
WULF	406	57	$1,137,279,777	$86,595,777
IREN	215	32	$668,511,514	$72,506,778
HUT	301	92	$834,248,847	$45,351,012
CIFR	340	33	$582,785,031	$20,758,435
APLD	328	56	$1,462,935,330	$37,869,960
FUFU	12	2	$9,030,861	$3,318
BITF	193	-2	$208,070,433	$6,218,953
BTBT	228	-10	$231,105,798	$2,687,210
ARBK	37	-5	$5,217,987	$192,863
HIVE	107	11	$120,791,795	$722,925
SDIG	66	7	$31,331,692	$1,251,543
DGHI	26	3	$2,255,801	$35,235
EBON	17	-3	$360,181	$82,374
BTCM	14	0	$1,131,910	$1,295
ANY	32	0	$1,819,665	$48,950
GRYP	36	4	$1,841,174	$92,995
SLNH	30	6	$1,263,949	$500
GREE	33	-2	$1,245,008	$1,707
MIGI	26	0	$2,831,713	$2,697
BTOG	6	0	$49,543	$98,566

Sources: Fintel database (Positions as of September 30, 2024. GLXY, CAN, NDA, DMGI and CBIT are excluded due to lack of data).

The growing institutional interest in Bitcoin mining stocks reflects a maturing market that continues to attract significant capital. While larger miners dominate due to their scale and credibility, the rising traction of smaller players signals a broadening interest that could reshape the competitive landscape. As Bitcoin mining solidifies its role within the cryptocurrency ecosystem, institutional investors are likely to deepen their participation, further validating the industry's long-term potential.



In summary, the growing institutional interest in Bitcoin mining stocks reflects a maturing market that continues to attract significant capital. **Larger miners are the primary beneficiaries of this trend**, thanks to their scale and establishment. However, the increasing traction of smaller players suggests a broadening interest that could reshape the competitive landscape. As Bitcoin mining solidifies its role within the cryptocurrency ecosystem, institutional investors are likely to deepen their involvement, further validating the industry's long-term potential.

Bitcoin Mining
2024 Review

FUTURE OUTLOOK

SPONSORED BY: NiceHash

7 Predictions for 2025

2024 has been a record breaking year in many aspects. Historical patterns suggest that the year following a halving often bring unique opportunities for miners. Let's analyse potential scenarios and explores some key projections for Bitcoin mining in 2025, .

Network Hashrate Surpasses 1 Zetahash

On January 1st, 2025, the Bitcoin network hashrate stood at 807 EH/s. In 2024, the network added 292 EH/s, following an increase of 250 EH/s in 2023. This represents an average annual growth of 271 EH/s.

- If 2025 maintains a growth pattern similar to the past two years, the network is projected to reach 1,078 EH/s by the end of the year. If the growth rate is exactly the same this year as 2024, the network will be at 1,099 EH/s.
- In 2024, the network grew 16.8% more than in the previous year. Applying this same growth trend to 2025 suggests an additional 341 EH/s, resulting in a total hashrate of 1,148 EH/s.
- In percentage terms, the network grew by 56.7% in 2024. If a similar percentage growth rate continues in 2025, the hashrate could reach 1,265 EH/s. Alternatively, using the average annual growth rate of the past two years (75.5%), the network could hit 1,416 EH/s by year-end.

Considering these scenarios, it seems highly probable that the Bitcoin network hashrate will surpass 1 Zetahash for the first time in history by the end of 2025.

BTC Needs to Exceed $200K for Hashprice to Return to Pre-Halving Levels

Before the halving, hashprice stood at $103/PH/day. Over the past two years, the average month-over-month difficulty adjustment has been 3.15%. By projecting this trend 6, 12, and 18 months into the future —and assuming transaction fees remain below 1% (as is currently the case)—we can estimate the Bitcoin price required to sustain various hashprice levels.

- To maintain the current hashprice in 6 months, Bitcoin would need to reach approximately $115,000.
- In 12 months, a Bitcoin price of $140,000 would result in a hashprice of around $55/PH/day.
- To return to the pre-halving hashprice of approximately $100/PH/day, Bitcoin would need to exceed $200,000 in 6 months and surpass $300,000 in 18 months.
- If in 12 months from now Bitcoin falls below $100,000 again, a new historic low hashprice will be measured.

These projections highlight the significant price growth required for hashprice recovery amidst rising network difficulty.

REQUIRED BITCOIN PRICE PER HASHPRICE LEVEL - PROJECTED 6, 12 & 18 MONTHS

Hashprice ($/PH/day)	BTC in 6 months	BTC in 12 months	BTC in 18 months
$40	$83,586	$101,307	$122,784
$50	$104,483	$126,633	$153,480
$55	$114,931	$139,297	$168,828
$60	$125,379	$151,960	$184,176
$65	$135,828	$164,623	$199,524
$70	$146,276	$177,287	$214,872
$75	$156,724	$189,950	$230,220
$80	$167,173	$202,613	$245,568
$85	$177,621	$215,277	$260,916
$90	$188,069	$227,940	$276,264
$95	$198,517	$240,603	$291,612
$100	$208,966	$253,267	$306,960

Source: Digital Mining Solutions

Price Outpacing Difficulty Adjustments

In the final quarter of 2024, Bitcoin's network difficulty rose by 24.2%, while its price surged by 56%. Building mining facilities, manufacturing, and deploying ASIC hardware takes time, creating a lag between rapid price movements and hashrate growth.

During the 2021 bull market, we witnessed this phenomenon firsthand: Bitcoin's price increased faster than the network's hashrate, resulting in a period of heightened profitability for miners. If Bitcoin continues its bullish momentum into 2025, we could see a similar scenario play out, potentially leading to another profitable cycle for miners

BITCOIN PRICE OUTPACING NETWORK DIFFICULTY

Source: Lincoin Lens

Launch of First 1 PH/s ASIC Miner

The hashrate output of ASIC hardware has grown remarkably over the past few years. In April 2020, the first ASIC miners with a computing power exceeding 100 TH/s entered the market. By early 2022, the first miner surpassing 200 TH/s was introduced. In 2024, hydro-cooled units from Bitmain and MicroBT approached 500 TH/s.

This year, Bitmain is set to commercialize the U3S21EXPH, boasting an impressive 860 TH/s—nearly double the hashrate of the S21XP Hyd (473 TH/s). It wouldn't be surprising if the first ASIC miner with 1 PH/s is announced in 2025. Such a machine will likely be hydro-cooled and utilize a U3 form factor to accommodate the immense hashrate density.

First ASICs to Reach Single Digit Efficiency

In 2024, the first ASIC miners with an efficiency below 20 J/TH entered the market. Most models achieved efficiencies between 15 and 20 J/TH, but standout models, such as the Bitmain Antminer S21 XP series, pushed boundaries even further—reaching efficiencies 13.5 J/TH for air- and immersion-cooled versions, and an impressive 12 J/TH for the hydro-cooled model.

Achieving single-digit efficiency will require only a 25% improvement, a milestone likely to be reached by 2025. Bitdeer has already outlined this ambition in the technological roadmap for their SEALMINER series.

SEALMINER TECHNOLOGY ROADMAP

Source: Bitdeer

The S19 Will Make a S9-Style Comeback

In Q4 2024, hashprice climbed back above $60/PH/day—a critical level where it spent most of 2023. This threshold is particularly significant for miners using 30+ J/TH ASICs, as it often serves as a key profitability benchmark. When hashprice fell below $60/PH/day after the 2024 halving, many miners faced tough decisions: either switch off their machines or invest in upgrading their fleets to more efficient models.

If hashprice stabilizes above $60/PH/day, it could lead to older-generation ASICs being brought back online, sparking a potential revival of mining hardware that has been sidelined. This scenario would further boost network hashrate. However, the ultimate impact will depend on hashprice trends and available rackspace with low enough operating expenses.

Such a revival could mirror the resurgence of the Antminer S9 during the 2021 bull run. In 2020, S9 units had lost over 95% of their value, with some miners even giving them away. Yet, as Bitcoin entered the later stages of the bull market and mining margins improved, S9s became profitable again, and their price surged from below $4/TH to over $50/TH—an extraordinary 1,350% increase.

ANTMINER S9 PRICE REVIVAL IN 2021

Source: HashrateIndex

Wider Adoption Bitcoin Treasury Strategy

The adoption of Bitcoin Treasury Strategies appears to be gaining traction as a standard practice. A pivotal development in this space is Bitwise's proposal to launch a Bitcoin Standard Corporations ETF (December 26, 2024), which would include companies meeting specific criteria:

- Market capitalization of at least $100 million.
- Minimum average daily liquidity of $1 million.
- Public free float of less than 10%.

If approved by the SEC, this ETF could include a significant number of public Bitcoin miners, potentially driving further demand for their stocks. This institutional backing could amplify the importance of Bitcoin holdings as a competitive differentiator among miners. As such, miners may be further incentivized to increase their Bitcoin reserves to align with investor and institutional expectations.

THE MOST BULLISH MAN IN BITCOIN

Credit: Stocktwits

About Us

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Digital Mining Solutions

Digital Mining Solutions delivers expert mining economics analysis, innovative business strategies, and actionable insights into the latest industry trends. We specialize in tailored content creation, in-depth research reports, and business plan optimization, empowering clients through engaging masterclasses and strategic guidance for long-term success.

We leverage an extensive partner network encompassing data center infrastructure providers, ASIC hardware brokers, mining facility operators and industry-leading consultants. This ecosystem enables us to deliver comprehensive solutions tailored to every aspect of Bitcoin mining operations.

Our diverse client base includes operators, hosting providers, miners, investors, a thriving community of 4,000+ newsletter subscribers, and an engaged social media audience. Backed by deep industry insights and extensive expertise, we've earned a reputation as a trusted authority in the mining sector—delivering strategic guidance to navigate and succeed in a rapidly evolving landscape

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BitcoinMiningStock.io is the go-to platform for comprehensive and transparent data on publicly traded Bitcoin miners. Our mission is to empower investors with timely, reliable insights to make confident decisions in this rapidly evolving industry.

Founded by a veteran of one of the largest public mining companies, BitcoinMiningStock.io bridges the gap between investors and companies. Our flagship Deep Dive delivers concise insights and translates complex operational updates into metrics that align with traditional financial standards.

In addition to providing comprehensive data, BitcoinMiningStock.io offers consulting and research services tailored to the unique dynamics of the Bitcoin mining sector. As we continue to grow, we are introducing innovative features designed to set new standards for transparency and accessibility in the industry.