

The Seventh CryptoSuper 500 List

CryptoSuper mining generates over \$40 Billion annual value, Bitcoin retakes the lead from Ethereum, US now the largest mining country

Stephen Perrenod
November 2021

Note: This paper is an analysis of the technologies and trends surrounding blockchain and cryptocurrencies. It is not, and must not be considered as, financial, investment, or legal advice.

Purpose of Cryptocurrencies

“Money has become information. Bitcoin is energy securely encapsulated as information. Electrons to eternal bits. Money in the Internet, and only in the Internet.” – @moneyordeb

Cryptocurrencies are not just idle, speculative assets. They represent new monetary and financial technology, underpinnings of aspects of, or even a foundation for, a more efficient and honest financial system.

Attribute of Money	Gold (Money 1.0)	Fiat (Money 2.0)	Bitcoin (Money 3.0)
Durability	Millennia	Computer and paper	Eternal in principle
Portability	Small amounts	Local, or international, a few days	Global less than 1 hour, any amount
Divisibility	Moderate	High	100 million Sats
Scarcity	Increase 2% per year	Varying rates of increase	Fixed maximum, 21 million BTC
Fungibility	Requires weighing, assay	Fully within national borders, exchange fees	Fully
Private / Public	Private / Government	Government	Private
Geography	Local, National, Multi-national	National and Multi-national	Global

Table 1: The four necessary attributes of money were enumerated by Aristotle over two millennia ago. This table adds a fifth, fungibility, which means one coin or piece of paper of a certain denomination is as good as another. Bitcoin scores favorably on all attributes.

Our current financial system is built on debt and fiat currencies, with many intermediaries, and is increasingly creaky. In the 21st century it still can take days to wire money internationally. In the US, it can still take days to move money from one account to another person’s account, even within the same bank. Bitcoin and Ethereum operate 24x7x365 and transactions complete in an hour or less.

Inflation is returning as the world recovers from the COVID-19 pandemic and yet interest rates remain extremely low due to central bank policies and excessive debt. People are looking at alternatives other than the stock market to deal with concerns about rising inflation and the need for sufficient returns on their retirement funds.

OrionX Constellation™ reports cover 6 Es: big trends (Envision), industry milestones (Events), historical view of a technology segment (Evolution), main vendors in a market segment (Environment), customer decision criteria (Evaluation), and how vendors in a segment score (Excellence) based on the OrionX methodology, which considers market presence and trends, customer needs and readiness, and product capabilities and roadmap.

Bitcoin is a revolutionary decentralized and open source monetary technology and a monetary asset. As an asset, it can provide stability to our centralized debt-burdened fiat system.

Cryptocurrencies have reached over \$2.5 trillion in aggregate market cap because they are addressing store of value as a new asset class, and medium of exchange (payments) gaps in our current system. With smart contract capability they are allowing greater automation of financial products and financial transfers; this goes by the name of DeFi (decentralized finance) within the Fintech realm.

Only a few Matter

There are some 13,000 cryptocurrencies in existence today. Only a few really matter. The market cap of all combined is some \$2.6 trillion, but 44% of that is in Bitcoin's roughly \$1.1 trillion market cap and another 19% is in Ethereum's \$500 billion market cap. Numbers three to ten account for another 20%, such that only 36% remains for all of the other 13,000 cryptocurrencies not in the top 10.

The distribution of market cap is thus steeper than a Zipf's law relation, which would have the rank order and market cap related as $r \sim 1/M$, where r is the rank (#1 highest) and M is the market cap of a particular cryptocurrency. In fact, a fit to the market caps for ranks 1, 2, 4, ..., up to 1024 and differing by powers of 2 suggests a steep power law index -1.57 (rather than -1). They aren't worth much, from a Zipf's law perspective.

Furthermore, the vast majority of cryptocurrencies have been artificially created, with no real work done, other than promotion. This is true for any air drop, user incentive program, or consensus algorithm that does not involve proof-of-work (PoW) mining. Their creators have gladly accepted dollars or Bitcoin or Ethereum, of course. The exception is stable coins that have fiat reserves backing them, at least in part.

That does not mean that some value cannot accrue from utility network effects, but the best assurance of value is through proof-of-work. Only some 700 or so of the 13,000 cryptos are mined via PoW. Only three of these account for the bulk of mining revenue.

Only three Cryptocurrencies have most of the Value

Our CryptoSuper lists are created twice per year; the first list was in November 2018. The information for this seventh edition of the CryptoSuper 500 list was collated during the last few days of October 2021.

This is a semiannual accounting of crypto supercomputer mining pools, and utility coins and stable coins are not relevant. Proof-of-work mining is a special form of high performance computing of the embarrassingly parallel sort, wherein mining rigs compete to solve a cryptographic problem, thereby winning the block subsidy and any associated transaction fees for a given block. In most cases, the pools attract hash power contributed by individuals across the globe. We list the host country when known, but they may have proprietary operations in several countries.

Miners compete to deploy as much hash rate (PoW) mining power for the lowest operating costs possible, those costs are dominated by electricity and the crypto mining computer capital cost. Miner profitability is very high currently. The Bitcoin price has increased from \$37,000 at the end of May 2021 when the last list was collated to over \$61,000 currently (10/29/21). Ethereum's ETH has increased from \$2500 to \$4300 as of 10/29/21.

We looked at the top nine mined coins and narrowed those down first to the top six based on daily production value. Then we looked at mining pools and placed a cutoff at \$100 million minimum production per year per pool, including transaction fees and block subsidy rewards of new coins. That left us with only the top three coins on the list, Ethereum (ETH), Bitcoin (BTC), and Dogecoin. The next three coins that are not tabulated are Litecoin (LTC), Bitcoin Cash (BCH), and Ethereum Classic (ETC) respectively. Coin

Coin	Algorithm	Block time	Block subsidy	Price \$	Hash rate	Units
Ethereum (ETH)	EtHash	13 sec.	2	4,130	719	Tera
Bitcoin (BTC)	SHA256	10 min.	6.25	61,271	136.4	Exa
Dogecoin (Doge)	Scrypt	1 min.	10000	0.251	313	Tera
Litecoin (LTC)	Scrypt	2.5 min.	12.5	199	351	Tera
Bitcoin Cash (BCH)	SHA256	10 min.	6.25	629	1.47	Exa
Ethereum Classic (ETC)	Etchash	13 sec.	3.2	55	28.95	Tera

Table 2: Top 6 Mined Coins (10/24/21 snapshot)

In Table 2:

- ✦ the first column has the coin name and
- ✦ the second one the algorithm for the cryptographic puzzle.
- ✦ The third column has the block time and
- ✦ the fourth the block subsidy in coins/block. Among the six coins only ETH and BTC gather significant additional transaction fees, which are currently 0.99 and 0.77 on average in coins / block.
- ✦ The fifth column shows the recent price and
- ✦ the last two columns the hash rate per second for the network, which can vary many orders of magnitude all the way from the Terahash range through Petahash and to Exahash. Only Bitcoin and Bitcoin Cash reach into Exahashes/sec territory.

These top 6 mined coins have an annual run rate of \$45 billion economic value, respectively, whereas the top 3 alone have a run rate of \$42.6 billion. Therefore, almost all the produced value is in Ethereum's ETH coin, Bitcoin, and Dogecoin.

We end up with 41 mining pools in our lists. Both Ethereum (19 large pools) and Bitcoin (17 pools) are being mined at a rate of over \$50 million economic value per day, and Dogecoin (5 pools) is around \$3 million per day.

Comparing to our last list (Sixth cryptosuper list of June 2021) Bitcoin has moved back into first place in mining revenue with a small lead over Ethereum, and Dogecoin (an Elon Musk tweet favorite) has retained its third position in third place.

Ethereum has benefited greatly from the growth in DeFi, as well as the recent surge in NFTs. NFTs are primarily artworks or collectibles stored on blockchains, although they could be any sort of document, file, or media with limited or unique ownership as well.

Ethereum will end Mining: The Merge

Ethereum is in the midst of a multi-stage upgrade to Ethereum 2.0 with consensus moving to proof-of-stake (PoS) rather than proof-of-work. It will also implement the sharding of workload across multiple blockchains.

There is already a new chain called the beacon chain that supports proof-of-stake rather than proof-of-work and will be merged with the mainnet.

At some point the miners have to be forced out. The point of the bomb is to freeze out proof of work by ramping up the difficulty exponentially after some chosen date. The bomb is already in the code, but its implementation date has just been delayed until June, 2022. This is a pattern with Ethereum, the move to proof-of-stake has been pushed back repeatedly for several years now. The Merge would need to occur before the bomb goes off, so sometime in the first half of 2022 is the current estimate.

Ethereum has used a PoW coin (called ETH) from the beginning, with a tightening of rewards, initially from 5 to 3, then later from 3 to 2, coins per block. Unlike the baked-in Halvings with Bitcoin this was done by community consensus in a somewhat arbitrary fashion.

The larger problem for miners will come when the PoW consensus mechanism is dropped entirely. The miners can move to become validators, or abandon ETH mining for other coins. Most will choose the latter, since validating with PoS is a financial game, in which one commits to holding shares effectively for yield.

With a full shift to Ethereum 2.0 blocks will be validated by a 2/3 majority vote of ETH staked by validators. The minimum stake is a rather expensive 32 ETH (over \$100,000), but staking pools have formed to allow for smaller contributors, and are currently advertising yields around 5% per annum.

The move away from PoW by Ethereum is going to have a serious impact on the global mining community in 2022 if Ethereum indeed implements this shift. While in principle nearly half of crypto miners' revenue could evaporate, they will seek to mine more Bitcoin, Dogecoin, Bitcoin Cash, Litecoin and other cryptocurrencies to make up for the loss of ETH as a target reward.

ETH mining is now done primarily with ASICs implementing Ethash and while there are other coins using that algorithm, they are much less rewarding, so much hardware could be obsoleted, or redistributed to the gamer community. There is an ETC classic fork that remains proof-of-work and which will probably benefit. But ETH miners have known for a long time that this is coming and presumably they are preparing. We show below that half of the Ethereum hashrate is already concentrated in two pools.

Our next report in June 2022 could look quite different if the Merge happens during the first half of next year.

Bitcoin's Electricity usage

Now the reason Ethereum is moving to PoS is they want to use less energy for validating transactions on their blockchain, for creating new ETH tokens, and for executing smart contracts.

Bitcoin is already the world's most energy-efficient way to move large amounts of money. One has to separate the cost of creating money (block subsidy) with moving money (transaction fees); most casual commentators miss this point. On May 28, 2021 a transaction for \$630 million was committed to the blockchain. The fee was \$5. Confirmation happens within an hour. This is breakthrough monetary technology, both with Bitcoin and cryptocurrencies more generally. Lightning second-layer technology is extending this efficiency to transfers for very small amounts.

For years Bitcoin has come under attack for its electricity requirements. Some have made doomsday claims that Bitcoin mining will consume 'all electricity', yet currently it is 0.51% of the world's electricity, according to cbeci.org. This is the website maintained by the University of Cambridge's (Judge Business School) Centre for Alternative Finance. It monitors Bitcoin mining's electricity consumption. Their best estimate is 114 TeraWatt-hours (TWh) per year, against a global electricity production of 26,730 TWh.

This is comparable to The Netherlands' usage, but that nation has less than 1% of global GDP. Or it is comparable to home refrigerators in the US, but only 5% of global air conditioning electrical needs.

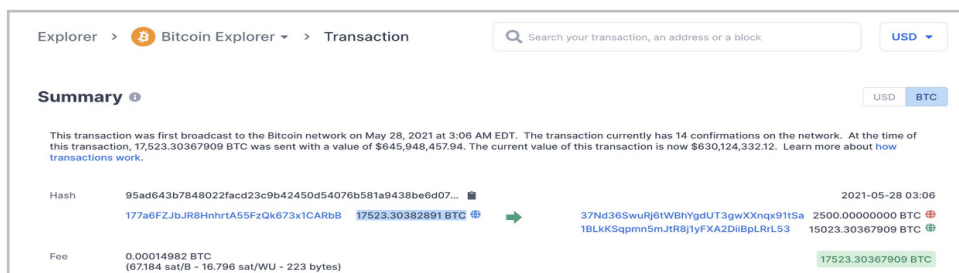


Figure 1. A transaction of over \$600 million on the Bitcoin blockchain was executed for \$5 in fees.

This attack over half a percent usage by Bitcoin is highly overwrought unless you believe it has no economic value at all. The history, with 13 years since its inception, and having remained the premier cryptocurrency during that entire period, denies such an argument any factual basis.

Most electricity is used for residential consumption purposes, anything from cooking and air-conditioning, to operating computers, to charging Tesla batteries. Electricity that goes to factories and businesses as an input to production of goods or services and does not overall “go to waste” if it is part of an efficient business model. Most goods and services endure for shorter life times than Bitcoin, however.

In fact, Bitcoin electrons, that create long-lasting value while confirming transactions on the blockchain, are greener than, say, Tesla charging electrons, which are used only for immediate consumption. Tesla electrons reflect grid average carbon emissions in US, China and other countries. A given Bitcoin is created once and then persists ‘forever’ and can be re-used many times over; Bitcoin usage is renewable. Note that Bitcoins are highly divisible with 100 million smaller units known as Sats, so very small amounts can be exchanged, not only large amounts of value.

Technology S-curve models suggest a 25 or 30-year time scale for Bitcoin to begin to saturate in its rapid relative wealth appreciation. Over decades Bitcoin block rewards will drop drastically and miners will be paid mostly through transaction fees that involve no new Bitcoin production. This will still entail competitive cryptographic mining but should slow the rate of electricity consumption growth. Governments, regional and national, will continue to regulate and price electricity consumption by crypto miners to cap usage.

If we look at Bitcoin as a sort of digital gold, it is approaching gold mining’s usage of energy of 131 TWh. Over its life Bitcoin has been capturing value that otherwise could have accrued to gold. Its current market cap of over \$1 trillion is of order half that of the gold held by global governments, 1/10 that of all gold.

You can read more about this issue here: <https://endthefud.org>. A Bitcoin Mining Council has been formed this year in North America to help push the efficient renewable frontier of mining. Models suggest that Bitcoin can supplement batteries as load balancer components in solar and wind farms, allowing for higher ROI and better scaling for large installations. This is already happening on the wind-intensive West Texas grid. Power on that isolated grid is generally cheap, less than 5 cents per KWh 88% of the time. When it gets too expensive because of load demands, the crypto mining is not economic and is suspended; as a result, crypto mining is a load balancer or buffer for the grid operators.

You do not even require high voltage power lines in place to make use of stranded renewable sources with no grid access, whether solar, wind, geothermal, or even natural gas that is currently flared into the atmosphere. Methane is extremely dangerous for the climate, 25 times as much as CO2. One places containerized crypto mining rigs directly into the location to capture the energy resource. The created value can be transmitted onto the blockchain via a mobile phone or other Internet device.

Bitcoin electricity encapsulates and encodes Value

Value is created with each Bitcoin, and the value of one Bitcoin has been rising very greatly on a long-term basis., Although highly volatile, it has proven to be a store of value, par excellence. Becoming such a store of value is a result of proof-of-work due to the high security it enables and the real input costs that effectively place a floor under prices.

Bitcoin is an alternative monetary technology and may be the foundation of an alternative monetary system that would be complementary to, or competitive with, the existing government fiat system. China's mining ban suggests they see it more as a competitor; the regulatory posture in the West suggests most governments see it and cryptocurrencies and blockchain as important technologies that could enhance the efficiency of finance. Governments everywhere are sufficiently concerned by Bitcoin and stable coin alternatives that they are beginning to implement their own fiat-based central bank digital countries. China in particular is out front on this.

Global wealth today amounts to around \$418 trillion. It took centuries to produce or exploit this wealth that has been derived from empires or frequently fought over in wars between nation-states. Bitcoin's wealth or market cap is \$1.15 Trillion, all produced via honest proof-of-work in the last 13 years. Some illegal crypto mining rigs were run over by government steamrollers in Malaysia this year, but no one died.

The global M2 money supply is about \$145 trillion (US M2 is \$21 trillion). For Bitcoin to provide a true complement or alternative its value would need to rise more than an order of magnitude to rival major central bank balance sheets (the Federal Reserve's is over \$8 trillion). One possibility is that Bitcoin becomes the standard for international transfers, replacing the US "petrodollar" standard, while nation-states implement their own fiat-based central bank digital currencies.

Bitcoin uses electricity as part of a production process that creates value. The market today says a Bitcoin is worth around \$61,000. Bitcoins that were produced five years ago are now worth \$61,000. New Bitcoins mined today are worth \$61,000. But Bitcoins that were produced five years ago were at that time worth just \$712. They are over 80 times as valuable as when originally mined. This is an incredible return on the electricity and capital investment.

Bitcoin mining is a value-producing industry, and the value produced far exceeds the electricity input, especially as Bitcoin trends higher longer term. Bitcoin gets a bum rap on electricity usage relative to that used residentially for consumption or by the compute-intensive finance industry, that moves money in large volumes, for a price, but does not generally produce anything of value.

The bottom line is that Bitcoin mining produces long-lasting wealth, whereas most electricity is for short-term consumption purposes. Bitcoin miners are seeking out green sources and use more renewables than the world average according to cbeci.org.

Great Chinese Mining Shutdown: US and others take up the slack, Price recovers

At one time China was responsible for over 2/3 of the hashpower in Bitcoin mining.

However, during late May and early June of this year information came out that the Chinese central government was planning to ban cryptocurrency mining completely. Rules started being promulgated by provincial authorities in the four provinces where the largest amount of mining was taking place. The global hashrate dropped precipitously starting from late May at 180 Exahash/s, falling more than 50% to 85 Exahash/s until bottoming on July 3th.

As mining hashrate was extinguished rapidly on June 19, the Bitcoin blockchain hiccupped, with the block time increasing to 70 minutes for the block that spanned midnight. But it quickly reverted to form with block times back around 10 minutes soon after. And since that time, the global hashrate has returned close to its old highs, and is now about 150 Exahash/s.

Perhaps July 4th was an appropriate date for the rapid hashrate recovery to start, because the US has taken the leadership spot for cryptocurrency mining. Over one-third of global hashrate is now in the US, and the #2 nation is China's neighbor, Kazakhstan.

The price of Bitcoin fell in half concurrent with the mining ban news and implementation in May and June, but has by now recovered and gone on to reach new all-time highs.



Figure 2. Global hash rate of Bitcoin blockchain during the past year. The peak of 180 Exahashes (graph shows millions of Terahashes) was in mid-May and over the next month and a half the hash rate fell by over 50%, only to recover to 150 Exahashes in the subsequent four months. Credit: Blockchain.com.

Ten hours after the Great Mining Shutdown the hashrate distribution of the top miners showed that four pools had dropped by 25% or more in their hashrate: Antpool, Binance Pool, Huobi Pool, and BTCtop. Most of the rest had single digit percentage drops, and the pool Foundry Digital increased hashrate slightly.

Why did China ban mining? Four possible reasons: (1) to limit capital flight, (2) to control electricity usage, (3) to better impose regulation and taxes (if they ever allow it in the future) and (4) to promote instead their digital currency, the DC/EP fiat stable coin, that they are introducing. The main reasons are (1) and (4), in our opinion.

One Chinese economics professor was interviewed on a business television show actually stating (in English) that if Bitcoin becomes a global currency "We will all die!". One imagines he was reflecting the 'party line'.

This is just one more major event that illustrates the de-centralized and thus anti-fragile nature of Bitcoin. The nature of Bitcoin is to be self-adjusting and resilient to drops in hashrate, and this mining shutdown was a great

global laboratory experiment demonstrating just that. Bitcoin’s difficulty parameter adjusts every two weeks (2016 blocks) reflecting the prior period’s average hashrate. This means that it becomes easier to mine during the new two-week period. Simply put, there is less competition and the remaining pools win more blocks and make more money than they would have otherwise.

It should be remembered that a pool typically consists of one or several mining farms owned by the operator together with hashrate contributed by many separate individuals or small miners. The pool shares rewards in proportion to contributed hashrate. To the extent that small miners are outside of China or inside China but too small to be noticed, they will continue to generate hashrate for that pool.

The net effect of all of this is it is good for Bitcoin and good for the growing Bitcoin mining industries in North America and Central Asia. In North America, substantial capital is being invested in growing the cryptocurrency mining base, especially in locations with access to renewables or stranded natural gas. It has been reported that one company, the UK’s Argo Blockchain, is investing \$1.5 billion to \$2 billion into its Texas mining facility.

A limited sample of four of the largest mining pools by the University of Cambridge’s Centre for Alternative Finance estimates 35% of the hashrate was located in the US in August of 2021. However, they only sample IP addresses associated with 34% of global hashrate, so this is a rough estimation. The second largest mining country is Kazakhstan, next to China, and an easy destination for export of crypto mining rigs, possessing low cost electricity rates. The US and Kazakhstan may now account for half of all global Bitcoin mining. Other significant Bitcoin production locations are Russian, Canada, Germany, and Iran.

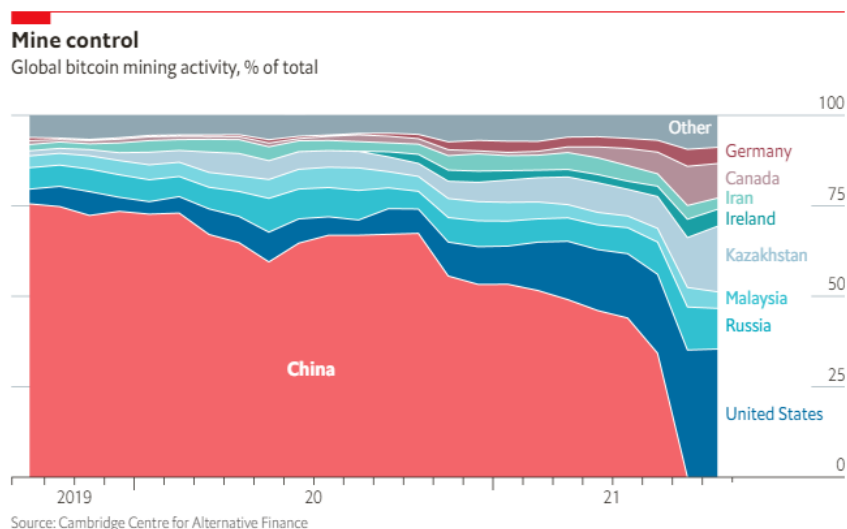


Figure 3. Graph of Chinese share of bitcoin mining and shares of other major countries as estimated by the Cambridge Centre for Alternative Finance. China’s share dropped from $\frac{3}{4}$ to $\frac{1}{2}$ between late 2019 and early 2021 as higher Bitcoin prices led to more crypto mining in a number of other countries. In June the Chinese share crashed to zero as a result of the Chinese government’s ban. The estimated share of the US is now 35%, and of Kazakhstan 18%; other large players are Canada and Russia. The CCAF is at the University of Cambridge’s Judge Business School.

Billion Dollar Pools

Many pools mine multiple coins. For example, the #1 pool globally, F2pool, mines Bitcoin, ETH, and Dogecoin. In Table 3 we show the top 10 pools, each has over \$1 billion in annual production. This is the same number of billion dollar pools as in the June 2021 report, and these 10 pools are responsible for over 70% of the annual economic value of the industry.

Pool	Country	BTC	ETH	DOGE	Total \$M
f2pool	Global	3,574	4,857	278	8,709
ethermine	Global	0	5,527	0	5,527
antpool	China	3,841	540	137	4,518
viabtc	Germany	2,300	0	267	2,567
btcdotcom	Global	2,136	332	0	2,468
foundry digital	US	2,321	0	0	2,321
hiveon	Global	0	1,930	0	1,930
binance	US	1,315	415	0	1,730
nanopool	Global	0	1,100	0	1,100
0xb7e39	n/a	0	1,017	0	1,017
					0
Top 10		15,487	15,718	682	31,887

Table 3. Top 10 mining pools, showing their production for each of the top three coins. These 10 pools alone are responsible for \$32 billion of the \$43 billion mining production of the top three coins.

There are four billion-dollar class pools mining only Ethereum’s ETH., whereas five of the other six pools are mining at least two coins of the three. F2pool is the largest, at over \$8 billion, and the ETH only pools Ethermine is over \$5 billion in size. Sparkpool in China was a \$4 billion Ethereum pool; it has suspended operations globally

Summary

We present details of the top 41 pools for Bitcoin, Ethereum, and Dogecoin in the Appendix. Cryptocurrency mining is a specialized domain of decentralized high-performance computing. This dynamic, highly competitive, and rapidly growing industry has surpassed \$40 billion in annual economic value.

Cryptocurrency mining revenues have grown at a compound annual rate of 97% over the past three years, since we first started this series of reports. Bitcoin mining revenue has grown at a 71% compounded rate and Ethereum mining at 174% compounded. We do not know the profits of various mining pools, and we don’t know miners’ actual costs. But based on the current estimates and coin prices, cryptocurrency mining is on average extremely profitable for those with access to electricity at less than 6 cents per KWh.

Trends to watch include the next generation of faster and more energy-efficient mining hardware, the new dominance of the American mining industry following the China ban, the end of Ethereum mining now expected in the first half of 2022, and the trend of increasingly green electricity by the industry.

Appendix: Largest Bitcoin, Ethereum, Dogecoin Pools

Rank	Pool Name	Percent, last 1000 blocks	Daily \$M	Monthly M\$	Annualized M\$	Host Country
1	antpool	18.7%	10.52	315.69	3841	China
2	f2pool	17.4%	9.79	293.74	3574	Global
3	foundry digital	11.3%	6.36	190.76	2321	US
4	viabtc	11.2%	6.30	189.08	2300	Germany
5	btcdotcom	10.4%	5.85	175.57	2136	Global
6	binance	6.4%	3.60	108.04	1315	US
7	slushpool	4.4%	2.48	74.28	904	Global
8	1E8CZ..	3.1%	1.74	52.33	637	n/a
9	17tUZL	2.8%	1.58	47.27	575	n/a
10	1FBMm	2.0%	1.13	33.76	411	n/a
11	emceed	1.9%	1.07	32.08	390	Global
12	marapool	1.8%	1.01	30.39	370	US
13	1GNgWA8	1.7%	0.96	28.7	349	n/a
14	sbicrypto	1.5%	0.84	25.32	308	Japan
15	luxortech	1.4%	0.79	23.63	288	Global
16	okex	1.0%	0.56	16.88	205	Hong Kong
17	huobipool	0.9%	0.51	15.19	185	Global
Total	of network	97.9%	55.09	1653	20,108	

Table 4. The top Bitcoin mining pools over \$100 million in size based on recent winning block distribution. We show the estimated daily, monthly, and annualized revenue and the host country.

The data snapshot, for these three tables for ETH, BTC, and Dogecoin mining, was taken on October 26, 2021. We used miningpoolstats.stream data for the percentage of mined Bitcoin per pool. They tabulate which pools won block subsidy rewards for the last 1000 blocks.

There are 17 Bitcoin pools larger than \$100 M annual revenue, shown in Table 4. The largest are Antpool, F2pool, and US-based startup Foundry Digital. Of all the pools three are in Asia (one in Japan, one in Hong Kong) and three are in the US. The top 17 Bitcoin pools represent 98% of the network hashrate and are responsible for \$20.1 billion of annual economic value based on the current rate. There are 6 pools producing over \$1 billion per year.

Rank	Pool Name	Percent, last 1000 blocks	Daily \$M	Monthly M\$	Annualized M\$	Host Country
1	ethermine	26.6%	15.14	454.3	5,527	Global
2	f2pool	23.4%	13.31	399.2	4,857	Global
3	hiveon	9.3%	5.29	158.7	1,930	Global
4	nanopool	5.3%	3.01	90.4	1,100	Global
5	0xb7e39	4.9%	2.79	83.6	1,017	n/a
6	flexpool	3.9%	2.22	66.5	810	Global
7	2miners	3.4%	1.93	58.0	706	Global
8	antpool	2.6%	1.48	44.4	540	China
9	miningpoolhub	2.5%	1.42	42.7	519	Global
10	0x2a203	2.5%	1.42	42.7	519	n/a
11	binance	2.2%	1.14	34.1	415	US
12	kucoin	2.0%	1.08	32.4	394	US
13	ezil	1.9%	1.08	32.4	394	Global
14	btcdotcom	1.6%	0.91	27.3	332	Global
15	0xab3b2	1.1%	0.63	18.8	228	n/a
16	0x2daa3	0.9%	0.51	15.4	187	n/a
17	gpumine	0.9%	0.51	15.4	187	Taiwan
18	0x6eba	0.7%	0.40	11.9	145	n/a
19	huobipool	0.6%	0.34	10.2	125	n/a
Total	of network	96.0%	54.61	1638	19,932	

Table 5. The top Ethereum mining pools, above \$100 million per annum, based on recent winning block distribution. We show the estimated daily, monthly, and annualized revenue and the host country.

In Table 5 we rank the top 19 Ethereum mining pools by annualized revenue, based on their percentage of recent blocks mined. The cutoff is a minimum \$100 million of annual revenue. There are 5 pools producing over \$1 billion per year each.

The two largest Ethereum pools are Ethermine and F2pool and between them they are responsible for a full 50% of the global hashrate. Sparkpool in China was a large Ethereum focused \$4 billion pool on the previous list, but they have announced a complete suspension of activity. Ethermine is an ETH only pool, whereas F2pool also mines Bitcoin. Two of the top 20 pools producing over \$100 M revenue per annum are listed as China or Taiwan, two are in the US. All the rest are global or of unknown location. The top pools are responsible for a run rate of \$19.9 billion of annual economic value, and represent 96% of the entire hash rate on the network.

Rank	Pool Name	Percent, last 1000 blocks	Daily \$M	Monthly M\$	Annualized M\$	Host Country
1	litecoinpool	25.4%	0.92	27.50	335	Global
2	f2pool	21.1%	0.76	22.85	278	Global
3	viaBTC	20.3%	0.73	21.98	267	Germany
4	poolin	11.2%	0.40	12.13	148	US
5	antpool	10.4%	0.38	11.26	137	China
Total	of network	88.4%	3.19	95.72	1165	

Table 6. The top Dogecoin mining pools based on recent winning block distribution. We show the estimated daily, monthly, and annualized revenue and the host country.

There are five large Dogecoin pools listed in Table 6, of which Litecoinpool and F2Pool are the largest. One of the interesting things about Dogecoin is it can be mined simultaneously with other coins. The top 5 pools produce 88% of Dogecoin, and \$1.2 billion dollars of annual economic value.

Glossary

Bitcoin – The original cryptocurrency, blockchain and consensus algorithm was outlined in October 2008 in the Satoshi white paper. The Bitcoin blockchain began in January 2009. Bitcoin uses proof of work and has a disinflationary monetary policy based on Halvings.

Blockchain – A chain of transaction blocks with each block linked to the one prior and the one after by a hashing technique. Each block incorporates a hashed representation of the prior block along with its own transaction records. A specific type of database with timestamped and linked record blocks.

Block reward – The reward for being the winning miner of a block. It consists of a subsidy and any transaction fees collected by miners.

BTC – Abbreviation for the bitcoin cryptocurrency.

Cryptocurrency – A currency stored in a digital ledger that implements cryptographic security to prevent theft or counterfeiting. Cryptocurrencies may be created with different mechanisms and the ledgers are often decentralized to varying degrees.

DeFi –Decentralized Finance. DeFi implements automated financial methods by use of cryptocurrencies and blockchains.

Dogecoin – A cryptocurrency created from Litecoin, itself a clone of Bitcoin, in 2013, as a joke. It has a mildly disinflationary monetary policy.

ETH – the native cryptocurrency of the Ethereum network.

Ethereum – The second largest cryptocurrency by market value was created in 2015 by Vitalik Buterin, Joe Lubin and others. It was designed to implement smart contracts such as those used in DeFi. It presently mines ETH, its native cryptocurrency via proof of work, but will shift to proof of stake as Ethereum 2.0 rolls out.

Halving – The algorithmically enforced decrease in the block reward subsidy for Bitcoin miners. Originally this was 50 BTC for the winning block. Halvings occur roughly four years apart after each 210,000 block interval. The last halving dropped the subsidy from 12.5 to 6.25 bitcoins per block.

Hash rate – The rate at which a computer system (mining rig) can generate hash guesses to solve the cryptographic puzzle. A Terahash/s is a trillion hashes per second, a Petahash/s is a quadrillion, and an Exahash/s is a quintillion (10^{18}) hashes per second.

Miners – The computer systems that solve the cryptographic puzzle for a proof of work cryptocurrency. Miners are characterized by hash rate, the amount of solution power. Custom ASICs or GPUs are employed, typically. The first computer that solves the puzzle commits the block of transactions and receives the block reward.

Money – A medium of exchange, store of value, and unit of account. Bitcoin and Ethereum represent monetary technology; they have not achieved full 'moneyness' but are on the path as their utility grows. Bitcoin is now legal tender in El Salvador.

Pools – Pools consist of mining farms plus smaller miners that voluntarily contribute their hash power in order to gain a portion of the mining rewards. Pools are run by companies for profit.

Sharding – Sharding is a database technique of dividing the database into multiple sections for faster parallel access. Ethereum 2.0 is implementing 32 shards.

Smart contract – An automated contract for exchange of value implementing agreed upon rules between the parties for transfers.

Zipf's law – A relationship that says the rank order and value of some quantity (e.g. size of lakes) are inversely correlated to the first power.

References, Data Sources

- ✦ Cryptocurrency topics: orionx.net/blog
- ✦ CryptoSuper 500 Fifth Edition, <https://medium.com/the-capital/crypto-super-top-50-fifth-edition-bbce1d15a6bf>
- ✦ Top Cryptocurrency Supercomputers November 2020, ([slide presentation link](#))
- ✦ The Brutal Efficiency of Crypto Mining, <https://medium.com/the-capital/the-brutal-efficiency-of-crypto-mining-far-beyond-moores-law-92fa90e617e0>
- ✦ Bitcoin's Long Term Value, An Adoption S-Curve for Monetary Technology, <https://medium.com/the-capital/bitcoins-long-term-value-e077e212264d>
- ✦ <https://cbeci.org/> - Electricity consumption and distribution of hash rate from the Cambridge Bitcoin Electricity Consumption Index project of Judge Business School's Cambridge Centre for Alternative Finance, University of Cambridge
- ✦ Overall statistics: coinmarketcap.com, coinwarz.com, cryptoslate.com, ycharts.com
- ✦ BTC: btc.com, blockchain.com
- ✦ ETH: btc.com, etherscan.io
- ✦ Top 6 coins: miningpoolstats.stream

Please visit OrionX.net/research for additional information and related reports.

Copyright notice: This document may not be reproduced or transmitted in any form or by any means without prior written permission from the publisher. All trademarks and registered trademarks of the products and corporations mentioned are the property of the respective holders. The information contained in this publication has been obtained from sources believed to be reliable. OrionX does not warrant the completeness, accuracy, or adequacy of this report and bears no liability for errors, omissions, inadequacies, or interpretations of the information contained herein. Opinions reflect the judgment of OrionX at the time of publication and are subject to change without notice.