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Fifth Bitcoin Epoch Portends Consolidation and Geographic Shifts; New Coverage in Exploiting Trends

Adding to our coverage with positioning advantaged companies. Mining growth and funding it in the prevailing 5.0-6.0 cent hash price environment is predicated on inexpensive power complemented by optimized fleet operation, and we contend that available power sources become increasingly competitive as demand for high-performance compute (HPC) also accelerates as presented in *Energy Hunger Games* June 10 this year—the thesis has been corroborated on many accounts in recent press, including an article in the *Financial Times* July 18. With investment returns widely favoring HPC over bitcoin mining, especially in the current mining environment, more attention in North America has turned that way, with a strong list of traditional bitcoin mining companies apparently more open to desegregating power use. The "awakening," and subsequent rise in HPC deployment, may have the effect of seeing hash migrate abroad where lower cost power elicits higher returns or other non-economic considerations rule the investment decision-making. In that vein, we are initiating coverage of Abu Dhabi-based *Phoenix Group PLC* (PHX.ADA; Buy) in presenting multiple growth avenues across various aspects of crypto. We are also initiating coverage of Las Vegas-based *Gryphon Digital Mining* (GRYP; Neutral) in its strategy to acquire assets by leveraging its public company platform. The strategy's implementation has not yet proven out in this case, but we understand progress is being made. More detail on each of these companies is available through the incorporated link—our bitcoin network forecasts are detailed herein.

Financial markets have a large say in the path forward. Access to capital is a hurdle for all businesses, but availability and cost are a perennial struggle for capital intensive businesses and exceptionally high hurdles rise for miners in rationalizing returns against hash price volatility. Since the last bitcoin bear, U.S.-based public companies have had little to no access to debt capital, instead primarily relying on at-the-market (ATM) stock transactions and their own cash generation to fuel capital expenditures. Interestingly, venture and debt capital has proven to be in better supply in funding HPC builds as Applied Digital's new deals attest as does the $150M Coatue Management investment in Hut 8 specifically prescribed for HPC development. Connecting the dots between demand for power and available capital, it would appear that building out large mining facilities becomes both more onerous and cost-of-capital expensive as compared with traditional data center builds, and as such we expect the current bitcoin mining epoch to showcase a gradual pendulum swing toward HPC development over mining particularly in the U.S. as export restrictions also serve to consolidate deployment.

Hash price and HPC demand: expect the large to get larger and others struggle for all-important scale. Not at all surprising as all soothsayers joined the fray in anticipating the facets of a post-halving world last year with the consolidation predictions bearing fruit thus far this year. Riot Platforms' pitch for Bitfarms has reached a contentious phase, where Kungsleden-Cathedra merger is a happier, consensual pairing. We expect to see more. Arguably, Stronghold Digital, SATO Technologies, IREN, and perhaps even Cipher Mining are in play, where the USBTC merger finally concluded late November last year has shown Hut 8 gaining steam, its shares up some 51% since versus a 22% gain in the Nasdaq. No doubt some of this may be attributed to the Core Scientific-CoreWeave HPC deal extension. Interestingly and apropos of earlier commentary, financial markets have a say in combinations where larger miners leverage scale and market access in the consolidation process; USBTC combined as a merger of equals. Public companies' liquidity access presents advantages in both capital raises and mergers. We argue further that HPC-touching data center companies have access to debt financing, generally reducing overall cost of capital, not otherwise easily available for strict bitcoin miners.

Beyond the underlying asset, stocks appear to reward consistent execution, growth, and diversification...perhaps less social media shyness as well. We would not expect to hear any argument against the extreme dynamism of the crypto sector as underlying asset volatility almost directly translates to crypto-related stock price whipsaws. But apart from the short-term unpredictability, certain companies have witnessed their stocks post longer-term gains as the crypto ecosystem expands; we were actively engaged analyzing then CEO Okamoto's Marathon when that stock bounced along below $1 and $50M market cap just more than four years ago. So, in light of past performance, what are the lessons learned and specifically what traits should investors embrace? We have offered a few ideas in starting off this paragraph, but are not comfortable enough to believe its exhaustive. There are some standout bitcoin miners, executing in completely matching or surpassing growth targets front that have seen stock returns benefit, such as Cleanspark, but others equally strong in consistent production, but have yet to see it fully reflected in the stock, such as Bit Digital. On the other hand, one leading characteristic entices retail activity and appears universal in its effect: social media—the Roaring Kitty Gamestop phenomenon presents an intriguing case study. Separately, though underappreciated just a few years ago, it has become abundantly clear most management teams recognize the influence garnered via social media and are using it to the fullest extent possible in addressing a still largely retail shareholder base across the industry.

Costs most concerning in anticipating future economics—we have the meats. As hash prices remain depressed, undaunted bitcoin maximalist and investors alike are eager for a bull run to $150,000 or $200,000 in referencing numbers we have seen thrown about. We flatly admit in following this space years longer than anyone else on the sell-side that we have little clue on predicting the next bull price—technicians might have more luck. Interestingly, addressing the other unknown in mining, our power-law function analysis on network hash rate was validated by research greats at CoinShares, so that is a plus, and we revisit that page herein. But without insight on the top line, it becomes all about managing what you can, spending. In that light, we offer our two cents on everybody else's spending, looking at power costs, all-in cost, hash costs, while introducing a view to efficiency that might shed interesting light on performance. The disparity in findings is not surprising, as reporting inconsistencies roll through not only our analysis, but also anyone else who digs into the figures. We recommend exercising caution in reaching definitive conclusions as both mining conditions and operations are dynamic; meanwhile, it is incumbent on industry participants to amalgamate and unify industry standards across both accounting and operating metrics. Some note, company management teams included, an analytical immaturity versus other longer-lived industries, such as oil and gas. We put it back to critics: provide fair and comparable data, and in saluting Ving Rhames, we have the "meats" in tools.

A view of valuation. With value accorded almost capriciously across the broad spectrum of public mining companies, much has been done to home in on specific factors posing the greatest influence. And the notion of buzz word of the day bears mentioning as experience suggests perspectives are fleeting, especially within a nascent industry that sees this news flow and underlying price fluctuation. Last year, looking at consolidation appeared to be the headliner. This year, it appears access to existing hard infrastructure draws the most attention, especially power infrastructure and power agreements. Permitted access is valued, but interconnects and substation power take off seems most important currently most likely on the heels of Core Scientific's deal extension with CoreWeave.

Miner Valuations and Efficiency Measures

		Price	Market Cap	Ent. Value	2023A	2024E	2023A	2024E	2023A	2024E	
		7/29/24	($'s M)	($'s M)	EV/S	EV/S	MC/TH	MC/TH	PH/MW	PH/MW	Rating
Sphere 3D Corp.	ANY	$1.04	$22	$18	0.8x	0.8x	17.8x	17.5x	32.2x	31.3x	Buy
Argo Blockchain PLC	ARBK	$1.64	$94	$128	2.5x	2.4x	34.9x	36.3x	30.7x	30.7x	Neutral
BitFarms Ltd.	BITF	$3.51	$1,072	$805	5.5x	3.7x	170.2x	59.6x	26.3x	18.9x	Buy
BitDigital Inc.	BTBT	$3.55	$440	$264	5.9x	2.1x	195.2x	0.0x	26.2x	24.7x	Buy
Cathedra Bitcoin Inc	CBIT	$0.08	$19	$15	2.3x	2.0x	47.1x	53.5x	100.8x	4.0x	Neutral
Cipher Mining Inc	CIFR	$5.57	$1,804	$1,581	12.5x	10.8x	250.6x	209.8x	30.5x	27.8x	Buy*
Cleanspark Inc.	CLSK	$16.29	$3,901	$2,963	17.6x	8.0x	387.8x	162.5x	117.0x	55.8x	Buy*
Core Scientific Inc.	CORZ	$9.56	$1,815	$3,426	6.8x	7.2x	115.4x	91.7x	21.7x	25.4x	Buy
Digihost Technology Inc.	DGHI	$1.41	$42	$39	1.5x	0.9x	24.9x	14.1x	18.9x	18.2x	Buy
DMG Blockchain Solutions Inc.	DMG	$0.43	$102	$51	2.5x	2.0x	105.9x	63.8x	12.0x	11.3x	Buy
Gryphon Digital Mining Inc.	GRYP	$0.95	$37	$51	2.3x	2.6x	41.0x	42.9x	32.1x	32.2x	Neutral
HIVE Digital Technologies Ltd.	HIVE	$3.67	$399	$194	1.8x	1.9x	99.4x	81.3x	28.6x	18.9x	Neutral*
HUT 8 Mining Corp.	HUT	$14.81	$1,371	$1,634	27.0x	8.8x	249.3x	240.6x	6.6x	5.1x	Sell*
IREN (Iris Energy Limited)	IREN	$9.72	$1,764	$812	9.9x	3.7x	316.9x	88.2x	34.4x	13.8x	Buy*
LM Funding America Inc.	LMFA	$3.63	$10	-$4	-0.3x	-0.3x	15.7x	15.1x	35.7x	17.3x	Neutral
Marathon Digital Holdings Inc.	MARA	$20.45	$6,100	$4,560	11.8x	7.3x	291.9x	164.3x	33.8x	16.7x	Buy
Mawson Infrastructure Group Inc.	MIGI	$1.23	$23	$36	0.8x	0.6x	18.2x	19.3x	11.5x	8.5x	Buy
Phoenix Group Holdings	PHX-ADS	$0.47	$10,203	$2,785	9.7x	11.8x	826.2x	261.6x	29.4x	0.0x	Buy
Riot Platforms Inc.	RIOT	$10.63	$3,234	$2,274	8.1x	3.5x	260.8x	127.3x	17.7x	7.8x	Buy*
SATO Technologies Corp.	SATO	$16.40	$15	$20	1.5x	1.7x	27.7x	26.9x	26.3x	26.0x	Neutral
Stronghold Digital Mining Inc.	SDIG	$2.94	$42	$104	1.4x	1.4x	10.2x	13.5x	24.8x	18.3x	Buy
Terawulf Inc.	WULF	$4.14	$1,476	$1,346	32.1x	16.9x	291.4x	167.7x	31.7x	22.4x	Not rated
Group Ave.					***7.5x***	***4.5x***	***172.7x***	***89.0x***	***33.1x***	***19.8x***	

Note: Asterisk (*) indicates covered by Colonnese; all others under our coverage as indicated by rating.
Source: FactSet Research (FDS; not rated), company reports, and H.C. Wainwright estimates all computed from an identical price deck across the universe of companies.

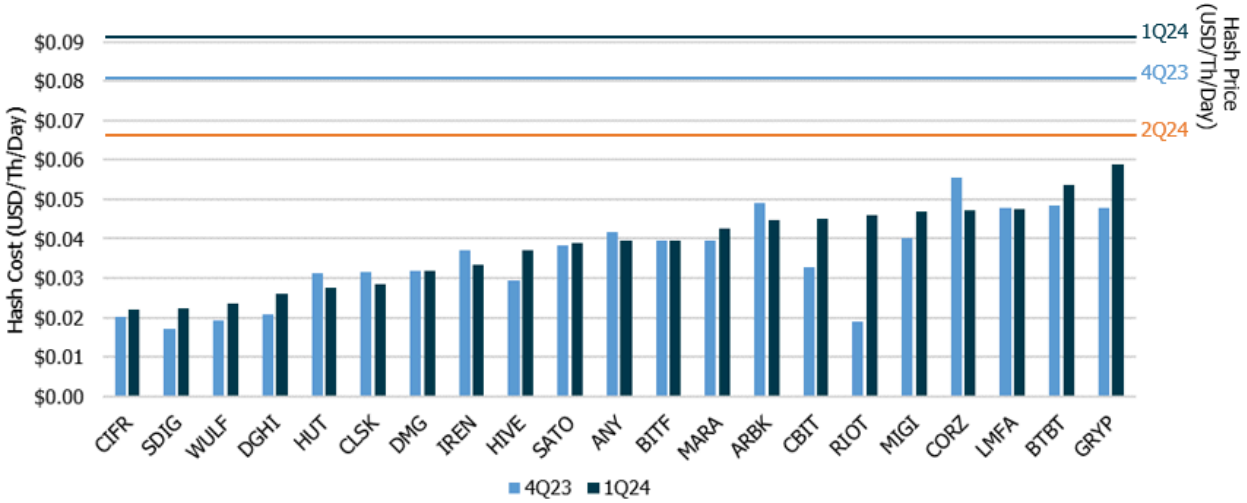
Operating metrics signaling efficiency garner greater interest in response to ETFs and HPC. As the bitcoin mining industry evolves, the metrics investors rely on to gauge success are shifting. In the past, targeted exahash—a measure of computational power—dominated the conversation, bolstered by healthy mining margins that allowed for rapid, albeit sometimes clumsy, growth. Today, with the network hash rate increasing, ASIC miners becoming more efficient, and miners leveraging inexpensive power sources worldwide, a broader array of metrics are required. In our report, we consider the number of bitcoins mined per exahash, hash cost, power costs, and the all-in costs to mine a bitcoin. Additionally, we incorporate our own mining efficiency indicator (MEI), which amalgamates production and cost

efficiency into a single measure. These metrics provide a more nuanced and accurate perspective on the competitiveness and operational prowess of public miners. Not only is the overall industry becoming far more sophisticated than the garage-like approach we noticed at first study in 2018, but also existential factors, such as the approval of bitcoin ETFs, an alternative bitcoin investment, the advent of ChatGPT, and some $35 billion investment in artificial intelligence development, have generated greater demand for power necessitating a laser focus on mining efficiency.

Miners earn the difference between hash price and hash cost. Hash price refers to the value earned by miners for each unit of computational power, or hash, they contribute to the network. In the proof-of-work scenario, this price fluctuates based on several factors, including the overall network difficulty, the price of the mined cryptocurrency, and the total network hash rate representing all the computers vying for block rewards. A higher network hash price can incentivize more mining activity, as it indicates greater potential profitability for miners. Conversely, a lower network hash price signals reduced profitability. The average hash price increased to $0.092USD/Th/Day in 1Q24 from $0.081 in 4Q23. While we need to wait for companies to report 2Q24 results prior to estimating hash costs, hash prices for 2Q24 came in around $0.067. The current hash price is approximately $0.053, per Hashrate Index as of July 29.

Hash cost refers to the expense incurred to generate a single terahash. This metric is crucial for mining companies as it directly impacts their profitability. Lower hash costs indicate more efficient mining operations and/or better power deals, leading to higher potential profits, while higher hash costs suggest increased expenses and potentially reduced margins. The chart below details the daily hash costs for public miners during 4Q23 and 1Q24, while also indicating the average hash price for 4Q23, 1Q24 and 2Q24. Hash cost to 1Q24 from 4Q23 shows a general increase across the bitcoin mining industry, with the average group hash cost rising to $0.038 from $0.035, reflecting an 8.6% increase. Companies such as Cipher and Stronghold experienced only a slight increase in their daily hash costs, to $0.022 from $0.020 and to $0.022 from $0.017, respectively. Demonstrating improved operational efficiency, others like Core Scientific and CleanSpark managed to reduce their costs to $0.047 from $0.056 and to $0.029 from $0.032, respectively.

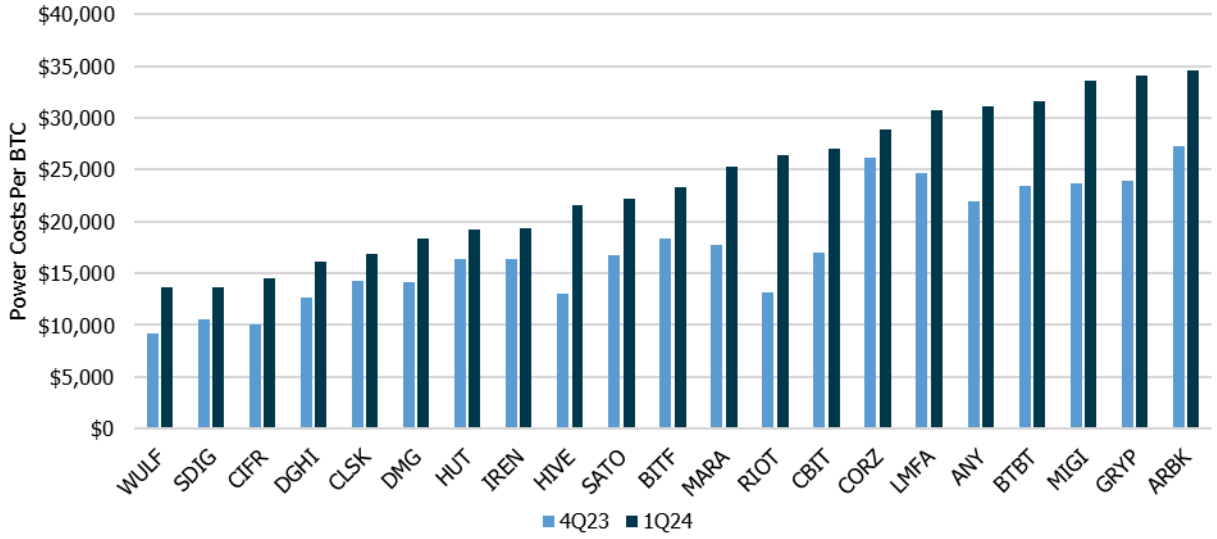
Economically Viable Power Deals Are More Important Post Halving



Source: Company reports, HCW Research, July 2024.

Power plays an outsized role. The graph below displays power costs to mine one bitcoin in 4Q23 and 1Q24, representing direct expenses associated with energy consumption. To 1Q24 from 4Q23, there is a noticeable increase in power costs per bitcoin for most companies, with the groups average increasing 52% to $23,899 from $17,646.

Power Costs Reflect Company's Business Model

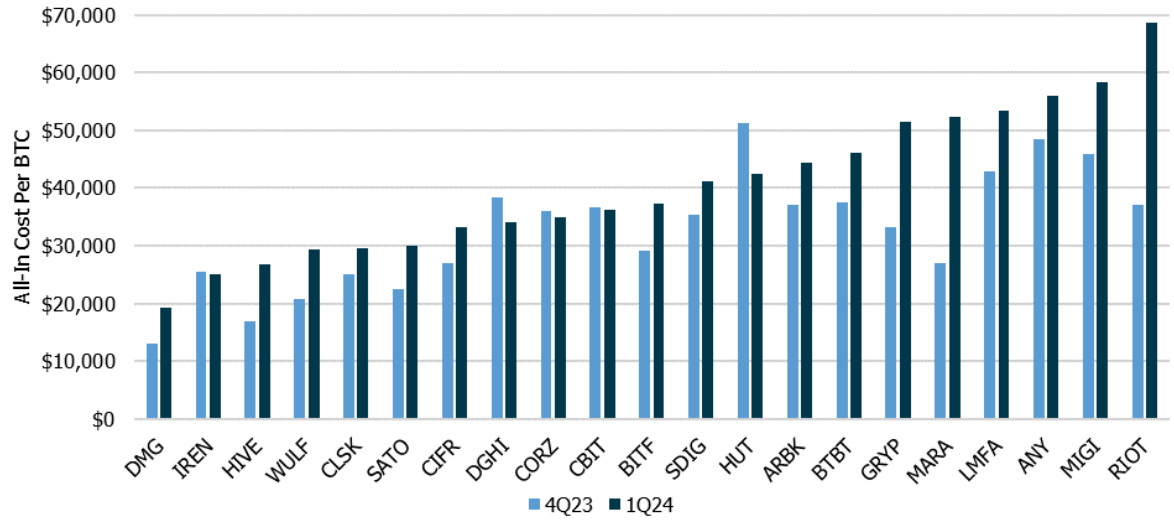


Source: Company reports, HCW Research, July 2024.

Similarly, all-in power costs have also risen significantly, as shown below. All-in power costs encompass all cash expenses, offering a comprehensive view of the costs in mining bitcoin. In 1Q24, the group average increased roughly 24% to $40,456 from $32,677 in 4Q23. Cost increases highlight the growing financial pressures on bitcoin mining companies, driven by factors such as rising energy prices and increased operational costs. Despite higher bitcoin prices, rising to an average price of $53,268 in 1Q24 from $36,136 in 4Q23, the increased costs underscore the importance of efficiency and cost management. While revenues increase, the margin pressures remain significant, necessitating strategic operational improvements. We intend to investigate all-in costs per bitcoin after 2Q24 earnings reports. In 1Q24, a number of public miners increased cash expenses in order to prepare for significant expansion of computer power. Given such adjustment and execution of strategy, we expect to see all-in costs per bitcoin for companies such as Riot to taper off or decrease.

All-In Costs Generally Nudged Higher at the Beginning of 2024

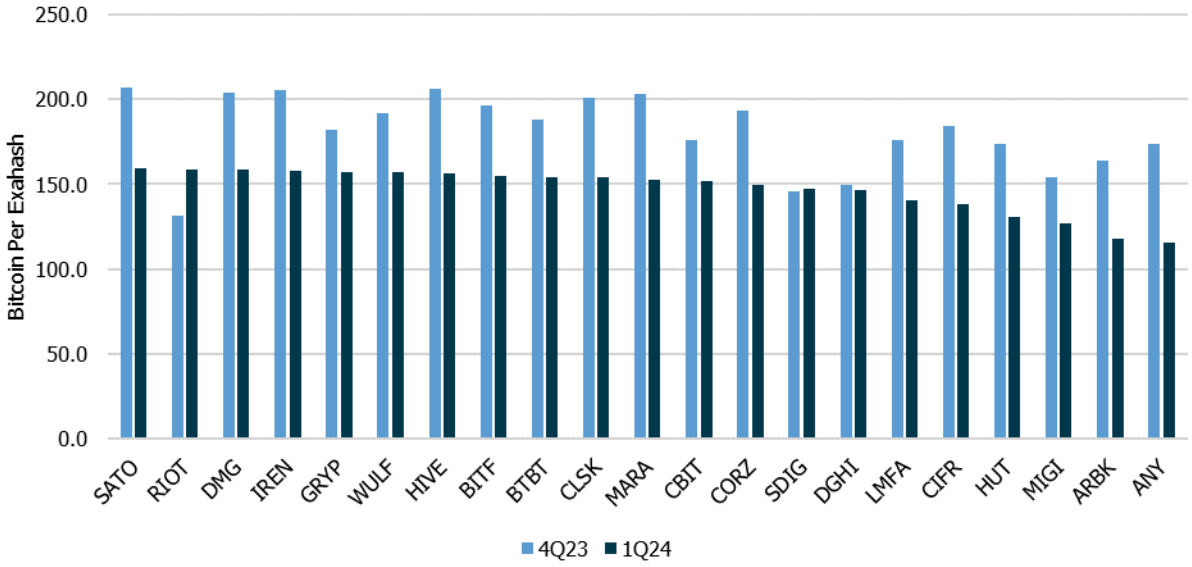
Includes power costs as well as cash expenses.



Source: Company reports, HCW Research, July 2024.

Less bitcoin per exahash necessitates efficiency. With increased network difficulty and heightened network hash rate, miners experienced a decline in average bitcoins produced per exahash (BTC/Eh) for the quarter, as exhibited in the chart below, with the group average decreasing 19% to 147BTC/Eh from 181BTC/Eh in 4Q23. SATO and Hut 8 saw significant declines in 1Q24 compared with 4Q23, with BTC/Eh falling to 160 from 207 and to 131 from 174, respectively. In contrast, Riot improved its efficiency, increasing BTC/Eh to 159 in 1Q24 from 132 in 4Q23. The industry's reduced BTC/Eh highlights the challenges of maintaining mining efficiency amidst growing competition.

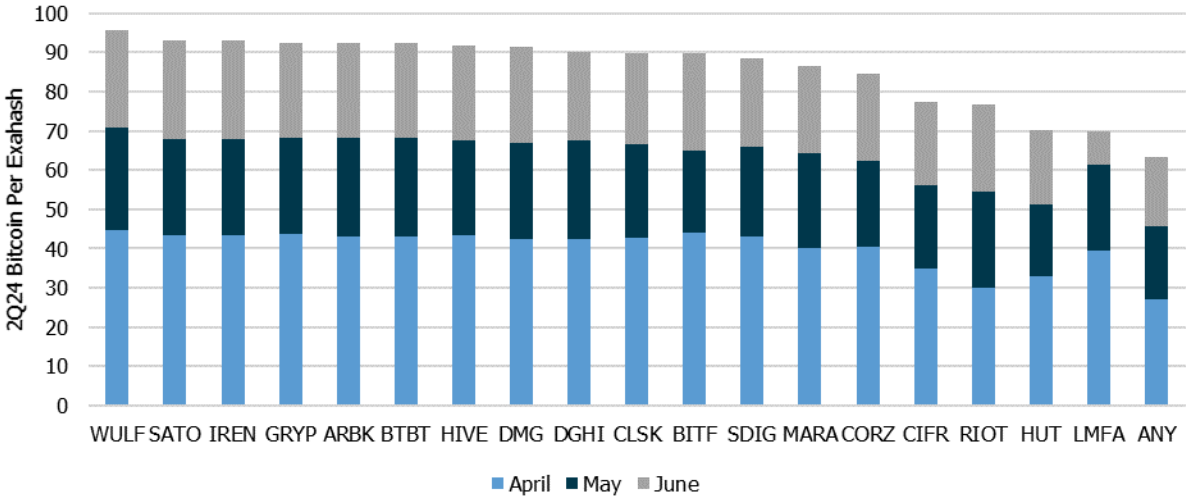
Increasingly Competitive Network Decreases Bitcoin Rewards Per Exahash



Source: Company reports, HCW Research, June 2024.

Unaudited data for 2Q24 in the chart below shows a continued decline in bitcoin production efficiency, with average BTC/Eh dropping to 86, from 147 in 1Q24. This decline reflects increased network difficulty and competition, intensified by the April 19 halving, which cut block rewards by 50% to 3.125 bitcoins per block from 6.25. We expected to see some fluctuation the quarter as miners execute on post-halving strategies, such as with LM Funding America's lower June BTC/Eh as it moved miners to its new Oklahoma site reducing dependency on its hosting agreement.

Recent Halving Amplifies Pressure on Miners to Outperform



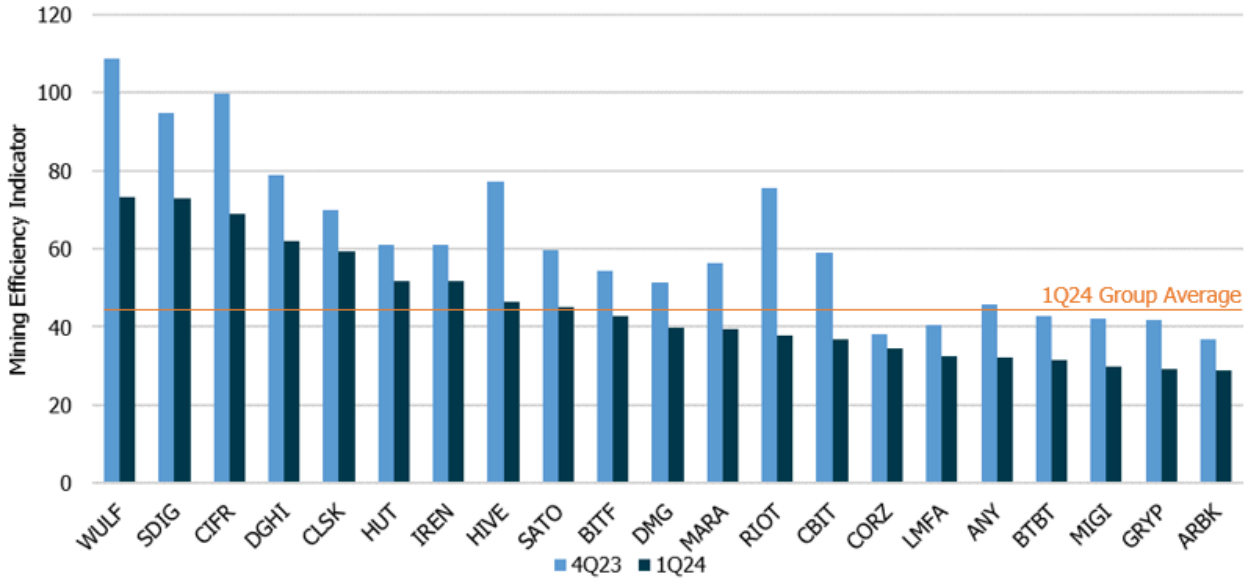
Source: Company reports, HCW Research, July 2024.

Combining production and cost efficiencies into one metric. In introducing our mining efficiency indicator (MEI), we offer an alternative evaluation of bitcoin mining operations by combining production efficiency and cost efficiency into a single metric. Calculated by dividing the amount of bitcoin produced per exahash (BTC/Eh) by the cost per exahash (USD/Eh), our MEI is expressed in bitcoin per dollar (BTC/USD). This metric presents an alternative in comparing mining operations, highlighting how well they convert computational power and financial resources into bitcoin. Our formula, devised here by the first, original crypto analytical team at H.C. Wainwright, for MEI is:

$$MEI = \frac{BTC\ per\ exahash}{Cost\ per\ exahash} = \frac{\frac{BTC}{Eh}}{\frac{USD}{Eh}} = \frac{BTC}{USD}$$

A higher MEI indicates better efficiency, showing that the operation produces more bitcoin per dollar spent and potentially offering a more comprehensive measure of both operational and financial metrics. The group average MEI, indicated below, dropped to 45 in 1Q24 from 62 in 4Q23.

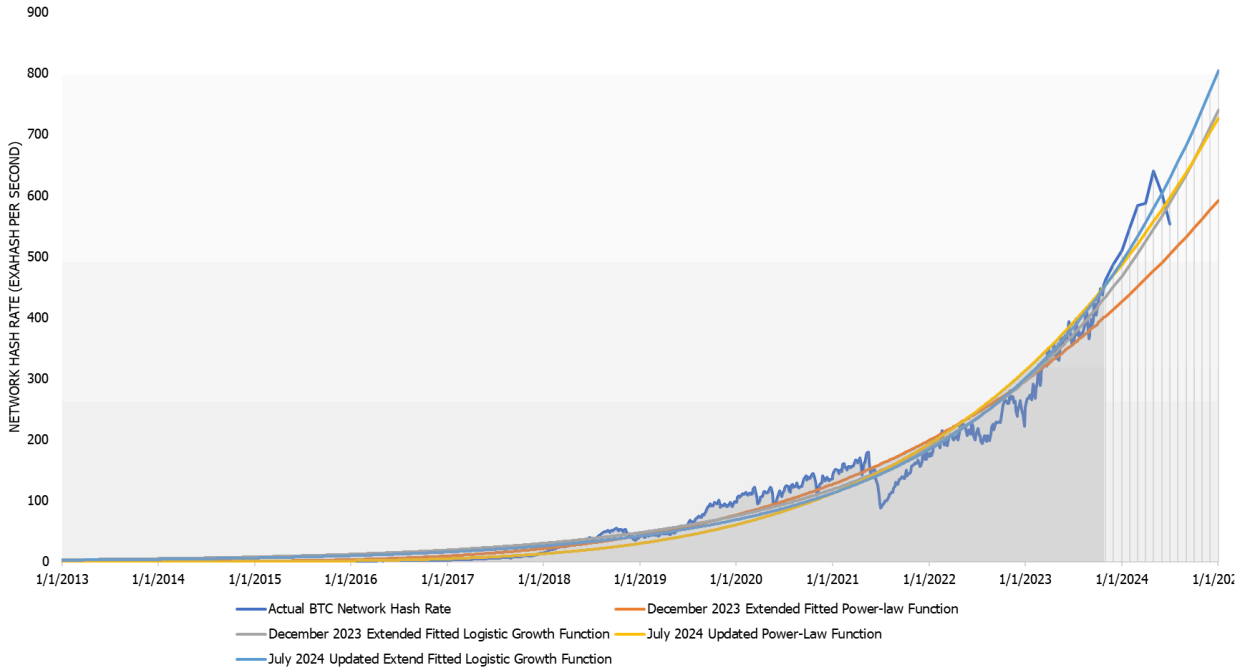
Those More Efficient Show Above



Source: Company reports, HCW Research, June 2024.

Power-law function continues to describe network growth. In our December 2023 report, *Crunch Time Approaches and Bitcoin Mining Efficiency Becomes Paramount—Extending Our Coverage*, we extrapolated the hash rate growth trajectory using power-law and logistic growth functions. Most asset classes do not behave as a power law; however, living organisms, the spread of diseases, or the growth of a city can be modeled with a power law. This growth makes bitcoin a unique asset but also one that draws philosophical discussions. Scale invariance and proportional growth of networks lead many to believe bitcoin may continue along a power law function as adoption increases. Starting from January 2013, our fitted curves projected the network hash rate to expand to 577Eh/s along the power-law function and to 711Eh/s according to the logistic growth function by the end of 2024. To 1Q24 from 4Q23, the hash rate increased by approximately 19%, rising to 561Eh/s from 470Eh/s. A current hash rate of 583Eh/s and all-time high reached of 657Eh/s shortly after the halving event suggest robust investment and increasing computational power in the bitcoin mining network. In the chart below, as indicated, we chart updated functions that shift upwards from our original functions from December 2023.

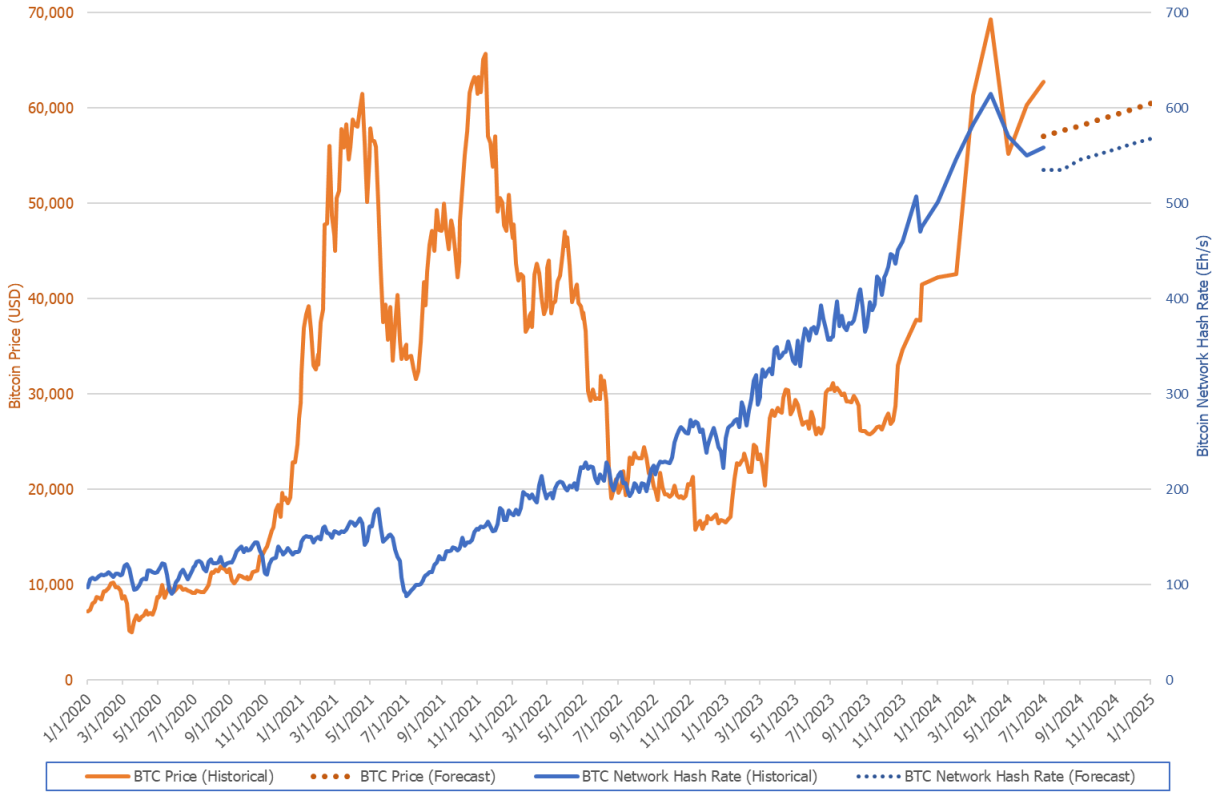
Updated Power-Law and Logistic Growth Functions Shift Upwards



Source: Blockchain.com, H.C.W. Research, July 2024.

Erring on the conservative side, with estimate updates this week. We maintain our conservative forecast for bitcoin throughout the year, closing out around $60,000 at a network hash rate around 568Eh/s. Given the accuracy the power-law function has in explaining network hash growth, we might increase our forecasts for hash rate in our next universal deck forecast during 2Q24 earnings. While we have seen a pullback in hash rate after the halving, we expect we are reaching the end of the capitulation stage for inefficient miners. Plus, we still see well-funded miners continuing to expand and increased appetite in international jurisdictions with inexpensive power. When inefficient miners exit the market, the selling pressure diminishes, leading to a stabilization of the hash rate and difficulty. The hardware from these failed operations is often acquired by more efficient miners, who utilize it to restore and increase the hash rate and difficulty. This cycle contributes to the overall upward trend in historical difficulty.

Our Forecasted Bitcoin Price and Network Hash Rate Shows in Forward Dots



Source: Blockchain.com, Coingecko, HCW research, December 2023.

Does HPC demand shift mining geographies? It should not be surprising to those following the bitcoin mining industry closely that access to power appears to have trumped bitcoin mining infrastructure investment. The evidence continues to build in supporting the notion that high-performance computing (HPC) is beginning to displace bitcoin mining. The CoreWeave deal that Core Scientific signed implies more of that company's infrastructure, approximately 400MW worth, turns to power and support GPU compute in a format called application specific data center. Further, Bloomberg reported July 17 that Cipher Mining, currently running 266MW but targeting 566MW in 2025, could be a takeout target for another HPC-focused company, and the company's shares began to reflect that interest. The company's new Black Pearl site has access to 300MW and is completely greenfield in the primary stages of construction—an opportune time for the facility's use to be re-directed. Meanwhile, as noted earlier herein, other miners have made their willingness to entertain merger and acquisition discussion quite clear. Bitcoin maximalists might find the concept controversial, but we look at the financial sense of the dynamic. Public company managers should make decisions that optimize the return profile for shareholders. HPC support and hosting provide more transparent and consistent cash flow such that lenders offer loans against collateralized assets, and we have many examples including the deals Applied Digital has struck—debt deals appear to be much more difficult in the bitcoin mining world. As such, the cost of capital for bitcoin miners, primarily limited to equity, ranges at 25%. Hyperscalers might see capital costs in the range of 10-11%, less than half. At that difference, it becomes difficult for bitcoin miners to compete for infrastructure access.

Why we like some non-U.S. miners. Recent reports suggest that bitcoin mining in the U.S. range between 26-38% of the global network hash rate, depending on source and timing. Based on the two examples cited above, or almost one gigawatt of bitcoin mining power is shifting to HPC support in concert with other anecdotes, we see HPC-directed power growth outstripping bitcoin mining growth in the U.S. while the potential exists to see bitcoin mining facilities "bulldozed" and transformed to HPC. Because bitcoin mining has found inexpensive power in other jurisdictions, such as Paraguay, Russia, Ethiopia, and even the Middle East, we foresee a mild decline of U.S.-centric bitcoin mining medium-term with a gradual acceleration in HPC mining power consumption at the expense of bitcoin should the HPC phenomenon hold true. In thinking back on supply and demand functions, HPC could drive data center energy pricing higher in U.S. jurisdictions sensitive to populist influence. Scarcity and rising power costs would certainly deter continued bitcoin mining investment, as we see it. Other jurisdictions, we think, may not have comparably heavy HPC expansion, particularly the Middle East. This is one of the reasons that pushed us to favor Phoenix Group, linked to

this report, apart from "bottom-less pockets" access to capital. Further, we have suggested in the past that autocratic governments may see the benefit of directing energy toward bitcoin mining—collecting globally useable currency where their government's printed paper may not be—outside of and with complete disregard of positive economic factors, pressuring the overall network's economics and forcing profit-based miners to taper operations or shutter completely. All told, it leaves us continuing to think that during bitcoin mining's fifth epoch the geographic center that is North America becomes one of a plurality of leading bitcoin mining centers globally.

ASIC efficiency improves and newcomers appear to be more than paper tigers. The bitcoin mining rig market has seen remarkable advancements thus far in 2024. Bitmain's Antminer S21 XP Hydro, with a hash rate of 473Th/s and energy efficiency of 12J/Th (operating specifications are detailed later in this section), and Canaan's Avalon A1566, offering a hash rate of 185Th/s with an efficiency of 18.5J/Th, demonstrate significant progress. Newcomer Auradine's Teraflux AI3680 model, achieving up to 375Th/s with 15J/Th, underscores the competitive and innovative nature of the market. Given the potentiality of newcomers withering away at Bitmain's dominant market share, we expect to see continued pressure on keeping prices down. Case in point is the Core Scientific-Block-ePIC deal discussed in our July 11 note *Risk-Mitigated Vertical Integration—Grabbing Machine Profits*. The focus here was on mining companies' endeavor to garner hardware manufacturers' profits as machine expense is highest on the list of capital investment and sacrificing them to others destroys bitcoin miners' overall profitability. More on the development of the mining rig market was offered in a past report reprised in the indented section below.

> ***Marathon's miner of choice***. *A spate of new product roadmaps and releases has muddied the waters that may have been, at first glance, fairly clearly defined between two major mining machine manufacturers just a short while ago. We contend that the field is far more complicated and competitive than that simplistic view and continues to be dynamic as it has for years back to the heydays of Innosilicon and Spondoolies-Tech, a now bankrupt Israeli manufacturer. Marathon's investment in Auradine speaks to the functionality of software embedded in managing bitcoin price, network hashrate, and power costs at the chip level to optimize mining output. We expect to see these machines infiltrate Marathon's network later this year, but until then and operating data are reported, we are hard- pressed to quantify the advantages in real operation. Auradine Teraflux miners are designed to lower total cost of ownership, and are targeting the 15-16J/Th range while delivering as much as 260-375Th in both air-cooled and immersion-cooled environments as these Auradine specifications claim:*
>
> *1. AT2880 air-cooled miner capable of achieving an output of 0 to 260 Th/s, with an optimal efficiency of 16J/Th.*
> *2. AI3680 immersion-cooled miner capable of achieving an output of 0 to 375Th/s, with an optimal efficiency of15J/Th.*
>
> *Meanwhile, at the WDMS conference in Las Vegas mentioned earlier, Bitmain introduced its most efficient machine, operating in a "hydro" configuration with specs expressed in the chart below. As opposed to immersion cooling, where machines are completely submerged, the hydro machines use a technology often seen in consumer-focused, high-performance gaming computers where cooling fluid, usually water or glycol mixture, is plumbed in tubes running through each machine's hashboard set in extracting heat. Various manufacturers have been more successful with the implementation than others, from what we hear, and note that one 40-foot container could ultimately draw 1.0-1.5MW in powering 180-260 miners, which requires a tremendous amount of tubing and plumbing, presenting a potential problem.*
>
> **Bitmain Top-of-the-Line Liquid Cooled Machine Presses the Ultimate Efficiency Envelope**

Model	S21 XP Hydro
Algorithm | Cryptocurrency	SHA256 | BTC/BCH/BSV
Hashrate, TH/s	473 ±3%
Power on wall @35°C, Watt(1-1)	5676 ±5%
Power efficiency on wall @35°C, J/TH(1-1)	12 ±5%

> *Source: Antminerdistribution.com.*
>
> *Canaan has introduced its newest machine class the A15 series, with the top machine, the A1566, now available and delivering 185Th/s at 18.5J/Th, clearly in the current competitive mix and landing purchase contracts with two prominent publicly traded bitcoin mining companies. We understand the company is taping*

out new chips that should lead to its next-gen A16 series release in early 2025 we absolutely expect to be competitive. MicroBT's M60 series, representing the company's latest machine generation, has a notable customer running immersion systems, the M66 miner model specifically now manufactured in the U.S., recently visited in Corsicana, Texas. Surprisingly, the manufacturer's presence in the North American market appears diminished somewhat of late but has not it has not lost footing to the same degree elsewhere globally our checks suggest. Note its machines, as top competitors do, come in air-cooled, immersion, and hydro versions, and MicroBT should be considered a highly competitive manufacturer going forward. On point against all that is the rising cost of chip development. Interestingly, semiconductor foundries work with miner manufacturers in testing their foundry process as new process node introductions are made. The static nature of the SHA-256 algorithm, even though each new chip design incorporates some alterations, in its application specific integrated circuits (ASIC) design are the optimal testing format in the foundry process. Certain manufacturers may use this to their advantage in securing lower cost production runs in working with their foundry partners, others may not be so fortunate. Suffice to say that over time, as process nodes move to smaller geometries, it may become overbearingly costly to continue to compete. In mimicking the process instilled at Bitmain, Jihan Wu may have integrated a two-team ASIC design approach as the legacy operation in the purchase of fabless chip designer Desiweminer in an all-stock deal valued at $140 million at the time. Bitmain's two-team development yields its S-series and its T-series mining rigs. We suspect Jihan Wu's new effort to follow a similar strategy. Meanwhile, his company put forth ambitious goals in SHA-256 semiconductor development of which we are somewhat skeptical unless 2nm process geometries, prospectively set for Apple (AAPL; not rated) use sometime next year, produce significant gains. Typical of most mining rig manufacturers, new generations of designs are released at 18-month intervals and offer 20% or so efficiency gains from the previous iteration. Either way, we suspect these new chip designs indicated below pack such density that they most likely mandate immersion or hydro configurations only.

Note Jihan Wu's Push to 5J/Th—Likely Not Feasible Without Liquid Cooling

Source: Company reports.

External factors imply bullishness. As the German state Saxony fat-thumb sold its 50,000 BTC seized from criminal investigations, driving the price of bitcoin down to $52,000, we also received news of Mt. Gox to begin payouts after a decade-long wait, further spooking newer bitcoin investors whose sentiment has apparently not yet been callused by the crypto rollercoaster we are so fond of. According to Arkham, the German wallet now stands at zero bitcoins, but has gained a few sats people sent to the address out of pity for the poorly perceived foresight of the German bureaucrats. Apparently, obscure German laws necessitated the sale of the bitcoin due to its price volatility, prompting the sale of 50,000 bitcoins over three and a half weeks. Additionally, the Mt. Gox overhang appears that it should offer payouts over a schedule that the market should be able to absorb without much downward pressure, and we suspect not everyone receiving their payouts would decide to sell. President Trump's escape from an assassination attempt and his pick for Senator J.D. Vance as the V.P. nominee quickly flipped sentiment and sent bitcoin up towards $65,000. BlackRock's Larry Fink's reiteration that he was initially wrong about bitcoin and belief that it is a legit financial instrument further adds to the fire of the bulls. J.P. Morgan's Dimon flipping does not hurt either. The culmination of this and the green lighting of Ethereum ETF creates an environment where we could see strong growth for crypto and bitcoin. Bitcoin is the mother of crypto, and we do not see the rest of crypto in direct competition but more of synergistic growth.

Buildout of bitcoin ecosystem gains traction. The bitcoin ecosystem, encompassing the primary blockchain, layer 2 solutions, ordinals, and sidechains, is exhibiting growth and innovation, driving bullish sentiment among investors and developers, as referenced in our May 10, 2024, Cryptocosm Currents note, *Marquee Digital Asset Development Spurs the Value of its Blockspace and Expansion of its Ecosystem*. Layer 2 solutions like the Lightning Network

enhance scalability and reduce fees, while ordinals introduce NFTs, attracting diverse user interest. Sidechains such as Rootstock (RSK) enable smart contracts and interoperability. Marathon's recent projects, Slipstream and Anduro, further bolster this growth. Slipstream streamlines large or non-standard bitcoin transactions via direct submission to the MARA Pool, and Anduro, a layer-2 platform, facilitates multiple sidechains with decentralized governance, offering new revenue streams for miners. Additionally, a substantial amount of dormant capital within the ecosystem awaits activation. Combined with increasing institutional interest and regulatory clarity, evidenced by bitcoin ETF approvals and favorable legislation, these developments position bitcoin for significant growth. This multifaceted expansion, alongside bitcoin's established security and decentralization, underscores a strong bullish outlook for the ecosystem.

Public Companies Mentioned in This Report

Applied Digital Corp. (APLD; Buy)
Argo Blockchain PLC (ARBK; Neutral)
Bitfarms Ltd. (BITF; Buy; Colonnese)
Bitdeer (BTDR; Buy, Colonnese)
Bit Digital Inc. (BTBT; Buy)
BlackRock (BLK; not rated)
Block Inc. (SQ; not rated)
Canaan Inc. (CAN; Buy)
Cathedra Bitcoin (CBIT.CA; Neutral)
CleanSpark (CLSK; Buy; Colonnese)
CoinShares (CS.ST; Buy)
Cipher Mining Inc. (CIFR; Buy; Colonnese)
Core Scientific (CORZ; Buy)
Digihost Technologies Inc. (DGHI; Buy)
DMG Blockchain Solutions Inc. (DMGI.V; Buy)
FactSet Research Systems Inc. (FDS; not rated)
GameStop Corp. (GME; not rated)
Gryphon (GRYP; Neutral)
HIVE Blockchain Tech. Ltd. (HIVE; Neutral; Colonnese)
Hut 8 Mining Corp. (HUT; Sell; Colonnese)
IREN (Iris Energy Ltd.) (IREN; Buy; Colonnese)
J.P. Morgan Chase & Co. (JPM; not rated)
LM Funding America Inc. (LMFA; Neutral)
Marathon Digital Holdings (MARA; Buy)
Mawson Infrastructure Group Inc. (MIGI; Buy)
Phoenix Group Holdings plc (PHX-ADS; Buy)
Riot Platforms Inc. (RIOT; Buy; Colonnese)
SATO Technologies Corp. (SATO.TSX; Neutral)
Sphere 3D Corp. (ANY; Buy)
Stronghold Digital (SDIG; Buy)
TeraWulf Inc. (WULF; not rated)

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RETURN ASSESSMENT

Market Outperform (Buy): The common stock of the company is expected to outperform a passive index comprised of all the common stock of companies within the same sector.

Market Perform (Neutral): The common stock of the company is expected to mimic the performance of a passive index comprised of all the common stock of companies within the same sector.

Market Underperform (Sell): The common stock of the company is expected to underperform a passive index comprised of all the common stock of companies within the same sector.

Related Companies Mentioned in this Report as of July/29/2024

Company	Ticker	H.C. Wainwright Rating	12 Month Price Target	Price	Market Cap
Applied Digital Corporation	APLD	Buy	$5.00	$4.26	$624
Argo Blockchain plc	ARBK	Neutral	$NA	$1.64	$95
Bitfarms Ltd.	BITF	Buy	$4.00	$2.55	$1016
Bitdeer Technologies Group	BTDR	Buy	$20.00	$9.60	$869
Bit Digital, Inc.	BTBT	Buy	$6.00	$3.55	$430
Canaan Inc.	CAN	Buy	$3.00	$0.98	$260
Cathedra Bitcoin Inc.	CBIT.V	Neutral	C$NA	C$0.02	C$19
CleanSpark, Inc.	CLSK	Buy	$27.00	$16.29	$3712
CoinShares International Limited	CS.ST	Buy	SEK80.00	SEK66.90	4449 SEK
Cipher Mining Inc.	CIFR	Buy	$7.00	$5.57	$1727
Core Scientific, Inc.	CORZ	Buy	$15.00	$NA	NA
Digihost Technology Inc.	DGHI	Buy	$2.50	$1.37	$40
DMG Blockchain Solutions Inc.	DMGI.V	Buy	C$1.00	C$0.60	C$102
HIVE Blockchain Technologies Ltd.	HIVE	Neutral	$4.00	$3.69	$386
Hut 8 Mining Corp.	HUT	Sell	$7.50	$14.83	$1341
LM Funding America, Inc.	LMFA	Neutral	$NA	$3.63	$9
Marathon Digital Holdings, Inc.	MARA	Buy	$27.00	$20.45	$5783
Mawson Infrastructure Group Inc.	MIGI	Buy	$3.00	$1.23	$22
Phoenix Group PLC	PHX-AE	Buy	AED3.00	AED1.72	
Riot Platforms, Inc.	RIOT	Buy	$17.00	$10.63	$3070
SATO Technologies Corp.	SATO.V	Neutral	C$NA	C$0.27	C$14
Sphere 3D Corp.	ANY	Buy	$4.00	$1.04	$21
Stronghold Digital Mining, Inc.	SDIG	Buy	$7.00	$2.94	$38
Gryphon Digital Mining, Inc.	GRYP	Neutral	$NA	$0.95	
Iris Energy Limited	IREN	Buy	$15.00	$9.72	$1816

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Distribution of Ratings Table as of July 29, 2024				
			IB Service/Past 12 Months	
Ratings	Count	Percent	Count	Percent
Buy	556	87.97%	132	23.74%
Neutral	69	10.92%	4	5.80%
Sell	1	0.16%	0	0.00%
Under Review	6	0.95%	1	16.67%

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