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The OrionX Constellation
Blockchain

Fifth CryptoSuper 500 List

If Bitcoin were a Company it would be #19 in Market Cap

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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.

Cryptocurrency as Global Money

> *"Money has become information. Bitcoin is energy securely encapsulated as information. Electrons to eternal bits. Money in the Internet, and only in the Internet." - @moneyordebt*

The market capitalization or value of all existing Bitcoin, is around one quarter of a trillion dollars. If it were a company it would be #20 in global market cap value.

Bitcoin is now worth over $16,000 per coin. Since each is broken down into 100 million smaller units (Satoshis), one does not need to possess or transfer an entire coin. It is now worth as much as 380 barrels of oil or 8 ounces of gold.

These comparisons are not insignificant. The US dollar used to be on a gold standard, until 1971. That was replaced by the floating exchange rate "petrodollar' standard. Petrodollar is shorthand for a world trading system, including oil and many other commodities, plus goods and services, all priced in the US dollar, as the most important fiat currency.

Money depends on the technology of the day. Coins are a certain fineness of precious metal content, and weighed, stamped and milled. Paper money has many attributes to inhibit counterfeiting. Central banks evolved to backstop the banking system. If Gold was Money 1.0, and Fiat with fractional reserve banking is Money 2.0, Bitcoin has all the Aristotelian characteristics needed for Money 3.0.

As we move away from oil as the center of the energy market toward more renewable sources, and since the Information Economy has replaced the Manufacturing Economy as the core of technological progress, an electricity-based and information-based monetary technology makes more sense.

Table 1 shows our scoring for the Aristotelian attributes plus fungibility for each of the three major categories of money.

Evolution

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.

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Table 1: Attributes of Money

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

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. In particular, in comparison to fiat paper and digital money, it has a pre-determined monetary supply, rather than one that is continuously adjusted by a small committee of people. Bitcoin is private, non-state, decentralized money created and stored in the Internet.

Decentralized Finance (DeFi)

Bitcoin, Ethereum, stablecoins, and some other cryptocurrencies are the linchpins of a newly developing alternative financial system that goes by the name of DeFi. One can now trade, lend, and borrow cryptos on both centralized and decentralized exchanges. Derivatives and futures exist for a number of cryptos. Smart contract technology provides the potential for more sophisticated instruments and tokenization of a wide variety of assets.

Since our last report in June, the Office of the Comptroller of the Currency in the US has ruled that US banks may provide custody services for Bitcoin and other cryptos. An ETF for Bitcoin remains on the horizon in the US, although there is one ETF-like vehicle. There is already a Bitcoin ETF trading in Germany, Austria, and Switzerland.

Corporations are entering the cryptocurrency market, including Facebook with their plans for Libra and PayPal's very recent offering of Bitcoin, Bitcoin Cash, Ethereum, and Litecoin on its platform. Unlike Libra, the PayPal capability to buy and sell Bitcoin on their platform is now up and running. And a number of companies including MicroStrategy and Square are converting the majority or part of their corporate cash holdings to Bitcoin.

Of great import is the urgency that central banks are showing to get in the game with central bank digital currencies (CBDCs). There is news every week on this front. China has already trialed its DC/EP in Shenzen with $300 million of transaction volume. The Bahamas has just rolled out a CBDC available to its entire population. The European Central Bank, the Bank of England, the Bank of Canada, the IMF, and yes, the Federal Reserve, are all studying the possibility of introducing CBDCs. It seems inevitable, but they want to 'get it right'.

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The Fifth CryptoSuper List, Released in Conjunction with SC20

Our CryptoSuper lists are created twice as year; previous lists were released in November 2018, June and November 2019, and June 2020.

The information for this fifth edition of the CryptoSuper 500 list was collated during the last few days of October. The block production and hashrate numbers are monthly totals in the case of Bitcoin, Ethereum and Bitcoin Cash. One thousand block averages were used for the other top mined coins.

For this list, across all the top six Proof of Work coins, the cutoff for a mining pool to be included in the Top 50 is an annual economic value of at least $14.5 million per year, including mining rewards and transaction fees.

There are over 7500 cryptocurrencies at present, but the vast majority are of little import, only 19 have market caps (tokens outstanding times price) over $1 billion.The current $400 billion of value is concentrated in Bitcoin with 65% of the total market cap, and Ethereum with 11%. In an extreme illustration of the Pareto principle, three-quarters of the market cap of all cryptocurrencies combined is with the top two.

There are different ways of creating new cryptos, different consensus algorithms or methods of solving the Byzantine generals' problem of preventing fraudulent transactions, e.g. double spending, a form of counterfeiting. The two most robust consensus algorithms from the security and value perspective are Proof of Work and Proof of Stake. But only Proof of Work is a computationally intensive process that leads to *supercomputing* levels of resources being assigned. Only PoW coins are 'mined' or 'minted'.

Thus we consider here only the most valuable Proof of Work coins. The six most valuable by total market cap are summarized in Table 2. Our prior list had eight coins; for this fifth relase of the list, Monero and Ethereum Classic have both failed to make the cut. We list the type of hardware required (ASICs in all cases), the algorithm, the target block time and subsidy and thus how many coins are 'minted' per day on average. And we list the total hash rate as of the last week of October 2020. Because consensus algorithms vary so widely, and the value and popularity of even the top coins varies significantly, hashrates range over many orders of magnitude, from the Gigascale range up to the Exascale range.

One difference from traditional supercomputing installations is that these are mining pools, and they often welcome anyone to contribute their own compute resources from anywhere in the world, and share in the crypto mining rewards. The problem is inherently embarrassingly parallel since one must make billions or trillions of guesses at a 'nonce' before computing the winning result. However, given the need for extremely cost-effective electricity it is becoming more difficult for many independent miners who have access only to electricity at typical residential rates.

Table 2: Top 6 Mined Coins (10/31/20 snapshot)

Coin	HW	Algorithm	Block time	Block subsidy	New coins / day	Hash rate	units
Bitcoin	ASIC	SHA256	10 min.	6.25	900	114.5	Exa
Ethereum	ASIC	Ethash	13 sec.	2	13,292	190.7	Tera
Bitcoin Cash	ASIC	SHA256	10 min.	6.25	900	2.63	Exa
LTC	ASIC	Scrypt	2.5 min.	12.5	7200	259.0	Tera
Bitcoin SV	ASIC	SHA256	10 min.	6.25	900	1.80	Exa
Zcash	ASIC	Equihash	1.25 min.	6.25	7200	6.49	Giga

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CryptoSuper Mining

Cryptocurrrency mining is a specialized form of supercomputing. It relies on large clusters of mining rigs with substantial power and cooling requirements, and the operators of these seek out low cost power and cooling locations. Hydropower access is especially favored, and it has been estimated that as much as 75% of power used in crypto mining by large compute farms is from renewable sources.

The critical parameters for a PoW crypto mining rig are its rate of hash generation and its power consumption. The hash generation rate determines how many attempts a rig can make at solving the cryptographic puzzle required to commit a block to the blockchain. Solving this puzzle provides the first-to-solve miner with the right to commit the block of transactions and received that block's reward. The reward consists of a mining subsidy and fees associated with transactions.

The electrical consumption of a mining rig is usually the dominant contributor to the cost of mining, and the capital acquisition cost of mining rigs is the second largest component. Because cryptocurrency mining is inherently a highly decentralized process, there is also an increasing trend toward operators locating major crypto mining resources in multiple countries, creating global pools. China has tightened up on some operators, rationing their access to electric power, and this has encouraged migration of resources to Central Asia, Europe and North America.

The current block subsidy for Bitcoin has been reduced from 12.5 Bitcoins per block to 6.25 Bitcoins, as of May 11, 2020. This is baked into the Nakamoto consensus algorithm that cuts the subsidy in half approximately every four years (after each 210,000 blocks of 10 minutes' average duration). This provides Bitcoin and other cryptocurrencies with similar algorithms with deliberately disinflationary monetary policies, by design.

Table 3 below provides an overview of current top 10 Bitcoin mining rigs. These are the top 10 miners for the SHA-256 algorithm, in terms of their ability to rapidly generate guesses toward a successful solution of a cryptographic puzzle, rated in Terahashes/sec performance (TH/s). The arms race obsoletes mining rigs very quickly, within a couple of years or less. All of these are ASIC-based, designed specifically to solve the SHA-256 algorithm. ASICs have replaced GPUs for the vast majority of cryptocurrency mining for over 5 years now.

Table 3: Top Bitcoin mining rigs (SHA-256)

Mining Rig	TH/s	Watts	TH/s per KW	Gross Margin, $/day, 5c per kWh	Gross Margin, $/day, 1c per KWh
Antminer S19 Pro	110	3250	33.8	7.50	11.79
Whatsminer M30S++	112	3250	34.5	7.44	11.96
Whatsminer M30S+	100	3472	28.8	6.29	10.61
Antminer S19	95	3400	27.9	5.95	10.07
Whatsminer M30S	86	3250	26.5	4.99	9.04
Antminer T19	84	3150	26.7	4.93	8.84
AvalonMiner 1166 Pro	81	3400	23.8	4.32	8.44
Antminer S17+	73	2920	25.0	4.06	7.64
Whatsminer M31S	70	3220	21.7	3.39	7.23
Antminer S17e	64	2880	22.2	3.18	6.62

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There are three brands represented; all are from Chinese manufacturers. The Antminer from Bitmain is the leading brand, followed by the Whatsminer systems.

One can see that the peak TH/s rate for an SHA-256 rig is of order 100. Just to show the scale of this, the current total hashing rate on the Bitcoin blockchain is somewhat over 100 Exahashes per second. Therefore, the fastest machines are about one-millionth of that, and thus we determine that there are a few million crypto mining rigs active around the world.

The machines typically consume around 3 kiloWatts of power. Access to cheap electricity is extremely important for a rig to be profitable. One can calculate a figure of merit TH/s per kiloWatt as shown in the fourth column of the table.

In the last two columns of the table we show the gross margin as a function of power costs assuming 5 cent power prices or 1 cent power. Unless you can get 5 cents or less as your power cost you should probably find another business besides Bitcoin mining. You may find other cryptocurrencies that you can mine economically at higher power charges. Usually the cheapest power one can find globally is about 3 cents. One cent power is unheard of, until recently.

There is a new mining operation in west Texas that has access to 2.5 cent power because of very cheap energy prices currently and access to flared natural gas. Furthermore, they have executed a load leveling agreement with the power authority stating that they will shut down crypto mining during peak load periods. This gives them credits back on their power bill, and the net result is that their power may be as cheap as 1 cent after credits.

An older rig that consumes too much power is headed for the scrap heap, unless you can move it to an even cheaper power cost location.

These are gross operating margins, and one has to subtract other operating costs including cooling, facilities, and administrative costs. And beyond that, every day mining gets harder, because of increased competition and difficulty adjustments. In Bitcoin's case, difficulty increases (decreases) every two weeks (2016 blocks) in proportion to the global collective hashrate that is deployed. It almost always increases since more and faster rigs are continually being deployed. And your rig that once had one-millionth of all the Bitcoin hashing power, after one year, may have only half as much as that in relation to the network.

Plus you have to earn sufficient rewards to recover the upfront capital cost of the mining rig, priced like an entry-level server, perhaps $2000 to $3000. Since each rig has less than one-millionth of the power of the entire Bitcoin mining network, one must have a large number of machines to have a chance of earning block rewards. Alternatively, with one or a few machines you can commit their hashpower to a mining pool, and earn a proportion share of all the rewards from the pool.

We look at the challenging economics of mining in more detail in this article: https://medium.com/the-capital/the-brutal-efficiency-of-crypto-mining-far-beyond-moores-law-92fa90e617e0

Global Hashrate: Ten to the 20th Power (100 Exa)

Hashes in crypto mining are the metric that parallels flops in the supercomputing world. But hashrates are much higher due to many repetitions of a small cryptographic problem attacked with custom ASICs.

Crypto miners compete via Proof of Work consensus algorithms in order to win a block reward (subsidy and fees) and commit a group of transactions to the blockchain. Cryptocurrency mining via Proof of Work continues to

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represent the most effective class of consensus algorithm to maximize security in a decentralized manner, and it allows coins to accrue significant value. They are scarce because they are costly to produce and because maximum supply is algorithmically constrained.

In our CryptoSuper 500 race, we only look at the top mined coins that use Proof of Work, since these are the *only supercomputer class workloads* in the cryptocurrency world. Other consensus algorithms are much less costly, but as the marketplace has consistently demonstrated, other consensus methods impart much less value and security to a cryptocurrency. This is a trade-off between store of value and utility attributes.

Crypto mining entered the Exascale era in 2016; four years ago, the global hash rate for Bitcoin was already exceeding an Exahash per second. As of this writing, Bitcoin's total computational power is over 100 Exahashes per second. Crypto hashes are very simple calculations, using SHA(256) in the case of Bitcoin hashing, with many repeated trials required until a winning result adhering to the pre-defined problem difficulty is achieved.

The problem difficulty is regularly adjusted by the consensus algorithm as the collective hashrate increases or decreases. Bitcoin has had over 300 such adjustments to data, on an approximate two-week schedule (each 2016 blocks).

Table 4: Hashrate History of Bitcoin over 6 Block years

Block Height	Block subsidy	Block Years elapsed	Date	Hashrate (TeraH/s)	log 10 of Hashrate	log 10 of Block Year	Power law, 4-year interval
315,000	25	6	2014-08-11	156,187	5.19	0.78	10.99
341,250	25	6.5	2015-01-31	296,921	5.47	0.81	12.47
367,500	25	7	2015-07-29	386,597	5.59	0.85	15.08
393,750	25	7.5	2016-01-17	766,473	5.88	0.88	16.32
420,000	12.5	8	2016-07-09	1,554,081	6.19	0.90	16.58
446,250	12.5	8.5	2017-01-02	2,420,682	6.38	0.93	14.88
472,500	12.5	9	2017-06-23	5,145,068	6.71	0.95	12.02
498,750	12.5	9.5	2017-12-11	12,845,067	7.11	0.98	9.95
525,000	12.5	10	2018-05-29	33,710,000	7.53	1.00	10.21
551,250	12.5	10.5	2018-11-24	41,483,900	7.62	1.02	11.15
577,500	12.5	11	2019-05-24	52,657,000	7.72	1.04	12.00
603,750	12.5	11.5	2019-11-14	89,789,000	7.95	1.06	11.84
630,000	6.25	12	2020-05-11	121,040,000	8.08	1.08	11.19
654,875	6.25	12.47	2020-10-27	114,815,500	8.06	1.096	10.26
Last 4 block years	HR ratio	47.73		R^2	0.944	slope	10.26
	CAGR	163%					

Table 4 shows the Bitcoin hashrate history at one-half block year intervals, starting from when Bitcoin was six block years of age. Each block year is 52,500 blocks of approximately 10 minutes' duration, and block years are running slightly shorter than regular calendar years, recently by about two weeks. Since the May 11 Halving, we are now in the 13th Block year since Bitcoin's blockchain launched in January 2009.

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In the table, the block height (number of blocks) is shown in the first column, then the block reward is shown in the following column. Note that it decreases by a factor of two each four block years; these are the key Halving events that drive inflation down toward zero. The calendar date is shown, then in the next column the total hashrate for all miners around the globe. Then we have the base 10 logarithm for the hashrate and the log of the block years elapsed. In the last column of the table one sees the four-year prior interval slope for a log - log regression (power law relationship) between hashrate and block years.

The hashrate is up by a factor of 48 in the past four years. Hashrate has been growing extremely rapidly, roughly as the 10th power of elapsed block time! For a while in the 2014-15 period hashrate was growing with a power law > 15 as a rapid switch from GPUs to ASICs was underway. Now it has settled down somewhat to “only” a power law of roughly 10 and still much, much faster than Moore’s law.

This rapidly growing global hashrate is a result of strong advances in the specialized ASIC-based crypto mining ASIC-based computer designs, in performance, packaging, and power efficiency. It also reflects the optimization efforts of mining pools as they seek out the least costly locations for electrical power and cooling and optimize their facilities design. It is of course additionally a result of the long-term increase of Bitcoin price, some four orders of magnitude since early 2011, that has attracted ever-larger investment.

The price of Bitcoin has been growing roughly as the 5th power of elapsed block time, driven by enhanced security and scarcity as Bitcoin’s inflation rate drops continually. Hashrate follows price as miners are incentivized to increase their capital investment in terms of the number of systems devoted to mining and by obtaining the latest and greatest hardware. The result is that the hashrate is increasing at roughly the square of the Bitcoin price.

Doubling each Nine Months

In the last four calendar years, as indicated in Table 4, hashrate increased 48 times for Bitcoin, over six doublings, for a compound (calendar year) annual growth rate of 163%. This implies a doubling each nine months or *two and a half times more rapidly than the Moore’s law rate*.

Hashrate follows price, price reflects security (that depends on length of blockchain and hashrate as well) and growing scarcity (decrease in remaining supply or its inflation rate) that is a simple function of blockchain length. Inflation is cut in half at each Halving separated one from the next by four block years.

Since the major equipment cycle is around two years, the miners must look out a couple of years ahead and guesstimate costs and the future bitcoin price to justify new capital investment. If price drops they can shut down their least efficient equipment and only mine with their newer equipment that has the best hashrate per kilowatt characteristics. There may also be seasonal effects, especially since a lot of the miners are located in regions with cheap hydroelectric power that costs less when spring runoff is flowing. If some miners shut in some equipment, the more efficient miners will increase their share of bitcoin rewards, as the mining difficulty will decrease. Somebody gets the rewards, without fail.

Capex is sunk cost, so miners will continue to mine in the face of dropping prices as long as they can have positive cash flow after operating expenses (they may have to defer equipment upgrades, though, if cash is tight). They also can hedge their expected future production through forward sales with Bitcoin options or futures.

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Summary Tables

Here we present tables of the top mined coins, top mining countries, and top pool operators (including multiple coins mined by a single operator). Since the price of Bitcoin moved quite a lot during the first week of November 2020, we have captured prices as of November 6th, although other date was captured the last week of October.

The cutoff to make the Top50 is $14.4 million annual run rate for a given pool producing a given coin.

As shown in Table 5, the total annual economic value for the top 6 cryptocurrencies is currently at a run rate of $9.1 billion, up a very healthy 90% from the $4.82 billion per year run rate in June 2020. This is a new high in annual economic value, above the previous record set with our June 2019 list, and despite the Bitcoin Halving in May of this year. The Bitcoin price is up 60% since our June 2020 list, but Ethereum is up in price by over 80%.

This large increase in annual economic value run rate since the June 2020 list is simply due to the rise in price of Bitcoin and Ethereum.. Bitcoin, Ethereum, and Litecoin increased substantially but the others were flat or even down.

Of the top pools, 18 are mining Bitcoin, 21 are mining Ethereum, 4 are mining Zcash, and 5 Litecoin. The other 2 major mined coins have one entry each. The percentage of annual economic value for Bitcoin has dropped from 66% of the total to 62%. Ethereum's share has increased to 33%, so the two coins are amounting to 95% of the value mined. The remaining 5% is spread across the 4 other significant coins. The Pareto principle is very much in evidence here.

Table 5: Top six coins that have mining pools in the Top 50

Coin	Top 50 Pools: M$ per year	M$ per year for All Production	Percent of Annual Economic Value
Bitcoin	4784	5621	61.8
Ethereum	2833	3031	33.3
Litecoin	114	160	1.8
Zcash	116	151	1.7
Bitcoin Cash	40	83	0.9
Bitcoin SV	19	53	0.6
Total	*7906*	*9098*	*100*

Table 6: Top Host Countries

Host Country	Number of Top Pools	Percent of Top 50 AEV	Annualized M$
China	19	39.6	3139
Global	13	34.0	2683
Hong Kong	4	9.1	715
United States	2	9.3	721
Europe	2	1.9	152
Other, N/A	10	6.0	498
Totals	50	100	7908

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In Table 6 we show the top crytpo mining countries. Out of the $9.1 billion of annual economic value for the top 6 coins, $7.9 billion or 87% is produced from the top 50 pools. China clearly dominates as before, with 40% of the annual economic value. When one considers also that the Global category includes Chinese mining as well, the Chinese share is over 50%, and adding in Hong Kong, over 60%. The US share is under 10%.

Table 7 shows the Top 10 pool operators, combining multiple coins mined by a given operator. Some operators are mining three or four of the top coins. If the entry is in the top 50 for pools of a given coin, it is aggregated in this list. F2Pool retained first place, followed by SparkPool and Poolin. Poolin fell one position and Sparkpool moved up ahead of both it and AntPool. Half of the top 10 pools are in China, two are global, one is in Hong Kong, one is in the US, and one is located in both the US and China.

The production from the top 10 operators is almost $6 billion out of a total of $7.9 billion AEV produced by the top 50 pools and $9.1 billion for all cryptomining for these top 6 Proof of Work coins.

Table 7: Top 10 Pool Operators

Pool Operator	Host Country	Number of Top Pools	Annualized M$
F2Pool	Global	4	1058
SparkPool	China	1	840
Poolin	US, China	3	736
BTCdotcom	Global	2	683
Ethermine	US	1	654
AntPool	China	3	514
HuobiPool	China	1	484
ViaBTC	Hong Kong	4	374
BinancePool	China	1	333
58Coin&1THash	China	1	298
Totals		21	5974

Tables 8a-8f in the Appendix show the full list of the top 50 cryptocurrency mining pools around the world, broken down by the top six cryptocurrencies. Again, the cutoff is annualized economic value of $14.4 million or more. In these tables, a 30-day month is used, and a 365-day year.

The AEV production for the top 50 mining pools has increased to almost $8 billion rate from over $7 billion one year prior. The mining industry has recovered since the May, 2020 halving, at least in terms of revenue production.

Models for Bitcoin's price and market cap such as PlanB's stock-to-flow model and Stephen Perrenod's future supply model suggest prices should continue to rise. The expected rise in Bitcoin's and Ethereum's price pushed the AEV back above the former high during this new Block era, despite the substantial decrease in Bitcoin block rewards.

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Appendix

Table 8a: Top Bitcoin Mining Pools

Rank	Pool	Coin	Monthly M$	Annualized M$	Host Country
1	F2Pool	BTC	58.36	710.0	Global
2	Poolin	BTC	54.59	664.2	US, China
3	BTCdotcom	BTC	54.40	661.9	Global
4	HuobiPool	BTC	39.74	483.5	China
5	AntPool	BTC	39.26	477.6	China
6	ViaBTC	BTC	28.65	348.5	Hong Kong
7	BinancePool	BTC	27.39	333.3	China
8	Slus58Coin&1Th ash hPool	BTC	24.50	298.1	China
9	OkExPool	BTC	14.08	171.3	Hong Kong
10	Lubian	BTC	13.99	170.2	Hong Kong
11	BTCdotTop	BTC	13.02	158.4	China
12	SlushPool	BTC	9.16	111.5	Europe
13	NovaBlock	BTC	4.65	56.6	US, Canada
14	SpiderPool	BTC	3.64	44.3	China
15	MiningCity	BTC	3.33	40.6	Europe
16	Tatmas	BTC	2.02	24.6	N/A
17	WAYIdotCN	BTC	1.21	14.8	China
18	OkKong	BTC	1.21	14.8	China

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Table 8b: Top Ethereum Mining Pools

Rank	Pool	Coin	Monthly M$	Annualized M$	Host Country
1	SparkPool3	ETH	59.72	726.5	China
2	Ethermine	ETH	53.72	653.6	Global
3	F2Pool2	ETH	23.75	288.9	Global
4	SpiderPool	ETH	19.09	232.2	China
5	NanoPool	ETH	13.72	166.9	Global
6	0xd224	ETH	13.32	162.0	N/A
7	SparkPool4	ETH	9.33	113.6	China
8	0xb3b	ETH	6.82	83.0	N/A
9	BeePool	ETH	4.88	59.4	China
10	0x3ece	ETH	4.75	57.8	N/A
11	0xa480d	ETH	3.29	40.0	N/A
12	XNpool	ETH	3.16	38.5	China
13	0x6ebaf	ETH	2.81	34.2	N/A
14	2Miners	ETH	2.24	27.3	Global
15	0x06b8	ETH	2.04	24.8	China
16	PandaPool	ETH	1.99	24.2	China
17	2MinersSolo	ETH	1.94	23.6	Global
18	BTCdotcom	ETH	1.74	21.2	Global
19	FirePool	ETH	1.52	18.5	China
20	0x45dd	ETH	1.52	18.5	N/A
21	0x8595	ETH	1.49	18.2	N/A

Table 8c: Top Litecoin Mining Pools

Rank	Pool	Coin	Monthly M$	Annualized M$	Host Country
1	Poolin	LTC	2.52	30.67	Global
2	ViaBTC	LTC	2.09	25.40	Hong Kong
3	F2Pool	LTC	1.96	23.80	Global
4	AntPool	LTC	1.65	20.13	China
5	BTCdotcom	LTC	1.18	14.38	China

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Table 8d: Top Zcash Mining Pools

Rank	Pool	Coin	Monthly M$	Annualized M$	Host Country
1	Poolin	ZEC	3.39	41.27	Global
2	F2Pool	ZEC	2.93	35.70	China
3	AntPool	ZEC	1.67	20.34	China
4	SlushPool	ZEC	1.61	19.58	Global

Table 8e: Top Bitcoin Cash Mining Pools

Rank	Pool	Coin	Monthly M$	Annualized M$	Host Country
1	Unknown	BCH	3.31	40.26	N/A

Table 8f: Top Bitcoin SV Mining Pools

Rank	Pool	Coin	Monthly M$	Annualized M$	Host Country
1	1M4CZG	BSV	1.58	19.17	N/A

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ETH: btc.com, etherscan.io

BCH: btc.com, cash.coin.dance

Other coins: miningpoolstats.stream

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