



**HASHRATE
INDEX**

Hashrate Index 2021 Year-End Report

Luxor[▲]

Research by Hashrate Index

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About Hashrate Index

Hashrate Index is a Bitcoin mining data, analytics and research platform. Our platform offers novel data sets that enable miners, traders, content creators, and investors to gain key insights into the mining industry and generate alpha. Hashrate Index is a product from Luxor Technology, a mining software and services company.

Table of Contents

1	Executive Summary	3
2	2021: The Year of the Great Hashrate Migration	5
3	Hashprice Rises from the Dead	8
	<ul style="list-style-type: none">• USD Hashprice Rises, BTC Hashprice Falls• China's Mining Ban Opens a Profitability Window• Miners Reel In Record Revenue in 2021• January 2021 Rig Payback Modeling	
4	The Great Hashrate Migration Opens the ASIC Market	17
	<ul style="list-style-type: none">• Not All ASICs are Created Equally• ASIC Manufacturing Is Leaving China• Spreads Between ASIC Sales in North America, Asia Are Closing• New Challengers Confront Bitcoin's ASIC Oligopoly	
5	North America's Mining Industry Hits a Growth Spurt	28
	<ul style="list-style-type: none">• Public Miners Cash In On China's Mining Ban	
6	Federal and Local Governments Make In-Roads With the Bitcoin Mining Industry	36
	<ul style="list-style-type: none">• Public Miners Cash In On China's Mining Ban	
7	Mining Pools Grapple for Dominance as North America Grabs Market Share	39
	<ul style="list-style-type: none">• Taproot's "Speedy Trial" Provides Potential Template for Future Soft-Forks• Chinese Pool Outages Highlight the Need for Stratum Redundancy	
8	Hashrate Financialization: On Track But Not There (Yet)	44
9	Altcoin Mining Has Its Moment in the Sun	47
10	The Dawn of a New Epoch	50
	<ul style="list-style-type: none">• 2022 Projections	



1

Executive Summary

When we launched Hashrate Index two years ago, we wanted to build a platform that made mining data more accessible and easier to understand for everyone. We started by creating the Hashprice Index, a metric that quantifies the expected market value of a unit of hashrate; hashrate is a digital commodity, and Luxor's Hashprice Index reflects the value of that commodity and provides a benchmark to measure how hashprice changes under different market conditions.

Our next major contribution to the realm of mining metrics, our Rig Price Index, aggregates ASIC market data from thousands of data points to create a reliable feed for up-to-date prices. Whereas ASIC markets have historically been fogged by opaque business practices and marred by pricing asymmetries, we believe our Rig Index provides an invaluable tool for miners and investors to accurately gauge trends in the ASIC market.

As linchpins of Hashrate Index, the above metrics were indispensable for our Year-End Report. Hashprice is the lifeblood of a mining operation—ASICs, the sinew and muscle. By using both metrics in chorus with other on-chain and off-chain data, we can make better sense of the cacophony of market forces that impact Bitcoin and its mining industry.

Our Year-End Report examines data for hashprice, regional and global ASIC prices, mining pools, public mining equities, hashrate derivatives, altcoin mining, and on-chain data, in addition to developments with global regulation, Bitcoin protocol development, and other trends.

We hope you enjoy reading this report as much as we enjoyed writing it.



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2

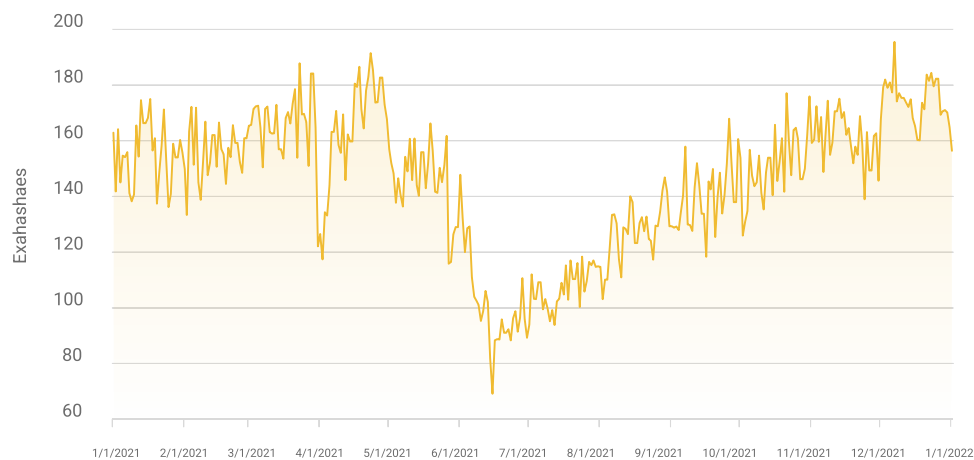
2021: The Year of the Great Hashrate Migration

On January 1, 2021, Bitcoin crossed \$30,000 for the first time. It was a little over two weeks since the cryptocurrency tore through its previous all-time high of ~\$20,000. Cruising past this prior high, Bitcoin rang in the New Year on an auspicious note, and the febrile excitement that infected its markets and stakeholders would foreshadow perhaps the most exciting and pivotal year in the cryptocurrency's short life.

2021 was the year that Bitcoin "rose from the dead" to many a cock-sure naysayer. It was the year that witnessed the first soft-fork upgrade since Segwit, Taproot. It was the year that the first nation-state in El Salvador adopted Bitcoin as legal tender (and started mining bitcoin to boot); the year of the first Bitcoin futures ETF and Bitcoin mining ETF; the year of bitcoin on corporate balance sheets; and it was the year that multiple public miners saw their valuations blossom to billion dollar marketcaps.

And for the mining industry as a whole, it was the year that China definitively threw the ban hammer on Bitcoin mining, the single most significant event for miners since the advent of ASIC mining in 2012. Perhaps the greatest stress-test for the Bitcoin mining industry to-date, the network displayed tremendous resilience during and after the event, bending but never breaking in the face of a momentous restructuring of hashrate across the globe.

Bitcoin Network Hashrate



Source: [Hashrate Index](#). Bitcoin's hashrate fell by roughly 60% from its Spring all-time high to its yearly low following China's mining ban. It quickly recovered some 126% and set a new 7-day moving average all-time high in December of 2021.

The Great Hashrate Migration—the global relocation of Chinese mining operations following the ban—marked the beginning of a new phase for the Bitcoin mining industry. Nation states are starting to devise mining strategies, miners are proliferating rapidly on public markets, and financing options are maturing as capital from boutique to blue chip firms alike look for exposure to the industry.

We're not early anymore, folks. In many regards, 2021 was the year that Bitcoin became a household name and, in a sense, undeniable. So too was 2021 the year that Bitcoin mining asserted itself as a multi-billion dollar industry that can't be ignored—and that won't be easily killed, even as the once-center of its universe, China, moves to ban it.

The center didn't hold, but it didn't need to; instead, it moved to the periphery, and places that were once on the fringe of the Bitcoin mining landscape are now its heartlands.

Bitcoin Mining Companies Landscape



Mining Pools



ASIC Manufacturers



Colocation/Hosting Providers



Foundries



Miners



ASIC Brokerage



Container Providers



Research



ASIC Financing



Custom Firmware





3

Hashprice Rises from the Dead

2021 Year End Snapshot

EoY Hashrate 7-Day Average
170.87 EH/s (+17%)

2021 Total Mining Rewards
\$16.7 billion | 375,911.62 BTC mined

EoY USD Hashprice
\$0.25/TH/day (+18%)

EoY BTC Hashprice
530 sats/TH/day (-27%)

Average 2021 Hashprice (USD)
\$0.31/TH/day 674 sats/TH/day

Average 2021 Hashprice (BTC)
674 sats/TH/day

2021 Hashprice (USD) High/Low
\$0.41/TH/day / \$0.19/TH/day

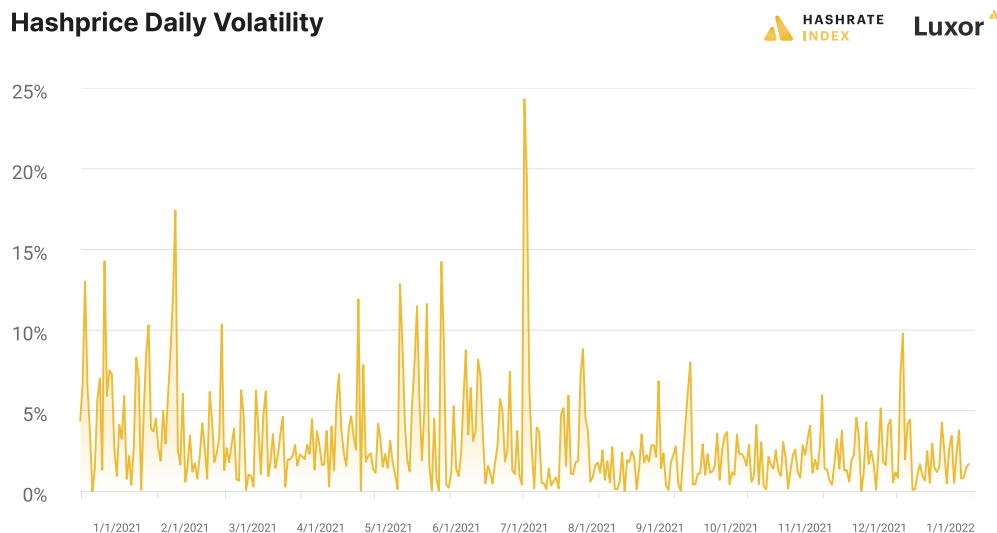
2021 Hashprice (BTC) High/Low
938 sats/TH/day / 522 sats/TH/day

2021 was the most profitable period for miners since the last bull cycle, a time when hashprice surged above \$3.00/TH/day and stayed above \$0.50/TH/day well into 2018.

Bitcoin's price began its run-up in Q4 2020, lifting mining profitability from rock-bottom levels of \$0.07/TH/day in September 2020 to \$0.21/TH/day by the beginning of 2021.

The three-fold increase presaged the most lucrative year for Bitcoin miners to date in terms of aggregate USD revenue. What it wouldn't portend, though, were the extreme profitability swings and the once-in-a-blue-moon opportunity presented by 2021's watershed event: China's bitcoin mining ban.

Hashprice Daily Volatility



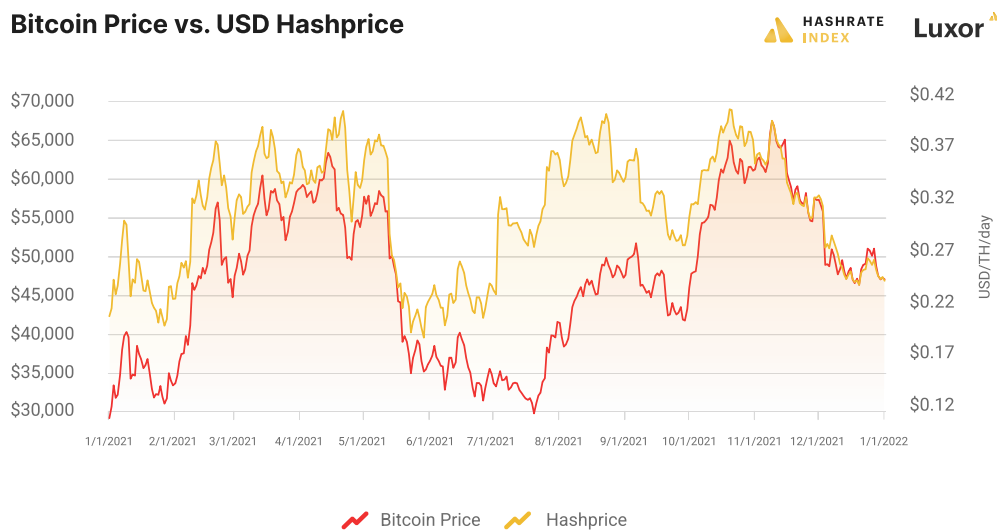
Source: [Hashrate Index](#).

USD Hashprice Rises, BTC Hashprice Falls

Hashprice and Bitcoin price are directly correlated: if number goes up, hashprice goes up, and vice versa if number goes down.

Of course, if hashrate and, by extension, difficulty go up faster than Bitcoin's price, then USD-denominated hashprice can drop. It can also go up regardless of Bitcoin's price if difficulty drops, as evidenced by the largest downward adjustment in Bitcoin's history following China's mining ban—a 28% decrease that paved the way for the most profitable months of the year.

With Bitcoin's price rising roughly 80% over the year, USD mining profitability also had a good year, appreciating some 35% over 2021.

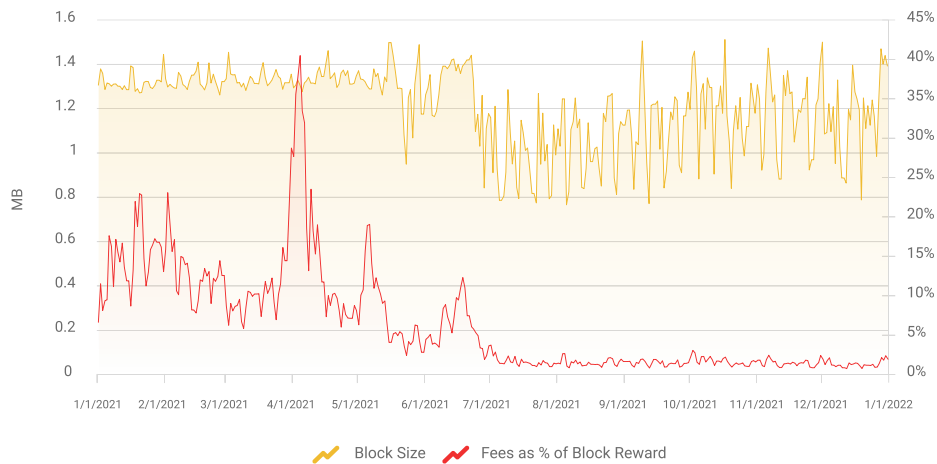


Source: [Hashrate Index](#).

Bitcoin's USD-denominated hashprice hit a three-year high of \$0.41275/TH/Day on October 19th, just weeks before the orange coin itself set a new all-time high. Notably, hashprice could have been several cents higher at this time if fee revenue were at pre-China ban levels.

But after China banned bitcoin mining, transaction volume and fees dropped precipitously.

The average blocksize for the first 6 months of the year, for example, was 1.32 MB, but this average dropped to 1.07MB for the second half of the year. **This triggered a staggering 86% reduction in fees as a percentage of block rewards, which made up on average 11.35% of block rewards in the first half of the year and 1.5% of rewards in the second half of the year.**



Source: [Hashrate Index](#).

Adoption of [Segwit](#), which now constitutes over 80% of all on-chain payments, and the growth of the [Lightning Network](#) partly explain the reduction in blocksize and fees. But they don't tell the whole story, particularly considering Bitcoin hit a new all-time high following the China mining ban; transactions fees typically spike whenever bitcoin makes a big move, but they stayed rock-bottom in Q3 and Q4 of this year even after bitcoin set this new all-time high.

We expect transaction fees to remain low as a percentage of mining revenue for the remainder of this halving cycle, another raging bull market notwithstanding.

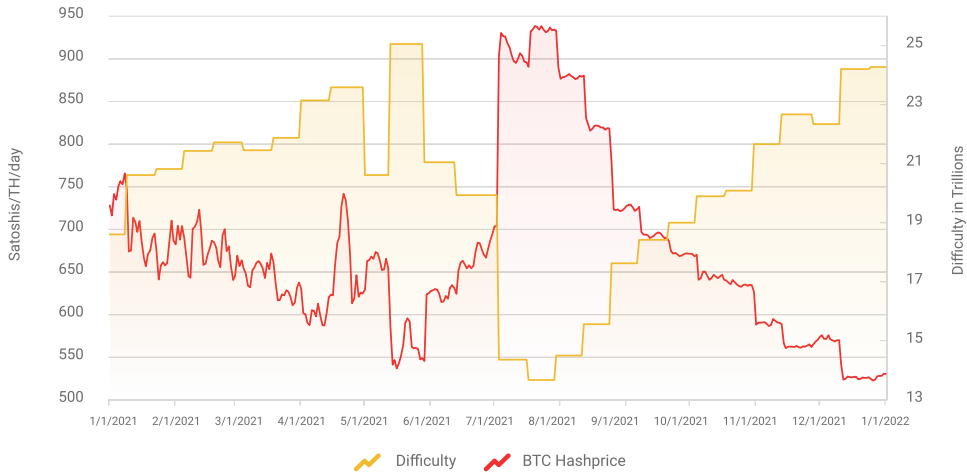
China's Mining Ban Opens A Profitability Window

While USD hashprice has been trending up, BTC-denominated hashprice fell over the year—with the exception of two uniquely profitable months thanks to China's mining ban.

The ban delivered a profitability boost in the form of Bitcoin's largest-ever downward difficulty adjustment on July 3, a 28% whopper that increased BTC hashprice by 32% from 703 sats/TH/day to 930 sats/TH/day.

This golden window closed quickly, though, as hashrate experienced a herculean recovery that threw difficulty back up to pre-China ban levels. **With the lucrative opportunity presented by China's mining ban gone, BTC-denominated hashprice fell 27% over the year.**

BTC Hashprice vs. Difficulty

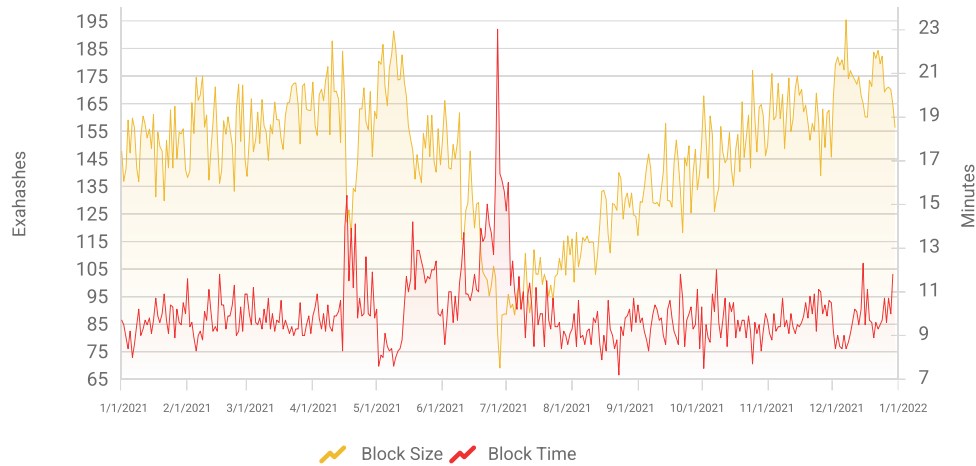


Source: [Hashrate Index](#).

Looking beyond hashprice, the network disruptions from China's mining ban sent ripple effects through every metric imaginable. For example, average block time became one of the most notable casualties in the immediate aftermath of the ban.

As hashrate began slipping in mid-May, block times began to spike, with miners taking on average 12.5 minutes to find blocks until July 3's record adjustment. This sluggish block propagation reached a crescendo on June 27, when the average block time was an incredible 23 minutes.

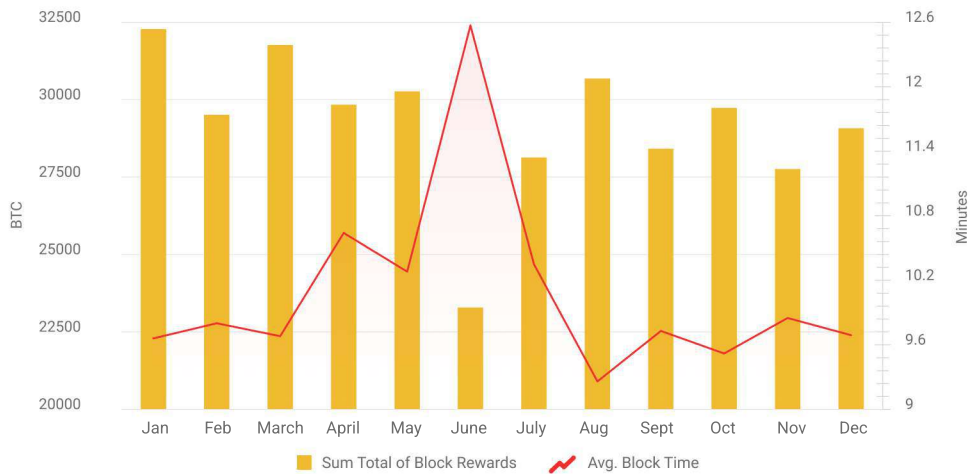
Avg. Block Time vs. Bitcoin Hashrate



Source: [Hashrate Index](#).

June's sluggish block times put a dent in miner revenue for the month. **Miners in June, for instance, earned just 23,289 BTC, 23% less than they had earned in the prior month of May.**

Monthly BTC Block Rewards vs. Monthly Avg. Block Time



Source: [Hashrate Index](#).

By Q3, the slog became a hustle. With hashrate coming back online at a rapid clip, block production went into overdrive in August with an average block time of 9.2 minutes. This netted miners 30,683 BTC over the month, a 9% increase from July’s rewards and a 24% increase from June’s. Moreover, the haul was even greater than the rewards miners earned in April and May, a time when fees were at yearly highs.

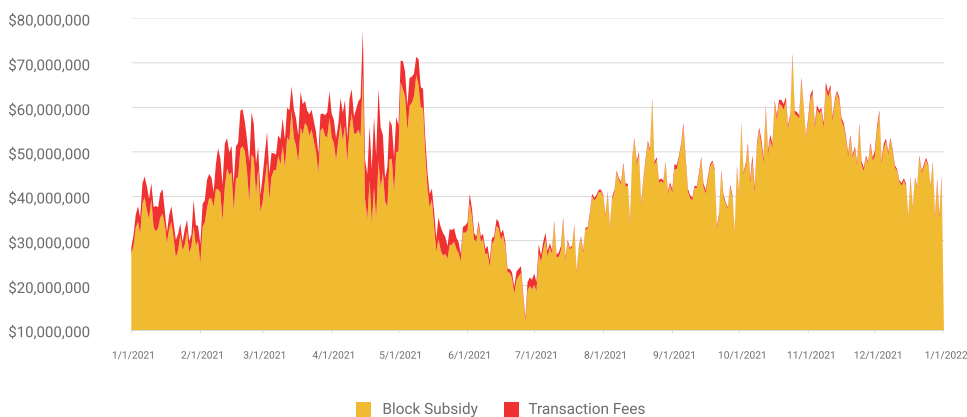
Miners Reel In Record Revenue in 2021

As of January 3, 2022, Bitcoin is a teenager. And in the bildungsroman of Bitcoin’s short life, 2021 was a pivotal chapter for the coming-of-age asset.

Nowhere is this more concretely demonstrated than in the hard numbers for yearly mining revenue.

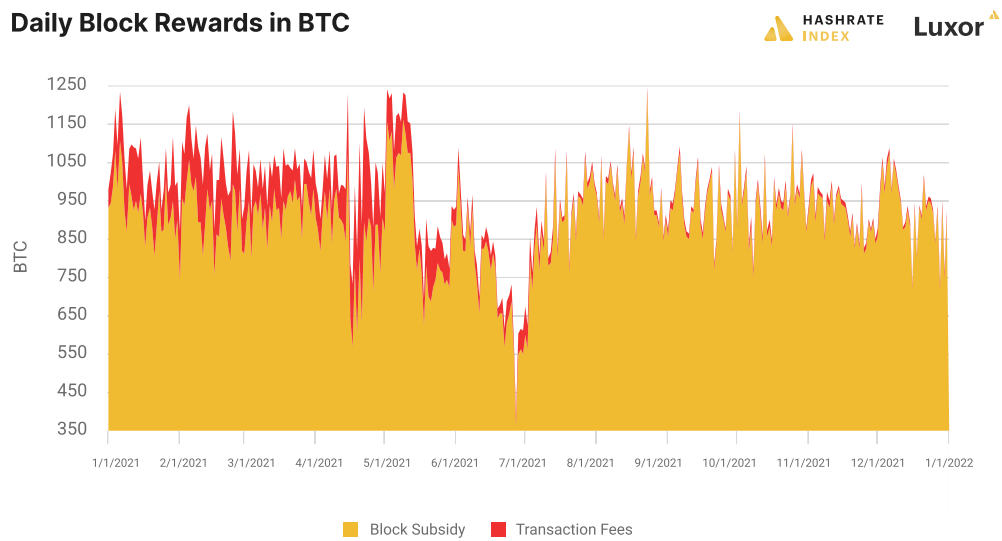
Bitcoin miners hauled in a record \$16.7 billion over the year: \$15.7 billion from block subsidies, the other \$1 billion from fees.

Daily Block Rewards in USD



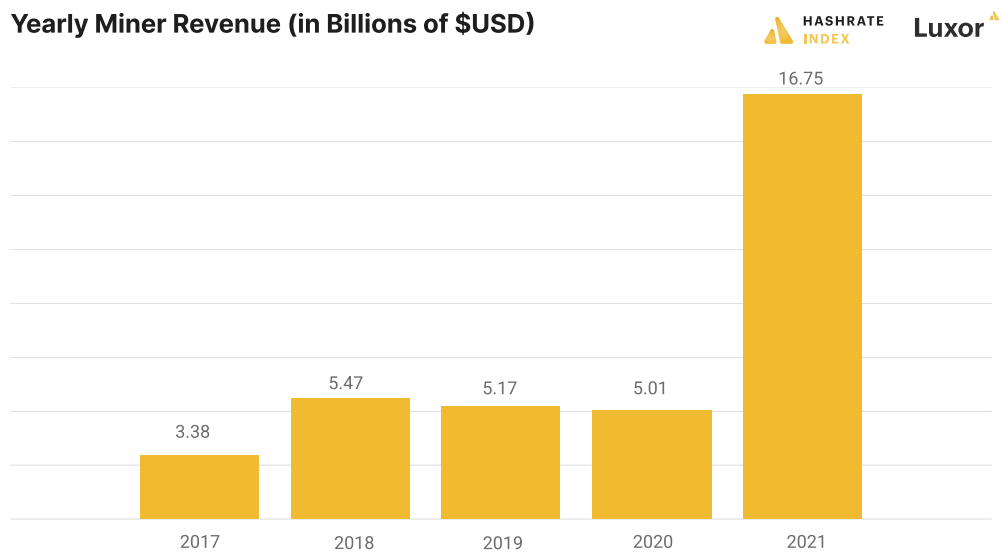
Source: [Hashrate Index](#).

This revenue came from 373,278 BTC, 350,512.5 of which were mined from the block subsidy while another 22,765.7 came from transaction fees



Source: [Hashrate Index](#).

With \$16.7 billion in revenue for the year, Bitcoin miners raked in more revenue on a USD basis last year than the prior three years combined.

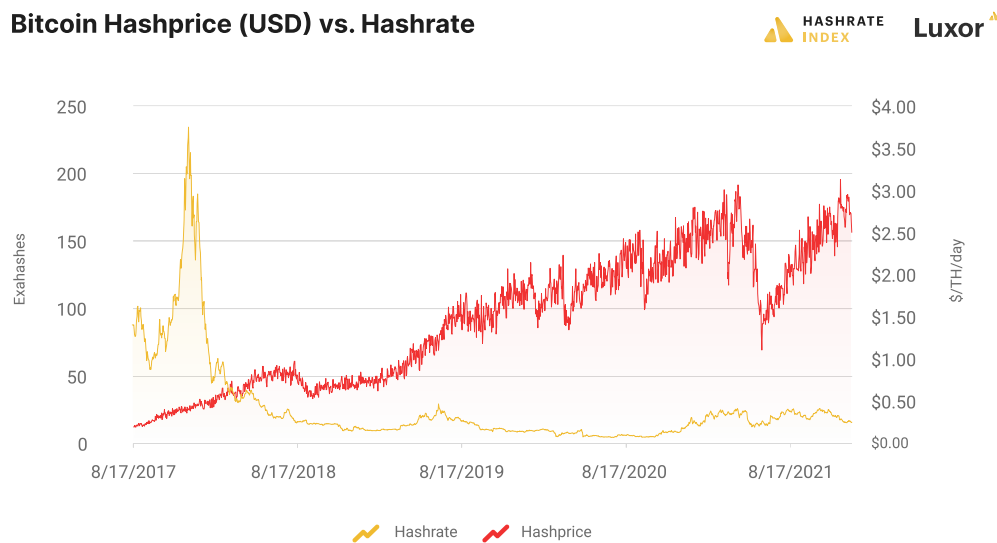


Source: [CoinMetrics](#), [Hashrate Index](#).

Even with aggregate USD mining rewards at a zenith, hashprice is still well below its 2017 all-time high. The higher Bitcoin's price, the fatter the USD-denominated rewards, even with Bitcoin's block subsidy slimmed by last May's halving.

Even so, there are more players competing for these block rewards than ever before, and top-tier rigs are thrice as efficient and produce 8 times as much hashrate as the S9—the apex ASIC at the height of 2017's hashprice cycle.

Simply put: the USD value of miner rewards in aggregate is greater for miners as a group, but individually, miners are earning less per unit of hashrate each year.



Source: [Hashrate Index](#).

January 2021 Rig Payback Modelling

Rig cost, operating cost, and hashprice are the holy triad for calculating mining profitability.

When miners build out operations, the initial capital expense (CAPEX) for their machines will dramatically impact their operation's payback time and profitability, as will their cost of power. With this in mind, we modelled out USD and BTC returns for the S9, S19, M20, and M30 at different power prices.

The model assumes the miner purchased each rig in December 2020 for that month's average price as listed on [Hashrate Index's Popular Rigs Index](#), and it assumes 100% uptime starting on January 1, 2021.

From the model, we observed that machines with a lower CAPEX cost (the S9 and M20), had a shorter payback period for most power costs when compared to their higher CAPEX counterparts (the S19 and M30). The S9's payback period was shorter for every electricity price except for \$0.12/kWh, while the M20 also had a quicker payback period for each power cost when compared to the S19, although it only beat out the M30's payback time for the \$0.06/kWh and \$0.08/kWh buckets.

Overall, the quickest machine to payback was the S9 (disregarding \$0.12 power), followed by the M20 and M30. The S19, the most expensive machine in the bunch, took the longest to pay back.

So if you were looking for a quick ROI in 2021 and began mining at the start of the year, it would have been best to purchase lower-end, older hardware regardless of power cost (with the one exception being S9s at \$0.12/kWh or higher energy costs). Of course, older machines like the S9 don't have as much operating life left as newer equipment, so newer machines like the S19 would be preferable for sustaining an operation into the mid-to-long term future.

S9		M20	
Power Cost	Days to breakeven	Power Cost	Days to breakeven
\$0.06/kWh	78	\$0.06/kWh	206
\$0.08/kWh	102	\$0.08/kWh	223
\$0.10/kWh	202	\$0.10/kWh	244
\$0.12/kWh	No Payback in 2021	\$0.12/kWh	277
S19		M30	
Power Cost	Days to breakeven	Power Cost	Days to breakeven
\$0.06/kWh	272	\$0.06/kWh	214
\$0.08/kWh	287	\$0.08/kWh	227
\$0.10/kWh	300	\$0.10/kWh	241
\$0.12/kWh	315	\$0.12/kWh	261

Source: [Hashrate Index](#).

We repeated the model for rigs purchased with BTC in December of 2020 and which began hashing at the start of the new year. Once again, the S9 had the quickest payback for each electricity price except \$0.12/kWh, followed by the M20, M30, and S19.

Notably, breakeven timeframes for these rigs were significantly longer than their USD-purchased counterparts, with the M20 only seeing a payback for \$0.06/kWh and \$0.08/kWh buckets and the M30 only achieving a payback for \$0.06 kWh. The S19 did not ROI for any power price over the course of the year.

S9		M20	
Power Cost	Days to breakeven	Power Cost	Days to breakeven
6 Cents kWh	116	6 Cents kWh	300
8 Cents kWh	190	8 Cents kWh	338
10 Cents kWh	279	10 Cents kWh	-
12 Cents kWh	-	12 Cents kWh	-
S19		M30	
Power Cost	Days to breakeven	Power Cost	Days to breakeven
6 Cents kWh	-	6 Cents kWh	343
8 Cents kWh	-	8 Cents kWh	-
10 Cents kWh	-	10 Cents kWh	-
12 Cents kWh	-	12 Cents kWh	-

Source: [Hashrate Index](#).



4

The Great Hashrate Migration Upends the ASIC Market

Rig Price Snapshot

EoY Rig Price (\$/TH)

Under 38 J/TH: **\$102.95 (+110%)**
 38-68 J/TH: **\$76.97 (+131%)**
 Over 68 J/TH: **\$26.56 (+99%)**

EoY Rig Price (Sats/TH)

Under 38 J/TH: **211,726 sats (+22%)**
 38-68 J/TH: **154,280 sats (+32%)**
 Over 68 J/TH: **48,353 sats (-0.32%)**

2021 Average Rig Price (\$/TH)

Under 38 J/TH: \$93.40
 38-68 J/TH: \$64.92
 Over 68 J/TH: \$28.50

2021 Average Rig Price (Sats/TH)

Under 38 J/TH: 228,684 sats
 38-68 J/TH: 167,864 sats
 Over 68 J/TH: 59,058 sats

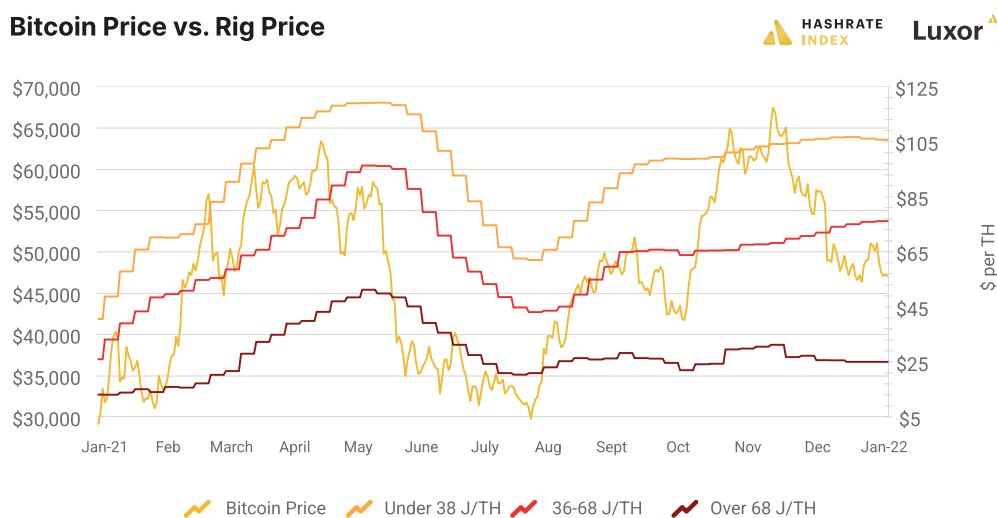
Total Value of ASICs in Circulation

~\$13.3 billion

2021 was a pivotal year for the ASIC market. The Great Hashrate Migration flooded the resale market with rigs looking for new homes. This injection of supply made ASICs more readily available to miners around the world, created greater pricing transparency, and reduced spot price spreads between China and other popular mining destinations (namely, North America).

The year also brought new entrants to the ASIC manufacturing space, as well as the announcement of the most powerful and efficient machine to date, the Antminer S19XP.

Over the course of 2021, rig prices (in USD) more or less doubled, with mid-tier machines (38-68 J/TH) rising in price the most at 191%, new-gen machines (under 38 J/TH) rising 159%, and older/less efficient machines (over 68 J/TH) rising the least at 90%.

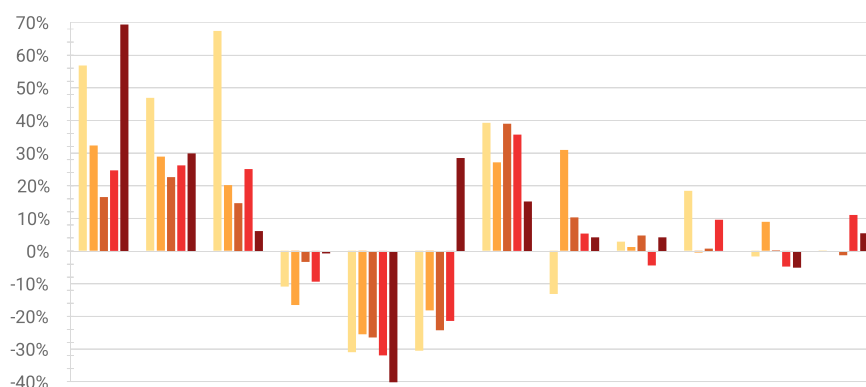


Source: [Hashrate Index's Rig Price Index](#)

2021 was a year of extreme price fluctuations for Bitcoin and everything tethered to its market. So with Bitcoin bouncing frequently between all-time highs and double digit drawdowns last year, rig prices were along for the ride.

Looking at month-by-month price changes, we can see that, in most cases, the older the equipment, the more sensitive it was to price changes, both on the upside and downside. Prices swung wildly in the first half of the year, and mass ASIC liquidations in Q2 following China's ban only exacerbated the volatility. This volatility became more tame as the year progressed.

Monthly Change in Rig Prices (USD)



	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
S9	56.77%	46.84	67.38%	-10.96%	-31.08%	-30.66%	39.19%	-13.25%	2.79%	18.38%	-1.77%	0.09%
S17	32.00%	28.80%	20.08%	-16.60%	-25.53%	-18.25%	27.01%	30.83%	1.13%	-0.58%	8.85%	0.00%
S19	16.54%	22.67%	14.65%	-3.36%	-26.51%	-24.30%	39.04%	10.32%	4.78%	0.76%	0.18%	-1.28%
M20	24.75%	26.27%	25.13%	-9.48%	-32.11%	-21.53%	35.77%	5.35%	-4.50%	9.60%	-4.80%	11.06%
M30	69.49%	30.03%	6.25%	-0.64%	-40.09%	28.60%	15.31%	4.29%	4.30%	-0.06%	-5.00%	5.57%

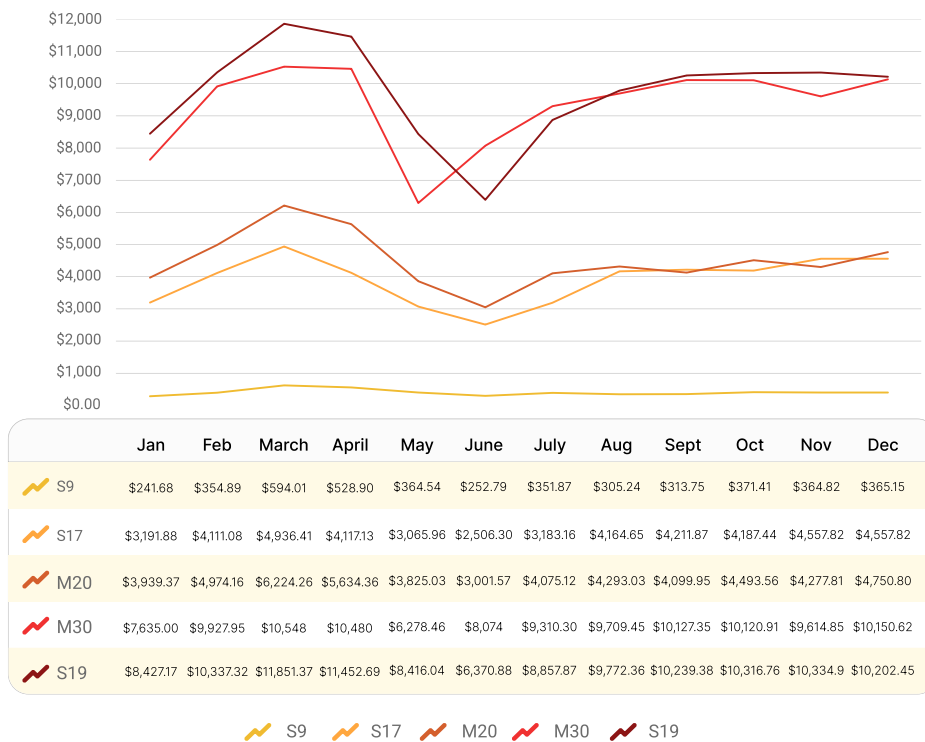
Source: [Hashrate Index Popular Rigs Index](#)

When priced in dollars, new and mid-gen rigs hit their all-time highs in the Spring when Bitcoin made its first moon-run to \$60k (older ASICs like the S9 hit a yearly peak during this time, but these rigs had already hit an all-time high during the last bull market before more efficient equipment came to market).

Shortly after this all-time high, Bitcoin's price and rig prices tanked as China moved to ban bitcoin mining. **Prices for each efficiency tier from our Rig Index were cut in half, with new-gen machines depreciating in price by 48%, mid-gen by 55%, and old-gen by 59% from their yearly highs to post-China ban lows.**

Rig prices have nearly fully recovered since the mining ban, but even as Bitcoin hit a new all-time high last Fall, ASIC prices did not transcend their own yearly highs.

Monthly Average Price of Popular ASICs



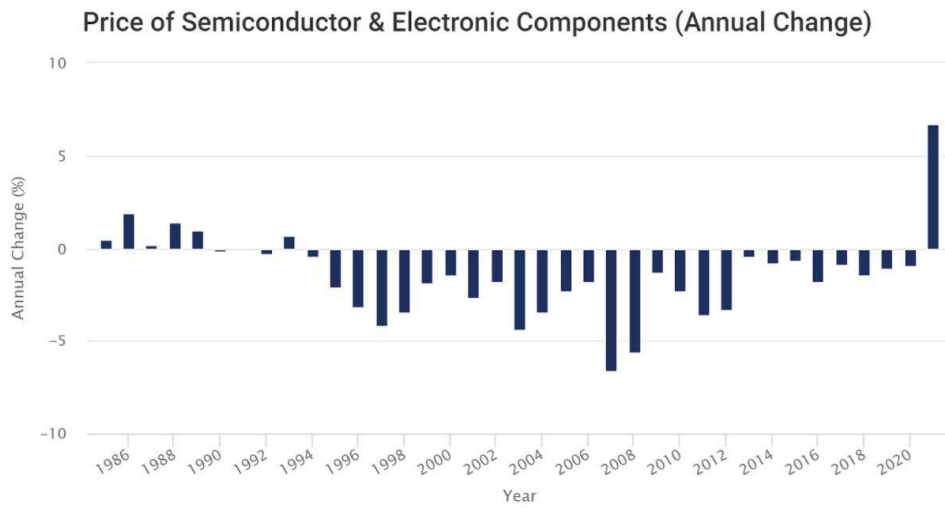
Source: [Hashrate Index Popular Rigs Index](#)

A few factors have coalesced to keep ASIC prices relatively depressed. To start, following China’s mining ban, some Chinese miners moved to liquidate their inventories, while others held onto their stocks in hopes that the ban would wane. As time wore on and it became clear that the CCP wasn’t bluffing, miners who held onto their machines joined in the selling.

The steady selling pressure complemented infrastructure shortages on the buy side. Miners outside of China could purchase machines easily enough, but they couldn’t magically materialize infrastructure to house these machines. Sourcing power and building warehouse space takes time, and it’s taking longer with economies, supply chains, and labor markets still reeling from COVID lockdowns.

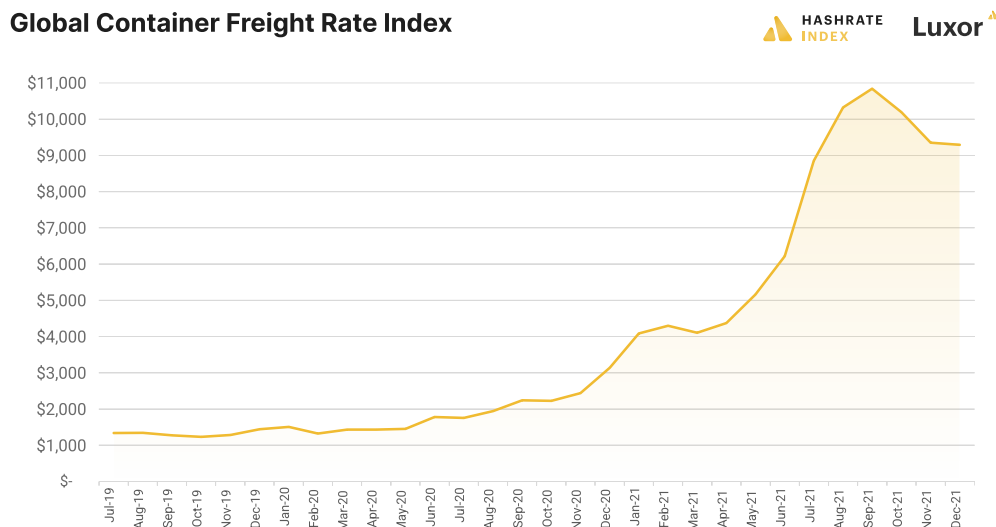
With parts harder to come by and taking longer to ship to their farms, many miners are playing catchup into the new year to accommodate additional hardware.

In 2022, we expect that miners of all sizes will have built out additional capacity to absorb the excess of machines sloshing around in the resale market. When this comes to pass, chip shortages and other supply chain constraints could eventually turn 2021’s rack space crunch on its head, resulting in a shortage of ASICs at a time when warehouse space around the world becomes readily available.



Semiconductors are becoming more expensive, as they experienced the largest price increase over 2021 in 35 years. Source: [IBISWorld](#)

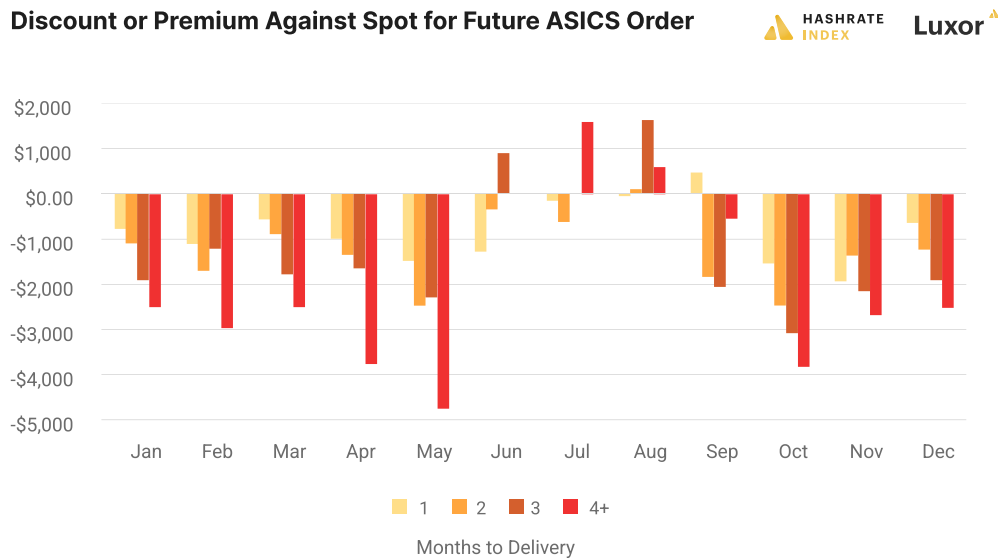
In addition to supply-chain constraints and a semiconductor shortage, skyrocketing shipping prices could accelerate the potential for rising ASIC prices in the new year. As global infrastructure slowed down and shipments became backlogged, the cost of shipping went up nearly 100% in 2021. Prices came down a bit toward the end of the year, but they are still highly elevated and show no signs of dropping to pre-COVID levels anytime soon.



Source: [Statista](#)

As a final remarkable example of just how much The Great Hashrate Migration impacted mining markets, the post-China ban fire sale temporarily turned the ASIC futures market on its head. **In June, July, and August, for example, machines purchased with a 3 and 4+ month delivery time carried a premium to spot. Given the lead time from purchase to plug-in for futures orders, typically, sellers provide a discount for these rigs.**

The premium that futures orders carried after the China ban indicates that sellers likely viewed China's mining ban as disproportionately affecting prices and that spot machines were selling below fair market value. Indeed, these prices strongly recovered in the second half of the year.



Futures and spot orders sourced from proprietary data from Luxor's ASIC brokerage business.

Not All ASICs Are Created Equally

As newer ASIC models like the S19 and M30 series continue to hit the market—and Bitmain has started taking preorders for the forthcoming S19 XP—older machines like the S9 are taking a backseat to more powerful, increasingly efficient hardware.

During its flagship mining summit in Dubai this past November, [Bitmain introduced the Antminer S19 XP](#). At 140 TH/s with an efficiency of 21.50 W/TH, the machine [is the most powerful and efficient miner to date](#). Bitmain sold the first batch of preorders for \$75/TH, which figures to \$10,500 a machine.

Depending on which model in the S19 series you're comparing it to, the S19 XP produces 40-66% more hashrate and is 27-40% more energy efficient than its cousins.

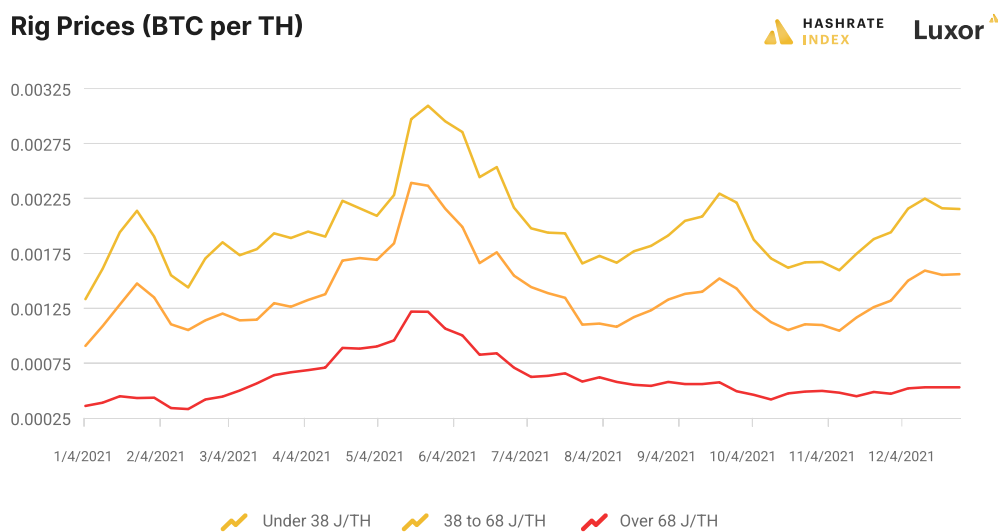
S19 Series Comparison	Hashrate	Efficiency	Wattage
S19 XP	140 TH/s	21.50 W/TH	3010 W
S19 Pro	110 TH/s	29.55 W/TH	3250 W
S19J Pro	100 TH/s	30.50 W/TH	3050 W
S19	95 TH/s	34.21 W/TH	3250 W
S19J	90 TH/s	36.11 W/TH	3250 W

Source: [Hashrate Index Machines Page](#) *W/TH is interchangeable with J/TH

Bitmain expects to begin shipping the first units of the S19 XP sometime in Q3 of next year, supply chain hiccups and other delays notwithstanding. With this new machine on the horizon and other new-gen equipment crowding rack space, older models like the stalwart S9, long a darling of miners worldwide, are being retired.

In fact, if we look at price trends for machines with an efficiency rating of greater than 68 J/TH, we notice that these rigs diverged from the price movements of new and mid-tier machines at the end of 2021. **Since early November, around the time the S19 XP became public, machines in the lowest efficiency tier have decreased 26% in USD value, while prices for new gen equipment have remained static and mid-tier machines have risen 12%.**

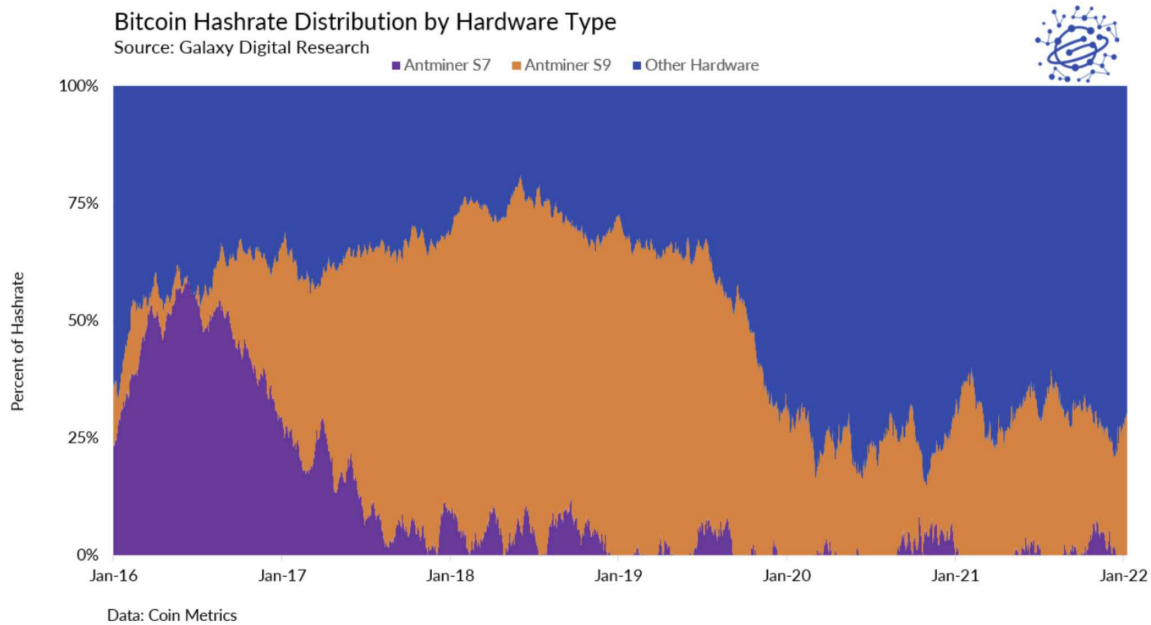
This divergence is clear in BTC-denominated rig prices, as well, whereby machines with an efficiency rating of greater than 68 J/TH have not recovered as well from the post-China ban sell-off when compared to mid-tier and new-gen models. **Over 2021, the BTC per TH price of new-gen rigs (under 38 J/TH) gained 22%, while mid-tier rigs (38-68 J/TH) gained 32% and old/low efficiency rigs (over 68 J/TH) fell 0.32%.** The price depreciation for old/low efficiency rigs is not a very large decrease, but it's another datapoint that demonstrates miners are shedding older, less efficient inventory in favor of newer, more efficient equipment.



Source: [Hashrate Index](#)

In 2020, miners were selling S9s and similar hardware for the cost of a cheap meal out—if not just giving them away entirely. As newer machines continue to phase out older models, it's probable that we will continue to see a depreciation in prices for outdated rigs as they become profitable only in regions with dirt cheap power costs or useful for niche mining sectors like oil and gas operations.

Even though it's on the way out, the S9 regained market share last year thanks to 2021's juicy hashprice average, and the rig constituted roughly 25-30% of active ASICs for the better part of the year, according to data from CoinMetrics and Galaxy Digital Research. Still, 2021 will likely go down as the S9's last gasp. With miners deprioritizing less efficient rigs and S9s becoming less profitable with each upward adjustment, we expect the S9's market share to recede below 2020 levels in the new year as factory-new equipment continues to phase out older hardware.



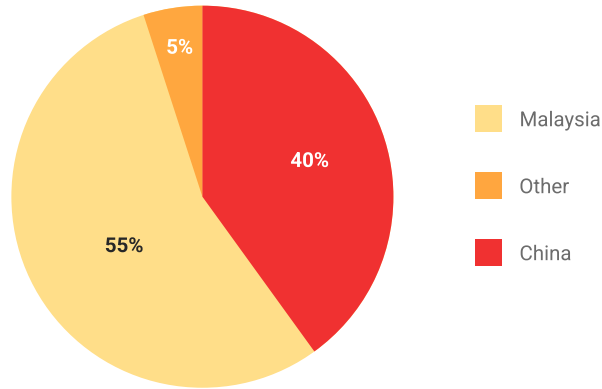
Source: [Galaxy Digital Research](#), [CoinMetrics](#)

ASIC Manufacturing Is Leaving China

When China levied prohibitions on any and [all crypto-related business in September](#), China's entrenched ASIC manufacturing industry became illegal almost overnight.

Now, that business is migrating to other countries.

Chiefly, Malaysia has become a primary site for relocation, with the majority of Bitmain's ASIC fabrication now taking place in the Southeast Asian country. MicroBT has begun shifting manufacturing to Thailand and is also evaluating options in the US, but difficulties with sourcing factory space are restricting its ability to migrate the majority of its manufacturing capacity off-shore. **We roughly estimate that Bitmain has reduced its manufacturing capabilities in China by 50-70% since the ban.**



Rough estimates based on proprietary market information and sales from Luxor’s ASIC brokerage business

Both Bitmain and MicroBT, the undisputed leaders in the ASIC market, have plans to completely shift their manufacturing capacities away from China in the coming years. The Chinese government’s anti-crypto sentiment, rising labour costs, and high tariffs to the US are making it a less-than-ideal location for manufacturing. Hong Kong still remains a popular jurisdiction for shipping newly manufactured machines to buyers, largely because of the tax breaks and low tariffs the country provides for international customers compared to China.

Factory relocation and chip shortages are likely to hamper ASIC production in 2022. Our friends at Viridi Funds estimate that “Bitmain will have the ability to produce on average 50,000-90,000 machines per month, MicroBT 25,000-35,000, and other manufacturers 20,000-30,000. This gives us a total supply of 115,000-175,000 new machines, producing roughly 9.5 EH to 15.5 EH per month of total new hashrate.”

Spreads Between ASIC Sales in North America, Asia Are Closing

North America’s Bitcoin mining industry has historically been reliant on China for machines and pool services. In 2021, this relationship became less one-sided and more symbiotic.

The diaspora following the ban sent many miners across the pacific to set up shop in North America; now, these Chinese miners are dependent on their North American counterparts to source energy, warehouse space, and to navigate new regulatory jurisdictions.

As a result, the Chinese and North American mining industries are more cooperative and intertwined than ever.

Hard numbers for ASIC sales in either region show how close they are becoming. **Throughout 2020 and 2021, the spreads between rig prices in either region gradually shrunk. In fact, spreads tightened the most in Q3 and Q4 of 2021, right after China's mining ban.**

**Average Spread Between ASIC Prices
In North America and Asia**



Quarter	Under 38 J/TH	38-68 J/TH	Over 68 J/TH
Q4 2021	1%	2%	5%
Q3 2021	2%	3%	4%
Q2 2021	4%	5%	8%
Q1 2021	5%	6%	10%
Q4 2020	8%	4%	15%
Q3 2020	5%	4%	10%
Q2 2020	5%	7%	13%
Q1 2020	7%	10%	11%

Source: [Hashrate Index](#)

Unsurprisingly, top-tier machines (under 38 J/TH) have some of the thinnest margins, followed by mid-tier (38-68 J/TH) and low-tier (over 68 J/TH) rigs. The large spreads between low-tier equipment, both before and after the ban, signal that these machines are less prevalent in the market and have thinner liquidity than their newer peers, likely indicating, once again, that these rigs are falling out of favor with most miners.

New Challengers Confront Bitcoin's ASIC Oligopoly

Bitmain and MicroBT dominate the ASIC manufacturing landscape. Is there a chance for change in the coming years?

Perhaps, but it will be a tough job for anyone challenging these juggernauts.

Still, that hasn't deterred newcomers like Blockstream and ePIC. Last August, Blockstream announced it [was entering the ASIC manufacturing game](#) with its acquisition of Spondoolies, an ASIC manufacturer from the primitive days of ASIC mining which is now best known for its DASH miners. ePIC Blockchain, which began as a SIA coin ASIC manufacturer, inked a deal with Argo last year to give the miner [first dibs on its forthcoming Bitcoin ASIC](#).

Both companies have offices in Canada (and Blockstream, in New York), and the groundwork they laid last year positions them as leaders in North America's formerly non-existent ASIC industry.

We believe that ASIC manufacturing on this side of the globe will only benefit North America's burgeoning mining industry, but the region will need foundries that can compete with TSMC and other top semiconductor producers if it wants to be truly competitive with Bitmain and MicroBT.

The background of the page is a dark grey or black color, overlaid with a pattern of thin, light-colored (yellowish-gold) contour lines. These lines are irregular and wavy, resembling a topographic map or a stylized representation of terrain. The lines are more densely packed in some areas and more spread out in others, creating a sense of depth and movement. The overall aesthetic is modern and technical.

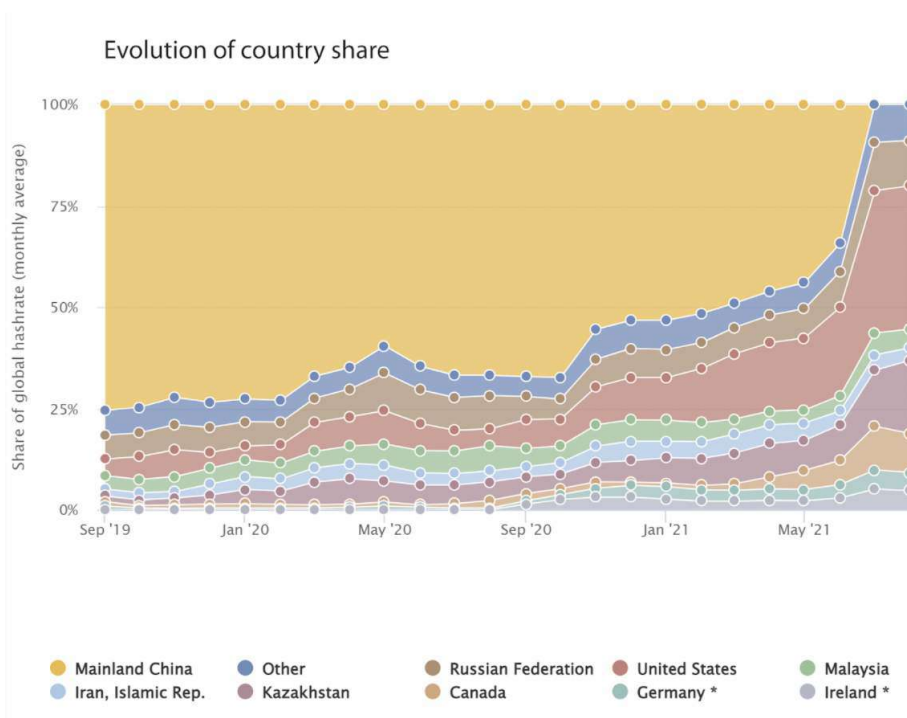
5

North America's Mining Industry Hits a Growth Spurt

Few regions have benefited from China's mining ban like North America, particularly the United States.

In the years leading up to 2021, the United States had lagged far behind China as a hashrate leader, typically taking up 2nd or 3rd place in the global hashrace behind other top competitors like Russia and Kazakhstan. Now, with China's mining ban driving miners from the country, which used to house anywhere from 50-70% of Bitcoin's hashrate, the United States has become a top site for relocation and/or ASIC liquidation.

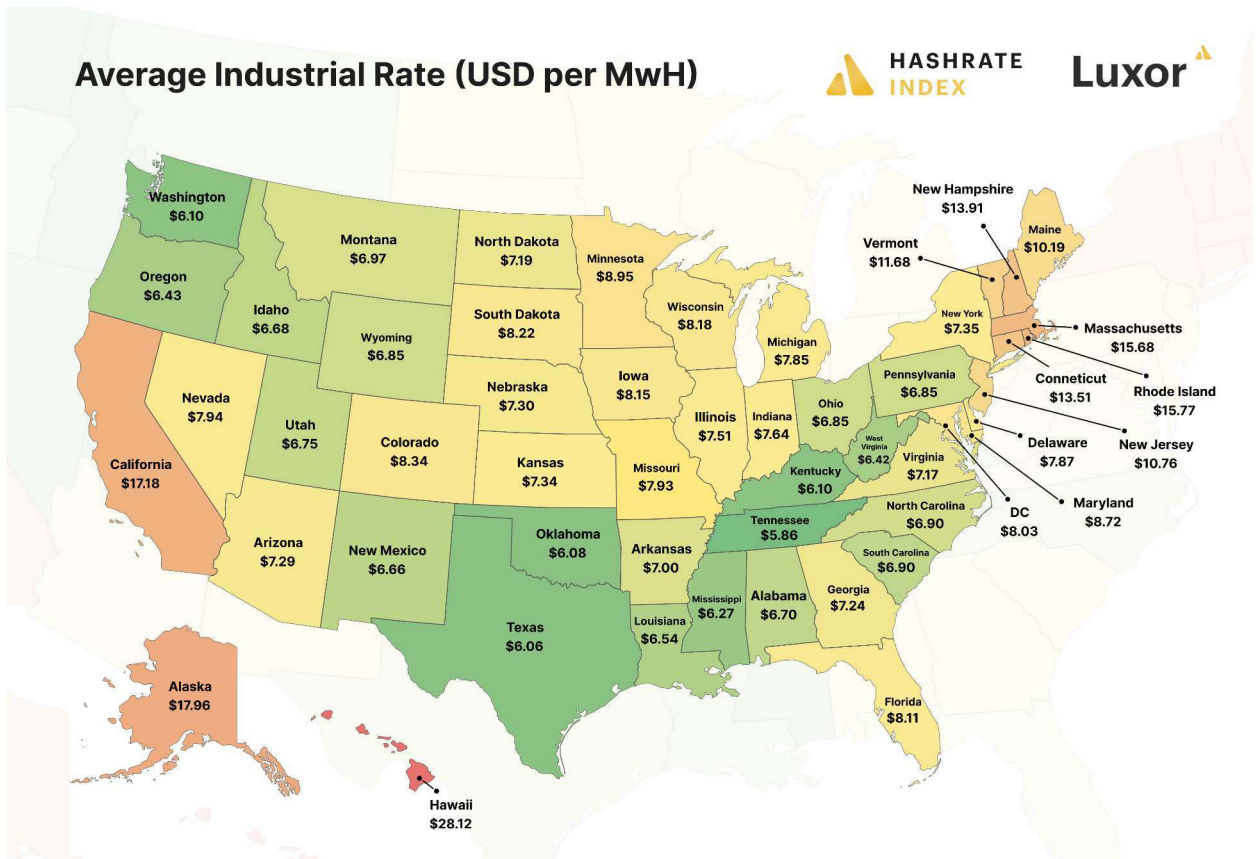
Rough figures from Cambridge University's Centre for Alternative Finance estimate that, as of September, the United States hosts 35% of the Bitcoin network's hashrate. **At the end of 2021, we estimate that this figure was at least 40%, with Canada capturing another 12%. We anticipate that North America will house over 50% of Bitcoin's hashrate into the near future.**



Hashrate share by country from [Cambridge University's Centre for Alternative Finance](#). It's worth noting that this dataset is limited to reporting from four mining pools and is skewed as a result of miners who use VPNs. The dataset should be taken as a rough estimate, as evidenced by the disproportionate hashrate reported in Ireland and Germany (and the fact that China is reported as having 0% hashrate).

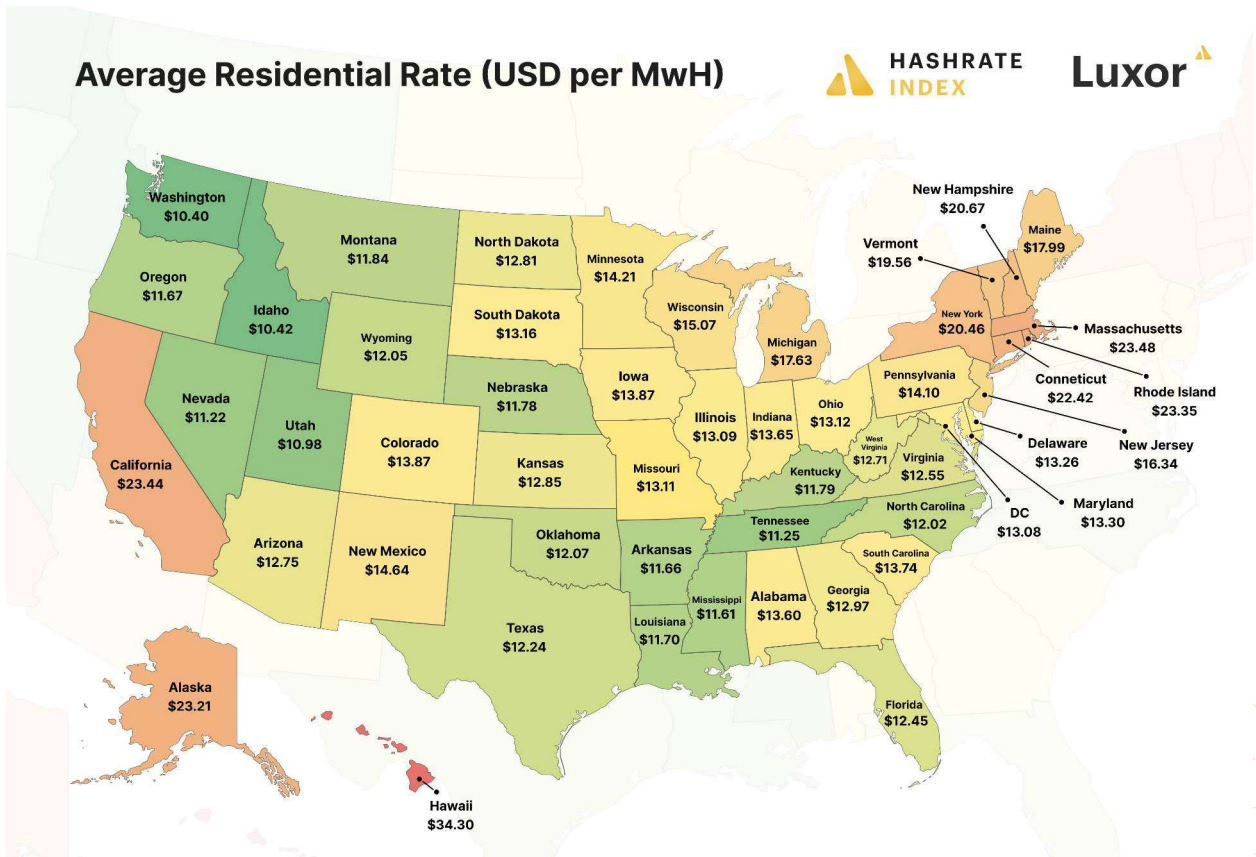
An abundance of power (particularly in resource-rich states like Texas), strong rule of law and solid judicial systems, and a federated state structure makes the United States an attractive destination for mining business, particularly for Chinese miners who are accustomed to the CCP's unilateral decision making and rule by law.

Average Industrial Rate (USD per MWh)



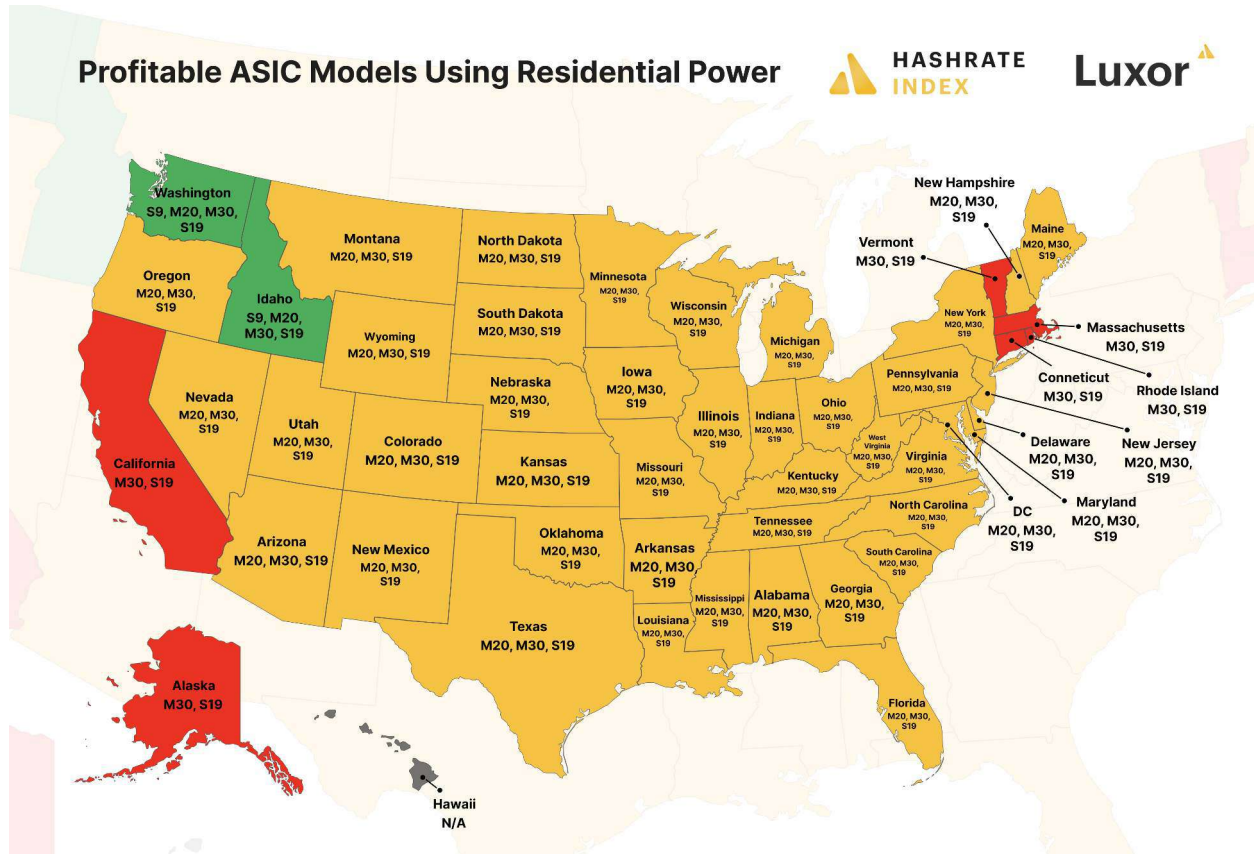
Source: [US Energy Information Association](#)

Average Residential Rate (USD per MWh)



Source: [US Energy Information Association](#)

Even on the residential level, mining is profitable for mid-tier and new-gen rigs in most states (with the sole outlier being Hawaii). For the time being, home mining is generally profitable, particularly with the S19 and M30 or similar equipment. How long it stays this way is anyone's guess, given that a bear market could plunge hashprice back below \$0.10/TH/day, putting most home mining operations in the red.



Source: [US Energy Information Association](#), [Hashrate Index](#)

Public Miners Cash In On China's Mining Ban

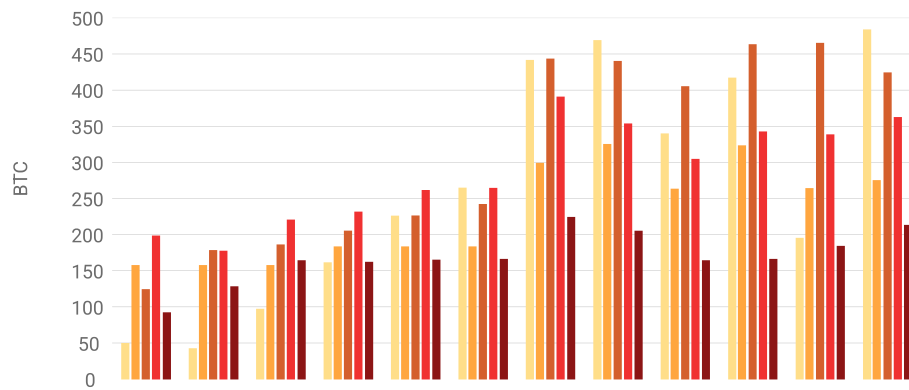
When North American miners divided the spoils from China's mining ban, publicly traded miners were sitting atop the loot.

North American miners captured significant market share in the aftermath of China's hashrate exodus. Many of the large, public miners were already aggressively expanding their hashrate in 2021 with shipments of the newest, top-of-the-line ASICs. This additional compute power positioned North American miners perfectly to capitalize on the reduction of competition following China's mining ban.

For example, with Bitcoin’s global hashrate cut down by roughly 60% (and difficulty down 45% from three downward adjustments in a row, a rare occurrence), public miners raked in more BTC per unit of hashrate than before the ban—and more than they would have had the ban not taken place. **Before the ban, 1 exahash of hashrate could feasibly fetch 5-6 BTC per day; in the immediate fallout of the ban, 1 exahash could mine roughly 9-10 BTC per day.**

As a testament to the ban’s positive effects for the North American mining industry, July and August were the most productive months for public miners as a collective.

Monthly BTC Production

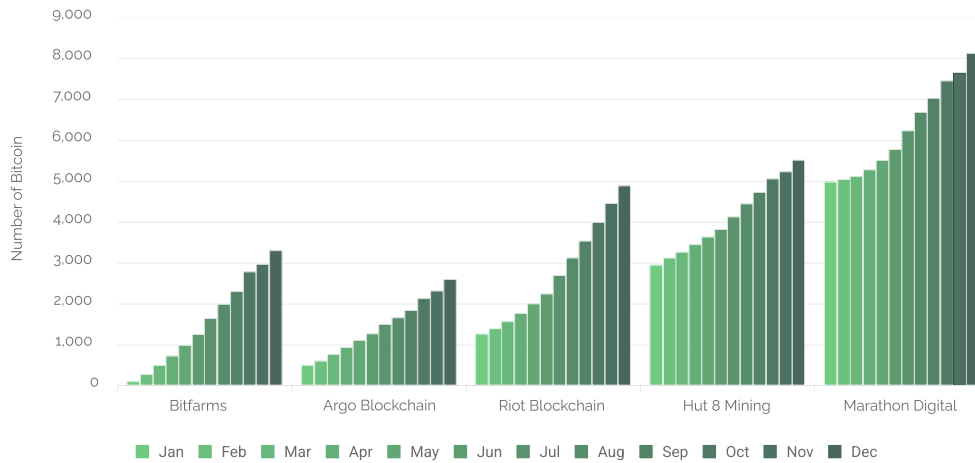


	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Marathon Digital	50	43	98	162	227	266	442	470	341	418	196	485
Hut 8 Mining Corp.	158	158	158	184	184	184	300	326	264	324	265	276
Riot Blockchain	125	179	187	206	227	243	444	441	406	464	466	425
Bitfarms Ltd.	199	178	221	232	262	265	391	354	305	343	339	363
Argo Blockchain	93	129	165	163	166	167	225	206	165	167	185	214

Source: **Public filings, press releases, and investor presentations**

Many of these miners are holding onto the bitcoin that they mine and opting to pay down OPEX and other costs with cash they fundraise from equity or with loans. All of the major public miners significantly increased their BTC treasury holdings over the course of the year.

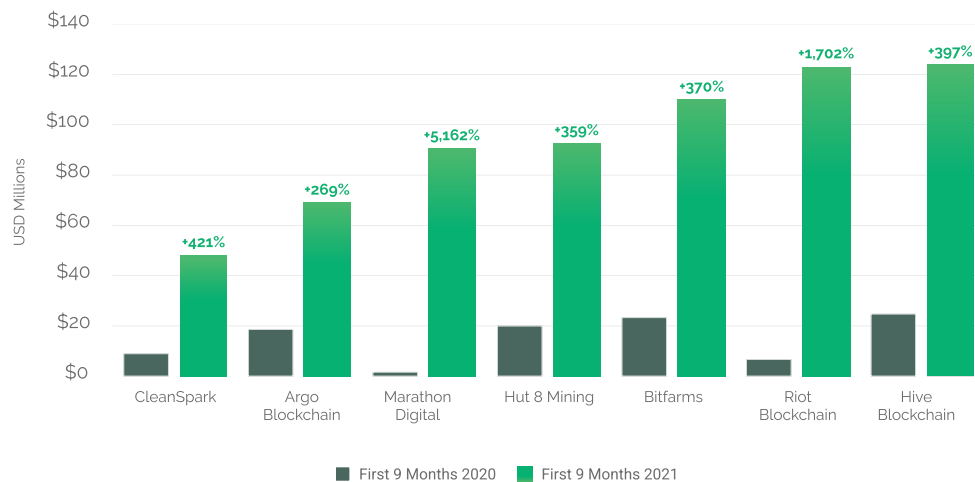
Bitcoin Accumulation



Source: [Virdi Funds](#). Disclosures found in company filings, monthly updates, and investor presentation material. Subject to errors.

With Bitcoin mining's center of gravity shifting to the West and these miners earning more BTC (and with Bitcoin's price hitting new highs in the Spring and Fall of 2021), public miners' 2021 revenues shattered their 2020 earnings.

Revenue Growth



Source: [Virdi Funds](#). Based on currency adjusted calendar 9 months sourced from S&P CapitalIQ. Subject to errors.

Public miners are using their BTC treasuries and swelling revenues as bargaining chips at the financing table.

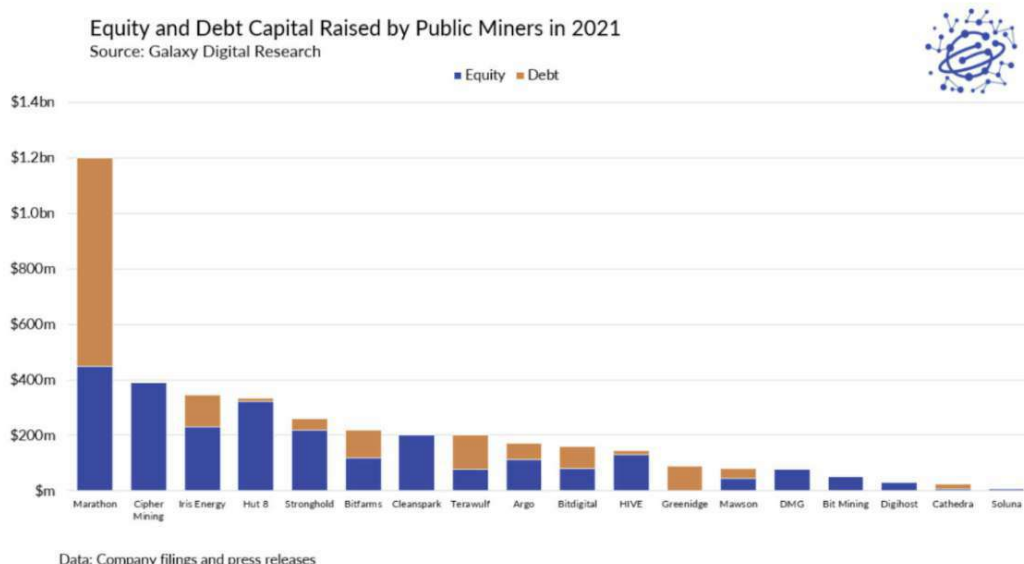
Indeed, as Bitcoin and its related markets mature and more capital flows into the space as a whole, these public miners have more financing options than ever and deeper pools of liquidity to tap into to expand their operations. In addition to selling equity for fundraising, miners are also taking out lines of credit or loans against their bitcoin to build additional warehouse space and finance new machines.

Marathon, for example, financed the largest ASIC order ever when [it purchased \\$879 million](#) worth of Bitmain's forthcoming S19 XP. Earlier in the year, Marathon took out a \$100 million loan from Silvergate for operational costs.

Marathon also sold equity last year, offering [\\$500 million in senior convertible notes](#) in a private sale in November and [\\$250 million in a common stock offering](#) in January. In September, Hut 8 [raised \\$172 million](#) in its common stock offering, while Riot received legal approval to [issue \\$600 million](#) worth of new shares for its own fundraising efforts. Bitfarms sought to raise [up to \\$500 million with an at-the-market offering](#) in August.

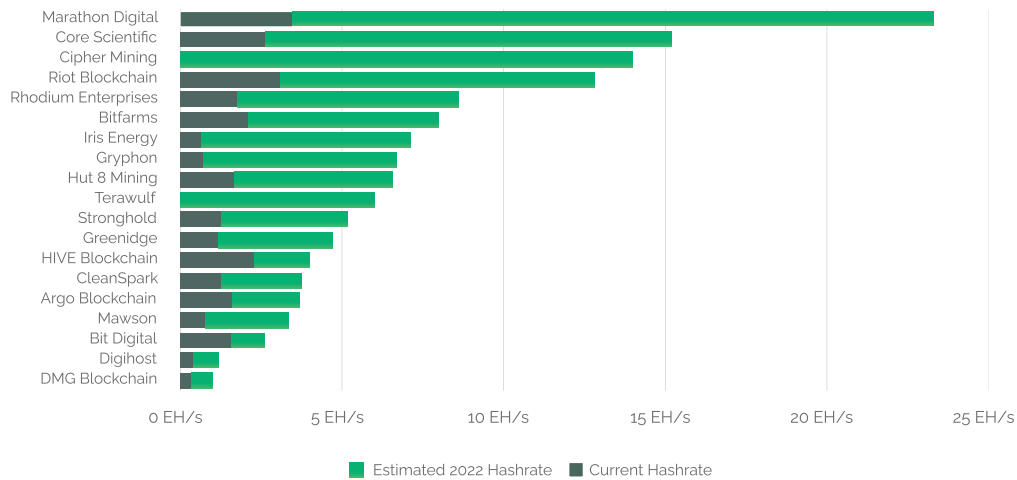
Additionally, Bitfarms secured [a \\$100 million credit facility from Galaxy Digital](#) using a portion of its BTC as collateral. Argo and Hut 8 have also leveraged their BTC treasuries for Galaxy Digital loans [to the tune of \\$45 million](#) and [\\$20 million](#), respectively.

Perhaps the most notable and publicized, the above examples are only a handful of the financing and fundraising actions taken by public Bitcoin miners in 2021.



With fresh funding flowing freely, these miners expanded operations immensely in 2021, but they are gunning to grow by several magnitudes more in the new year. With billions of dollars in preorders slated for delivery throughout 2022, the burning question is whether these companies will have enough rack space to accommodate the new hardware. Bitmain and MicroBTC, among other manufacturers, may take longer to deliver these machines, too, as production is hamstrung by factory relocations, chip shortages, and supply chain congestion for raw materials.

Current & Expected Hashrate



Source: [Viridi Funds](#). Based on corporate guidance, filing, press releases, and internal assumptions. Subject to errors.

Finally, perhaps as a testament to the industry’s maturation in North America, the [first Bitcoin mining ETF by Viridi Funds](#) launched in July of last year. Trading under the ticker \$RIGZ, the ETF includes a basket of public mining companies, semiconductor producers, ASIC manufacturers, and other mining-related stocks.



6

Federal and Local Governments Make In-Roads With the Bitcoin Mining Industry

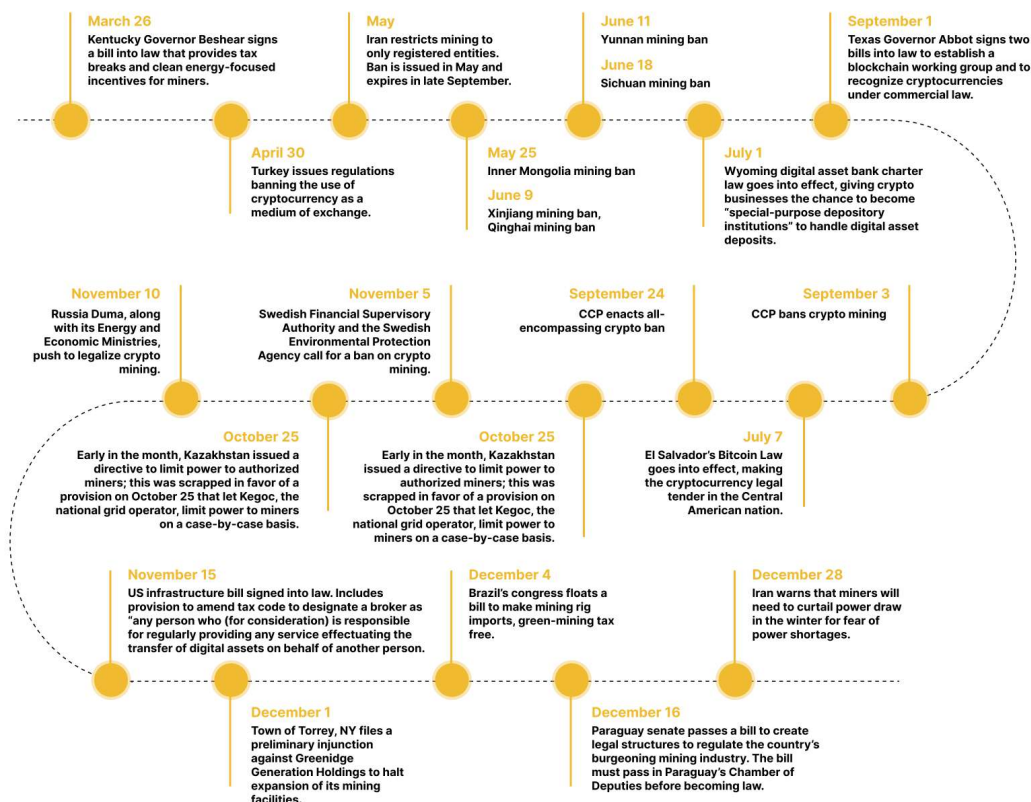
The global mining industry made serious in-roads with regulators and the political sector in 2021—for better or, in most cases, worse.

[China's mining ban](#) (and its subsequent [all-out crackdown on the crypto industry](#)) was the most significant regulatory action of the year. The ban precipitated a global restructuring of hashrate away from Bitcoin mining's historical epicenter in China and affected everything from Bitcoin's price, to mining revenue, to ASIC values, and everything in between.

As China moved to ban Bitcoin mining, US lawmakers drafted and adopted new laws to absorb the influx of mining business coming to the country's shores. A handful of states, namely [Kentucky](#), [Texas](#), and [Wyoming](#), passed legislation to incentivize or accommodate bitcoin mining and/or crypto-related businesses in their states; the Federal Government was less-than accommodating, however, [with Congress shoeorning a provision into the infrastructure bill](#) which classifies certain crypto entities as brokers for taxation purposes.

Outside of the US, other would-be mining hotspots like [Kazakhstan](#) and [Iran](#) have handicapped miners' access to power as a result of grid instability. In Latin America, El Salvador's world-first [Bitcoin Law](#) went into effect, making Bitcoin legal tender in the region, and the government has [started mining bitcoin](#) using the country's volcano-powered geothermal energy. Farther south, [Brazil](#) and [Paraguay](#) have begun drafting legislation to encourage mining in their energy-rich regions.

Global Bitcoin and Bitcoin Mining Regulations, Policy Proposals, and Legislation in 2021



Source: [Various news sites](#)

The Rise of "Green" Mining

Bitcoin—and by proxy, Bitcoin mining—is in the public limelight now more than ever, and one of the fallouts of the popularity is increased scrutiny over Proof-of-Work's energy appetite.

Whether or not criticism is justified is somewhat irrelevant. The criticisms are coming all the same, so some miners (particularly those in the public arena) are trying to defend themselves against attacks on Bitcoin's energy use the best they can.

Carbon offsets and carbon credits are the most common line of defense. Greenidge Generation Holdings is a [salient example](#); after coming under scrutiny in New York for its mining operation, the public miner has made a pledge to run "100% carbon-neutral" operations by purchasing carbon offsets. Others, like the soon-to-be public Gryphon Digital Mining, are taking it one step further by advertising their mining operations as [100% renewable](#).

We anticipate that publicly traded miners (and those companies seeking to go public) will continue to "green" their operations by seeking out renewable energy and purchasing carbon credits/offsets for two reasons: 1) ESG mandates from regulators will necessitate this and 2) these companies will do so voluntarily in an attempt to mollify criticisms surrounding Bitcoin's energy debate.



7

Mining Pools Grapple for Dominance as North America Grabs Market Share

While miners raise capital to expand their operations, mining pool operators move in the background fighting for hashrate market share to increase the size of their pools. The mining pool space gets more competitive every year as pools become more sophisticated by expanding their business development teams, marketing presences, and product lines.

As institutional miners move into the space and change the geographic location of their operations, mining pool market shares are shifting. In 2021 we saw a large shift in hashrate from Chinese pools to, particularly, North American pools as miners avoid Chinese companies in order to stay compliant and build relationships with overseas mining companies.

Mining Pool Market Share Jan. 2021



Pool	Hashrate	Hashrate Share
F2Pool	23.95 EH/s	16.30%
Poolin	21.90 EH/s	14.90%
Binance Pool	17.49 EH/s	11.90%
BTC.com	15.28 EH/s	10.40%
Antpool	14.70 EH/s	10.00%
ViaBTC	12.49 EH/s	8.50%
Huobi Pool	11.46 EH/s	7.80%
58CPOM&1THash Pool	7.94 EH/s	5.40%
Lubian.com	5.44 EH/s	3.70%
SlushPool	5 EH/s	3.40%

Bitcoin Mining Pool network share at the beginning of 2021. 7-day average. Source: [BTC.com](#)

Mining Pool Market Share Jan. 2022

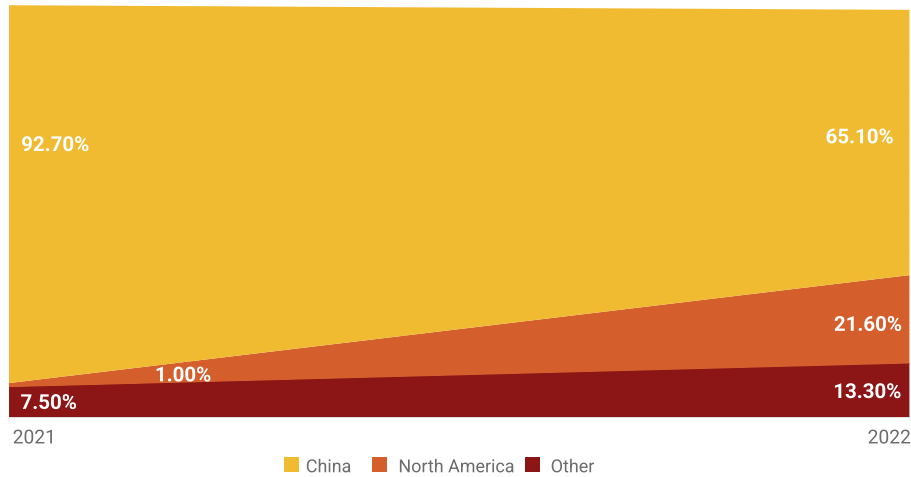


Pool	Hashrate	Hashrate Share
Foundry	30.4 EH/s	16.57%
Antpool	28.9 EH/s	15.73%
F2Pool	27.6 EH/s	15.07%
Binance Pool	21.9 EH/s	11.96%
ViaBTC	21.1 EH/s	11.49%
Poolin	14.7 EH/s	8.00%
BTC.com	10.4 EH/s	5.65%
SlushPool	9.5 EH/s	5.18%
SBI Crypto	5 EH/s	2.73%
Luxor	2.9 EH/s	1.60%

Bitcoin Mining Pool share at the beginning of 2022. Source: [Hashrate Index Pool Page](#)

In 2022 we expect this trend to continue, with North American pools representing over 50% of the network hashrate and taking up 5 of the top 10 slots on the pool leaderboard. Miners seeking out regulatorily compliant pools and better auditing at the payout level will largely drive this shift, as well as pools introducing new product offerings such as ASIC brokerage, financial services, financing, and so on.

Share of Global Hashrate By Mining Pool Region



Source: [Hashrate Index](#) and [BTC.com](#)

On the topic of new offerings, in 2021, mining pools also began expanding into secondary product lines and services. Each of the top 10 mining pools now has some additional product offering in a bid to increase their client base and drive revenue. As the mining ecosystem grows increasingly competitive, we expect all “stand-alone” pools will be forced to create additional business lines if they want to maintain their market position and turn a profit.

Mining Pool	Payout Method	Ancillary Services
Luxor Technologies	FPPS	ASIC Brokerage, Financial Products
Slush Pool	PPLN	Firmware
Foundry	FPPS	ASIC Financing, Financial Service
Poolin	FPPS	Financial Services
F2Pool	PPS+	Staking Services
BTC.com	FPPS	Self Mining / ASIC Manufacturing
ViaBTC	PPS+/PPLNS	Venture Capital
Binance	FPPS	Financial Services
Antpool	PPLNS	ASIC Manufacturing
SBI	FPPS	Financial Services (Primary Business)

Source: [Mining pool materials](#) and [Hashrate Index](#)

Taproot's "Speedy Trial" Provides Potential Template for Future Soft-Forks

Mining pools played a key role in 2021's Taproot activation. In order to ensure that mining pools would upgrade their nodes to support the softfork, Bitcoin Core developers devised a method called "[Speedy Trial](#)" to gauge interest. During Speedy Trial, miners had roughly three months to blazon support for Taproot in the block headers of the blocks they mined. When 90% of the blocks in one difficulty period signaled support, Taproot "locked in" for activation in November of 2021.

This method was something of a compromise between those who believed miners should be trusted with locking in an upgrade, and those who believed that only users should decide on upgrades by updating their nodes (or not).

Speedy Trial allowed miners to signal their [support](#) for the upgrade without triggering the upgrade itself. It also sought to avoid the stalling that stymied Segwit's activation in 2016. Unlike the Segwit fiasco, mining pools had no financial incentive to reject the upgrade, and they were at risk of being ostracized if they rejected the non-contentious upgrade.

Mining Pool	Taproot?	Speedy Trial Signal	Global Hashrate % (1 month)
Luxor Technologies	Yes	■	0.4%
Poolin	Yes	■	13.33%
Slush Pool	Yes	■	2.82%
BTC.com	Yes	■	9.58%
F2Pool	Yes	■	17.02%
Antpool	Yes	■	14.44%
SigmaPool	Undecided	■	0.39%
NovaBlock	Yes	■	0.57%
ViaBTC	Yes	■	7.4%
Binance Pool	Yes	■	10.55%

Source: [Taproot Activation](#)

While some critics denounced the method for its reliance on mining pool input, Speedy Trial was largely successful and well-received. In fact, it's possible that the method could be used once again to smoothly navigate soft-forks in the future.

Indeed, with [BIP-119](#) being formed, mining pools may be heading back to the polls in the coming years. Still, BIP-119 needs more review and discussion before it accrues enough consensus for activation. Luxor has sponsored a bug bounty to encourage code audits and reviews of the proposal. It will likely be a year or more before the proposal evolves into a tangible plan to upgrade Bitcoin Core.

Chinese Mining Pool Outages Highlight the Need for Stratum Redundancy

In the final days of November, there was a DNS crackdown on Chinese companies operating in the cryptocurrency space. During these days, China-based mining pools started having issues, quickly changing their website domain and asking miners to update their stratum configurations. There's evidence to suggest that cloud providers such as Alicloud (Alibaba) aided in the disruption. This event has raised concerns of a new attack vector on mining pools through cloud providers such as AWS, GCP, Azure and Alicloud. We suspect that over 80% of the network operates on these four providers.

Mining Pools are learning from these experiences, and many have started creating backup stratum to pivot away from server providers to their own servers on short notice.



8

Hashrate Financialization: On Track But Not There (Yet)

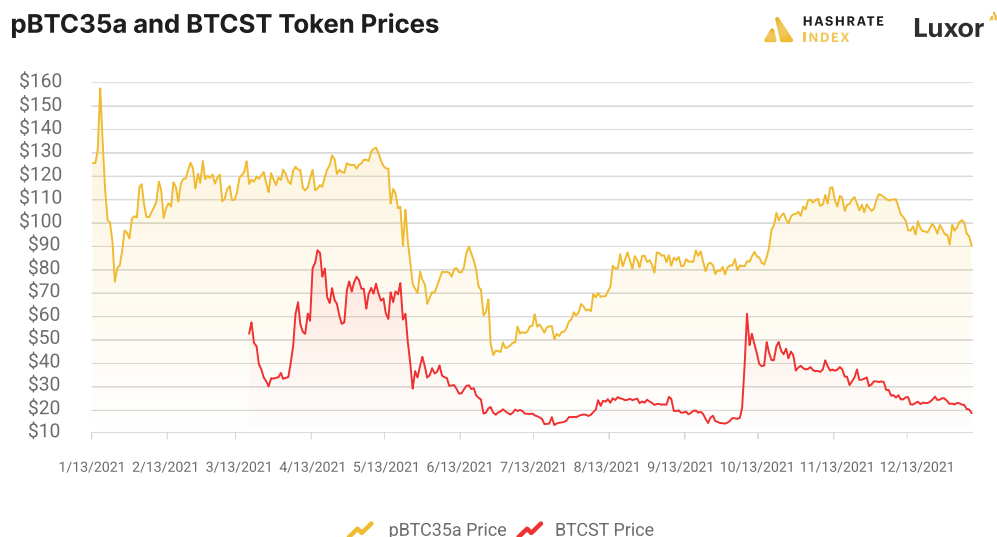
We have been talking about the commoditization of hashrate for some time, and while our vision for financialization hasn't come into focus yet, 2021 brought new products to light.

In 2020, we saw the failure of a difficulty-based, cash-settled, quarterly futures listing for hashrate on FTX. Although there was a lot of excitement around its launch, the product failed to garner volume. Many miners were skeptical of the instrument's viability as a hedge given it was based on network difficulty and not on hashprice. Additionally, the quarterly settlement period was suboptimal for miners to use to hedge their deployments.

Experimentation, though, creates learning opportunities. While FTX wasn't successful it did teach the industry some lessons about how to structure products that are both attractive to investors and miners. In the footsteps of FTX's attempt, Blockstream launched its BMN note, Poolin its pBTC35a token, and Binance its BTCST token.

The total traded volume across Poolin and Binance's tokens decreased precipitously over the year. **Poolin's token averaged \$3.1 million daily volume in its first month of trading at the beginning of 2021, only to fall 97% to a piddling \$93,000 average in the month of December. Binance's token attracted more trading volume but didn't fare much better as the year wore on. The token posted a \$62.5 million average daily volume for its first month of trading before falling 86% over the year to an \$8.5 million average in December.**

It's worth noting that [Poolin disabled payouts](#) for its token for some months following the China mining ban, likely impacting its liquidity and trading volume.



Source: [CoinGecko](#)

The BMN contract represents revenue produced by 2,000 TH/s and costs \$235k. It lasts three years and currently requires no operational costs. The holder of the contract receives the Bitcoin at the end of three years. This instrument is almost like an OTC cash-settled, forward contract for hashrate--an interesting development in the market.

	Capex	Est. Opex	Est. Residual	Est. Cost
BMN	\$ 235,000	\$ -	\$ -	\$ 235,000
ASICs	\$ 200,000	\$ 113,175	\$ 40,000	\$ 273,175

Source: [Stokr.io](#)

By purchasing and then staking [hashrate tokens](#) such as pBTC35a and BTCST, holders receive daily Bitcoin rewards that correspond to the number of tokens they stake. Poolin's pBTC35a represents 1 TH per token, while Binance's token equals 0.01 TH. These tokens allow anyone to gain exposure to mining without setting up their own mining operations.

Where success as a mining operator is largely determined by an individual's ability to acquire low-cost power, source cost-effective equipment, and to sell hashrate at top dollar, hashrate tokens do not require such intensive management. For some, this is a positive; for others, this is a downside, given their capabilities to build a strong mining operation on their own and because they don't want to expose themselves to counterparty risk (such as Poolin pausing payouts for its token).

Type	\$/TH	Premium / Discount
BTCST	\$2,245	2,101%
pBTC35a	\$92.75	-9.1%
New-Gen ASICs	\$102	-

Source: [Hashrate Index](#), [CoinGecko](#)

As evidenced by the fact that Poolin and Binance's tokens saw dwindling volume and prices over the course of the year, hashrate tokens and derivatives still have plenty of room to mature before they see wide market adoption.



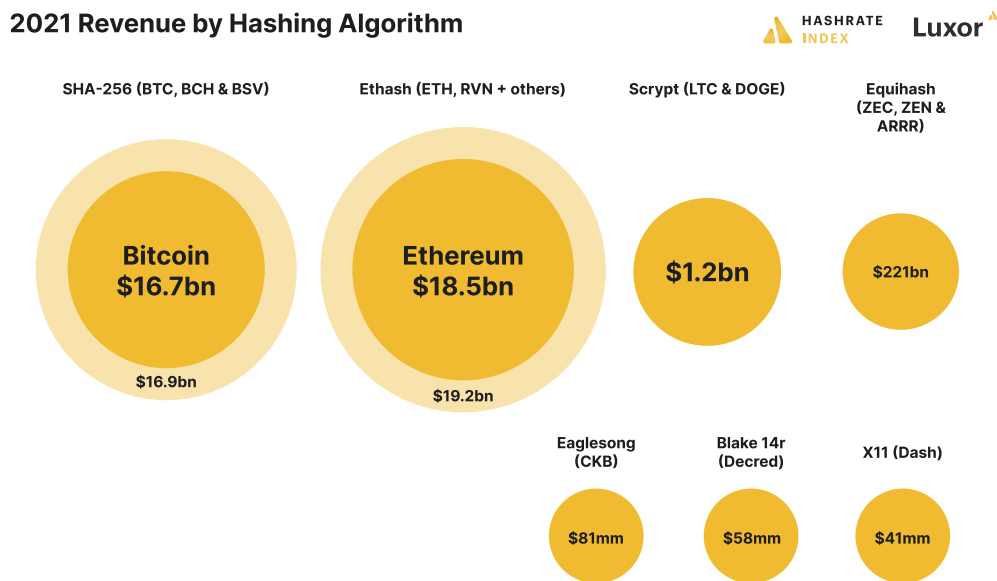
9

Altcoin Mining Has Its Moment in the Sun

Most of our report has focused on Bitcoin mining as it is the most popular chain for ASIC mining and the largest cryptocurrency in the ecosystem, both in terms of market cap and user base. Still, there are other popular PoW chains that are both ASIC and GPU mined. Many ASIC manufacturers produce machines for both Bitcoin and other blockchains, and many miners work across multiple chains.

And sometimes, these chains can provide better opportunities for miners if they know where to look.

For example, while 2021 saw an explosion in USD-denominated mining rewards for Bitcoin miners, Ethereum miners made \$2 billion more.



Source: [Luxor](#) and [CoinMarketCap](#)

In the final days of the year, Ethereum surpassed Bitcoin in total mining revenue. Ethereum mining is notable as it comprises many retail miners thanks to its GPU-friendly algorithm; additionally, some data centers will switch between mining Ethereum and using their compute for other jobs, which results in an on-again-off-again practice that is much different than Bitcoin miners' 24/7 approach. This is one of the reasons we don't see many large, public-facing Ethereum miners at conferences and talking to the media.

Ethereum is scheduled to move to Proof-of-Stake in 2022 with ETH 2.0 ([despite persistent delays](#)), putting an end to mining on the network. Luxor's view is that this move will not happen and [Ethereum will stay Proof-of-Work](#). Regardless of ETH 2.0's promise to upend Proof-of-Work, Ethereum mining presents prime opportunities for miners to capitalize on Ethereum's lucrative, DeFi and NFT-fueled fee market through novel methods like [Miner Extractable Value \(MEV\)](#).

Outside of Bitcoin and Ethereum mining, **which account for about 93% of the PoW emission**, there are a number of other PoW blockchains. With the rise of Dogecoin in 2021, Scrypt mining (the algorithm for DOGE and LTC) generated significant revenue and gave miners the optionality to dual mine Litecoin and Dogecoin.

Additionally, Equihash coins as a group provided miners who utilized Luxor's profit switch with a chance to haul in healthy revenues.

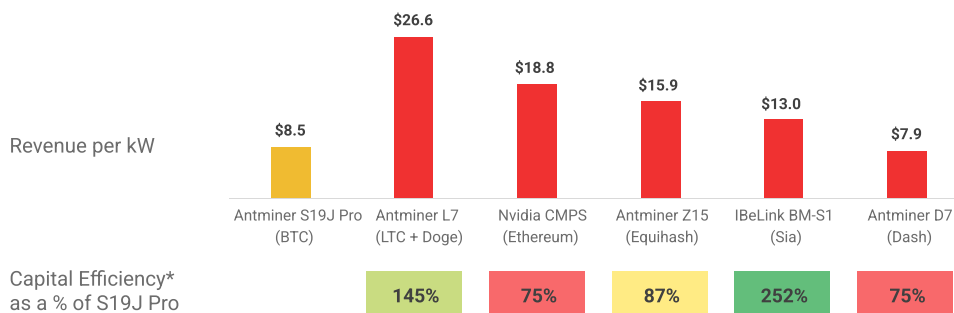
Although the altcoin mining market is relatively small compared to Bitcoin mining, some coins are more profitable to mine with ASICs than Bitcoin. There are tradeoffs for this increased profitability, though, namely altcoin price volatility vs. Bitcoin, ASIC maintenance, and scant after-sale support from manufacturers. These opportunities are also pretty limited and hard to come by for investments above \$10 million.

Still, when factoring in the machine costs, miners like the L7 by Bitmain were a better investment in 2021 than an S19J Pro.

Altcoin Returns



Revenue Efficiency
as a % of S19J Pro



* Capital Efficiency based on machine prices and payback period

Source: [Hashrate Index](#), [ASIC manufacturer documents](#), [CoinMarketCap](#)



10

The Dawn of a New Epoch

The advent of ASIC mining in 2012 indelibly altered the course of the mining industry, so much so that miners and analysts will refer to the “pre-ASIC era” and “ASIC era” when analyzing historical trends.

China’s mining ban will likewise be seen as an inflection point for Bitcoin mining’s development. And as such, 2021 could very well mark the beginning of a new epoch for Bitcoin mining.

What should we expect from this new epoch? Much of the same. On the subatomic level, miners will still be transmuting electrons into satoshis; financially, they will hunt for the cheapest power costs, for favorable hosting agreements, and for the most efficient equipment. As ever, they will compete to produce new coins at the lowest possible cost.

But competition will continue to grow, both in the size and calibre of participants. Bitcoin mining is now a multi-billion dollar industry that has attracted nation states and, increasingly, traditional investment capital. The number and size of institutionally-capitalized miners grows by the quarter, and so too do the financing options available to these miners. Mining is maturing into a recognized, legitimate industry in the eyes of many market participants and governments, so much so that we believe Bitcoin mining will begin to merge with the energy sector in 2022; power producers and electrical grid operators will start devising mining strategies--if not outright establishing mining farms--in the new year.

The scope and scale of the industry will never be the same, and 2021’s China Mining Ban will likely go down in the books as the seminal event that precipitated (or at the very least, accelerated) many of the changes that will come to define this new era of Bitcoin mining.

Bitcoin mining has evolved from its scrappy beginnings as a garage shop curiosity for hobbyists and early adopters into a global industry whose industrial scale and yearly revenue are on par with the [United States’ cannabis industry](#).

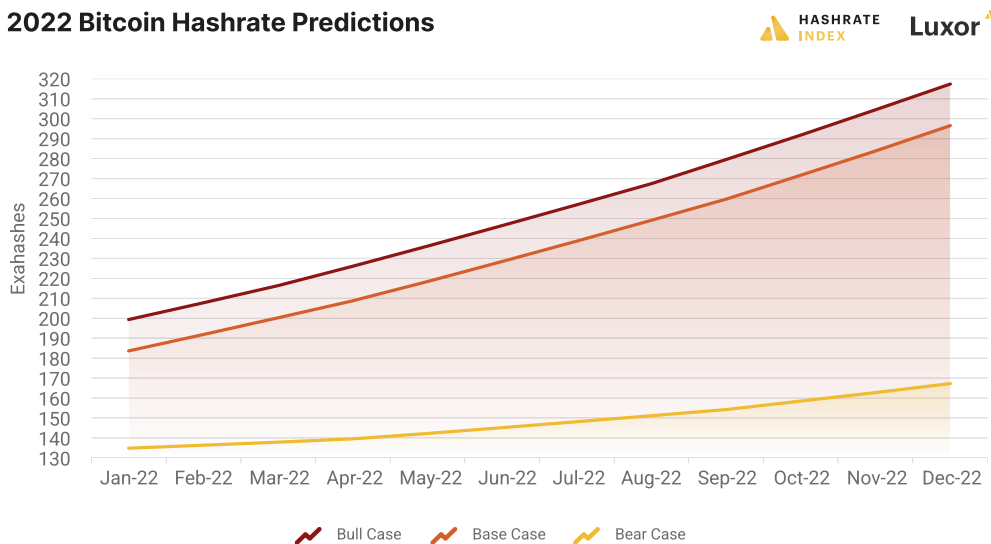
This growth occurred over the course of roughly a decade. Imagine how many more changes will come over the next one.

2022 Projections

Playing soothsayer for such a volatile market is tough task, but taking into consideration the trends and data we present in this report, we anticipate the following for 2022:

- Bitcoin's hashrate will cross 250 EH/s in 2022 and could conceivably hit 320 EH/s by the end of the year.
- If Bitcoin's price continues its run (or stays at present levels), ASIC prices for new-gen and mid-tier equipment will surpass their all-time highs. If Bitcoin plunges into a bear market, ASICs will revisit their post-China ban prices.
- At least one large energy provider in the United States or Canada will announce a bitcoin mining operation.
- Mergers and acquisitions between mining companies will be a major trend this year.
- Hashprice will end 2022 lower than \$0.25/TH/day.
- At least six more mining companies will go public, not including those like Core Scientific and Gryphon which are scheduled to go public.

2022 Bitcoin Hashrate Predictions



Rough estimates based on Luxor modelling

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