Hashrate Index

Hashrate Index 2025 Year in Review: Standing on Soft Ground

BY: LUXOR

About Hashrate Index

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

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Introduction

2025 was a challenging year in Bitcoin mining, defined by a sustained compression of fundamentals. While 2024 ended with optimism driven by spot Bitcoin ETFs, the fourth halving, and institutional adoption, miners entered 2025 facing a harsher reality: rising hashrate, weakening transaction fees, higher power costs, and a rapidly shifting hardware and capital landscape. Bitcoin's price flirted with six figures, but mining economics deteriorated throughout the year, exposing structural fragilities across fleets, balance sheets, and business models.

At the protocol level, transaction fees collapsed. The mempool repeatedly cleared for the first time since 2023, and fee revenue fell to just ~1% of total block rewards, removing a critical revenue buffer that many miners had come to rely on during the Ordinals-driven fee boom. With fees dormant and the subsidy fixed post-halving, revenue per unit of hashrate became almost entirely a function of difficulty growth. As a result, hashprice ground steadily lower, reaching record lows in USD terms by year-end despite bitcoin's elevated average price.

On the supply side, 2025 saw relentless hashrate expansion driven by aggressive deployment of next-generation hardware. Manufacturers introduced an unprecedented number of new ASIC models, accelerating innovation around efficiency, form factor, and cooling. The year marked a clear inflection toward hydro-cooled and datacenter-native designs, enabling higher hashrate density but demanding materially higher infrastructure CapEx. At the same time, the market was flooded with surplus machines as legacy fleets were displaced. Prices for older-generation ASICs collapsed, secondary liquidity remained deep, and survivability increasingly depended on firmware optimization and access to low-cost power rather than nameplate specifications alone.

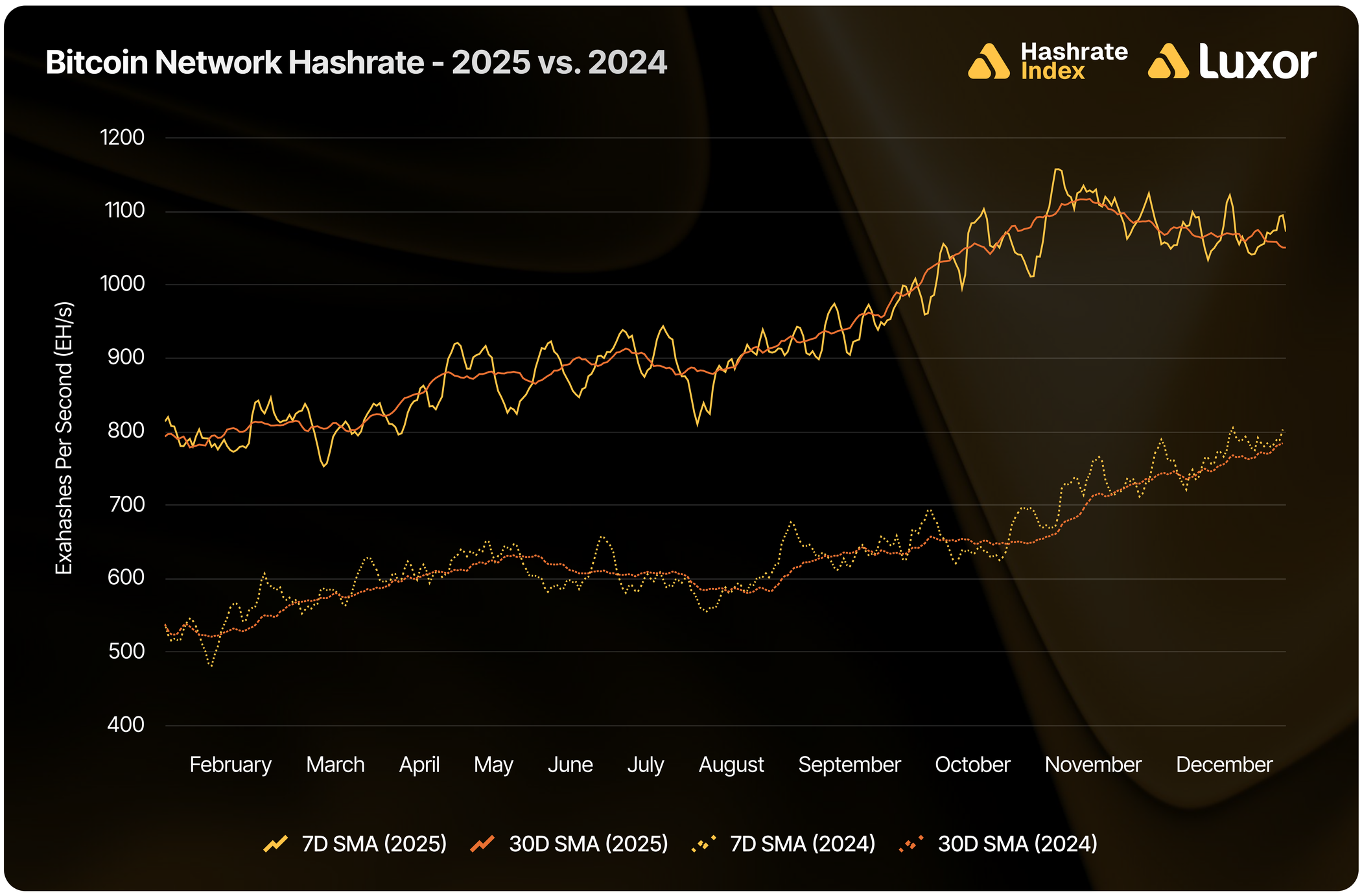
Energy markets added another layer of pressure. Power prices rose across much of the U.S., while weather-driven volatility, ERCOT's 4CP program, and winter load stress forced widespread curtailment. Mining economics became increasingly location-dependent, reinforcing the importance of intelligent power management and real-time optimization.

Against this backdrop, capital behavior shifted decisively. Public miners increasingly redirected future growth capital away from pure SHA-256 expansion and toward AI and HPC infrastructure, reframing mining as a bootstrap mechanism for power and data center development. Meanwhile, the forward hashrate market reached maturity. Fixed pool payouts moved from experimental hedging tools to core financial infrastructure, enabling miners to lock in revenue, manage hashprice risk, and finance fleet upgrades in an environment where spot mining alone was no longer sufficient.

Bitcoin's downtrend on the year may be a convenient summary, but for miners, the story was far more consequential. 2025 marked the transition to a post-halving, zettahash-scale regime where operational excellence, capital structure, and risk management determined survival. This report examines how miners navigated that shift, where pressure accumulated, and which strategies proved resilient as the industry moved onto increasingly uncertain ground.

Let's dig in.

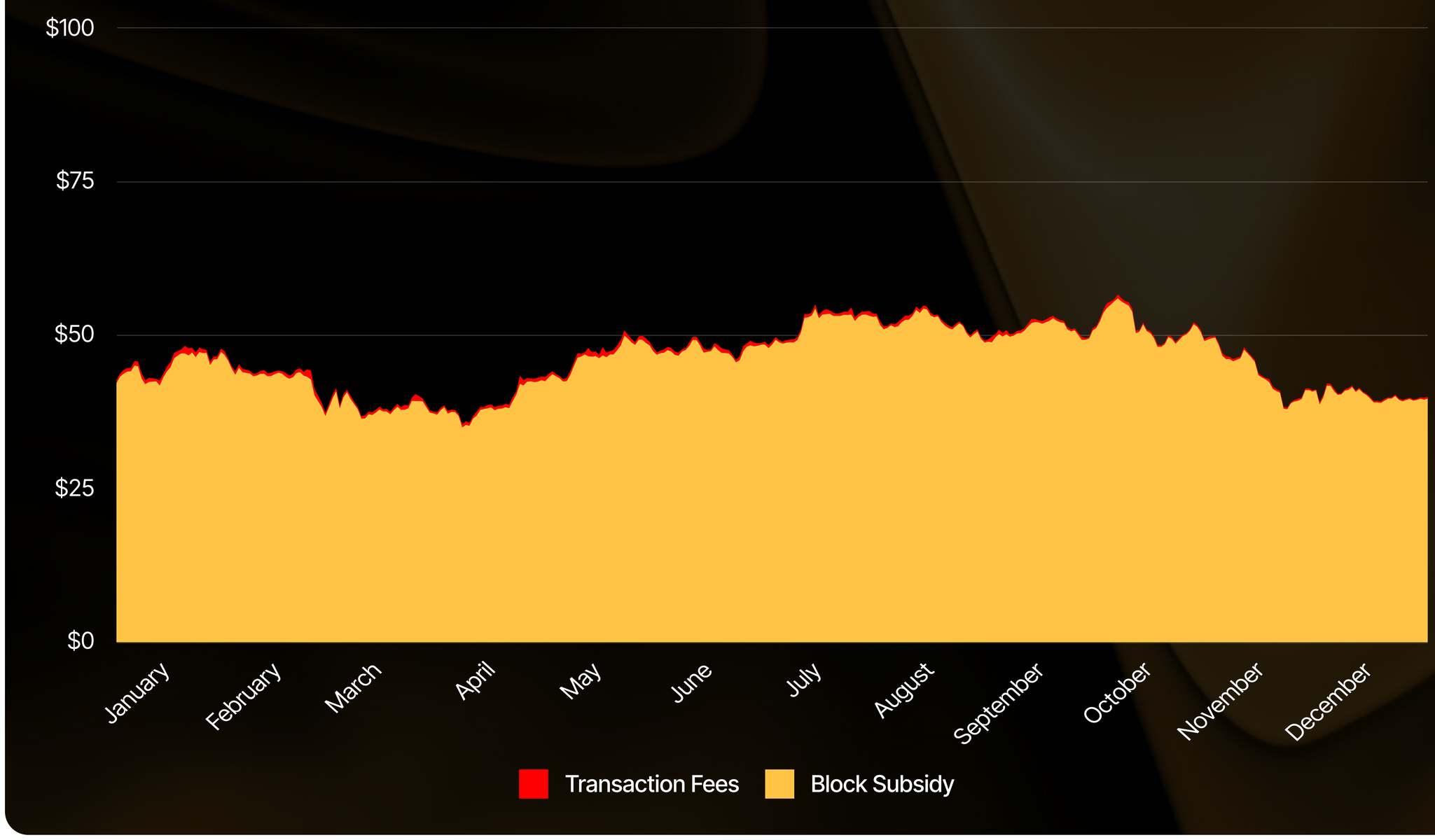
The 7-day simple moving average (SMA) hashrate grew from 800 EH/s to 1,072 EH/s in 2025. This is a relatively slower growth rate in percentage change terms versus 2024's growth rate at 51.2%, but nearly identical in absolute terms (272 EH/s in 2025 vs. 274 EH/s in 2024). The continued deployment of newer-generation mining hardware equipped with more efficient ASICs drove 2025's hashrate growth.



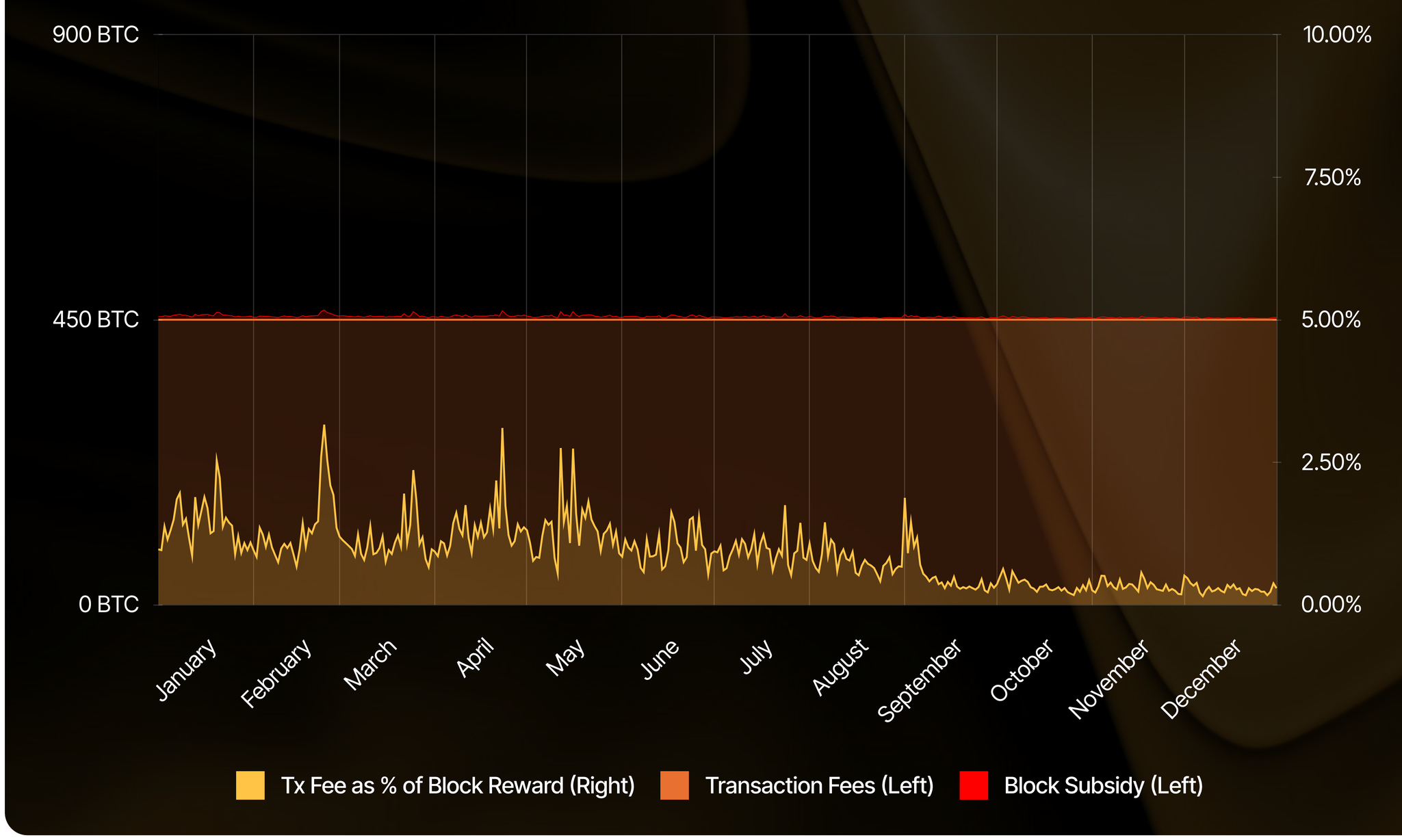
Hashprice took its toll as volatile bitcoin price action combined with a secular growth in difficulty and bone-dry transaction fees, which compressed miner earnings. Bitcoin's price fell by 6.0%, network difficulty grew by 35.0%, and transaction fees declined by 30.2%. As a result, dollar-denominated hashprice fell 30.8%, and bitcoin-denominated hashprice fell 26.4%.

In total, 2025 witnessed $16.87 billion (232,526 BTC) in bitcoin mining block rewards, a 14.1% increase in USD terms from 2024's $14.78 billion (232,935 BTC). Transaction fees constituted 1.0% of overall block rewards, versus 5.6% in 2024.

Bitcoin Mining Block Rewards (USD M) - 2025



Bitcoin Mining Block Rewards (BTC) - 2025



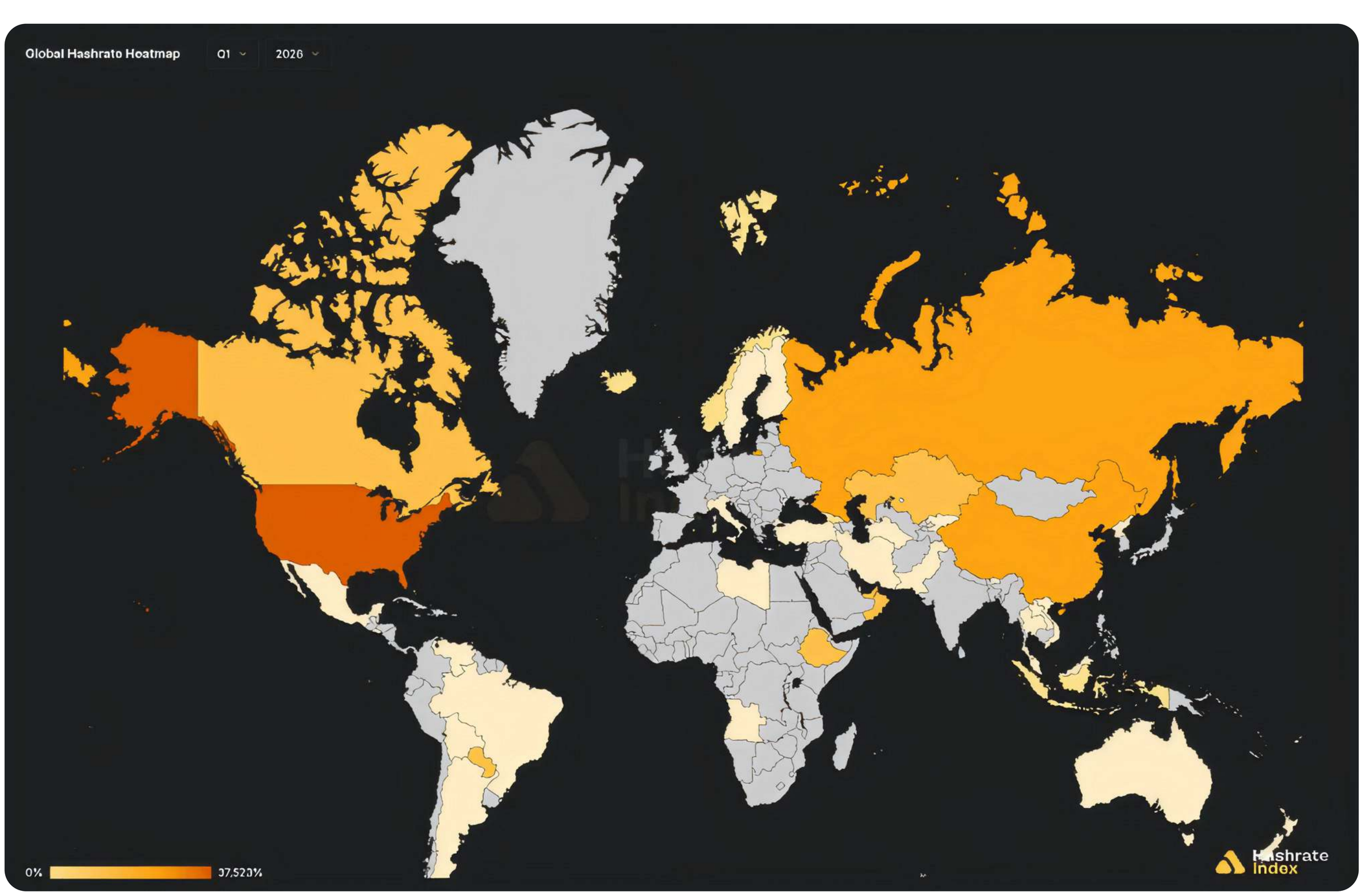
Global Hashrate Market Distribution Estimates

Well-known mining maps achieve the tracking of geographic distribution for Bitcoin's hashrate by aggregating geo-locational data from participating Bitcoin mining pools, which collect IP addresses of mining operations connecting to their servers. Participating pools aggregate this data to determine the average geographic distribution of their total hashpower by region.

This methodology serves as a proxy for the global distribution of Bitcoin's hashrate, however, relies on several assumptions, such as IP addresses accurately indicating the location of hashrate, mining pools sharing correct data, and data samples being representative of regional and global hashrate distribution. If these assumptions are incorrect, the results may be skewed.

While current mining maps provide valuable insights into the geographic distribution of Bitcoin mining, their methodologies have inherent limitations which can affect precision and accuracy.

Hashrate Index's **Global Hashrate Heatmap** aims to improve on the status quo by leveraging multi-faceted data from Luxor's suite of Bitcoin mining services spanning mining pools, ASIC trading, and firmware. It aims to provide more accurate, granular, and representative insights into the global mining landscape by integrating proprietary datasets as well as best estimates.



Q1-2026 Global Hashrate Heatmap | Source: Hashrate Index

Country	Market Share (%)	Hashrate (EH/s)	YoY Change
United States	37.5%	400	112 EH/s (+0.4%)
Russia	16.4%	175	50 EH/s (+0.4%)
China	16.4%	125	15 EH/s (+0.1%)
Paraguay	11.7%	43	15 EH/s (+0.5%)
United Arab Emirates	4.0%	33	3 EH/s (+0.1%)
Oman	3.1%	32	7 EH/s (+0.3%)
Canada	3.0%	28	4 EH/s (+0.2%)
Ethiopia	2.6%	27.5	15.5 EH/s (+1.3%)
Kazakhstan	2.1%	22	2 EH/s (+0.1%)
Indonesia	1.9%	20	8 EH/s (+0.7%)

Top 10 Bitcoin Mining Countries (Q1-2026) | Source: Hashrate Index

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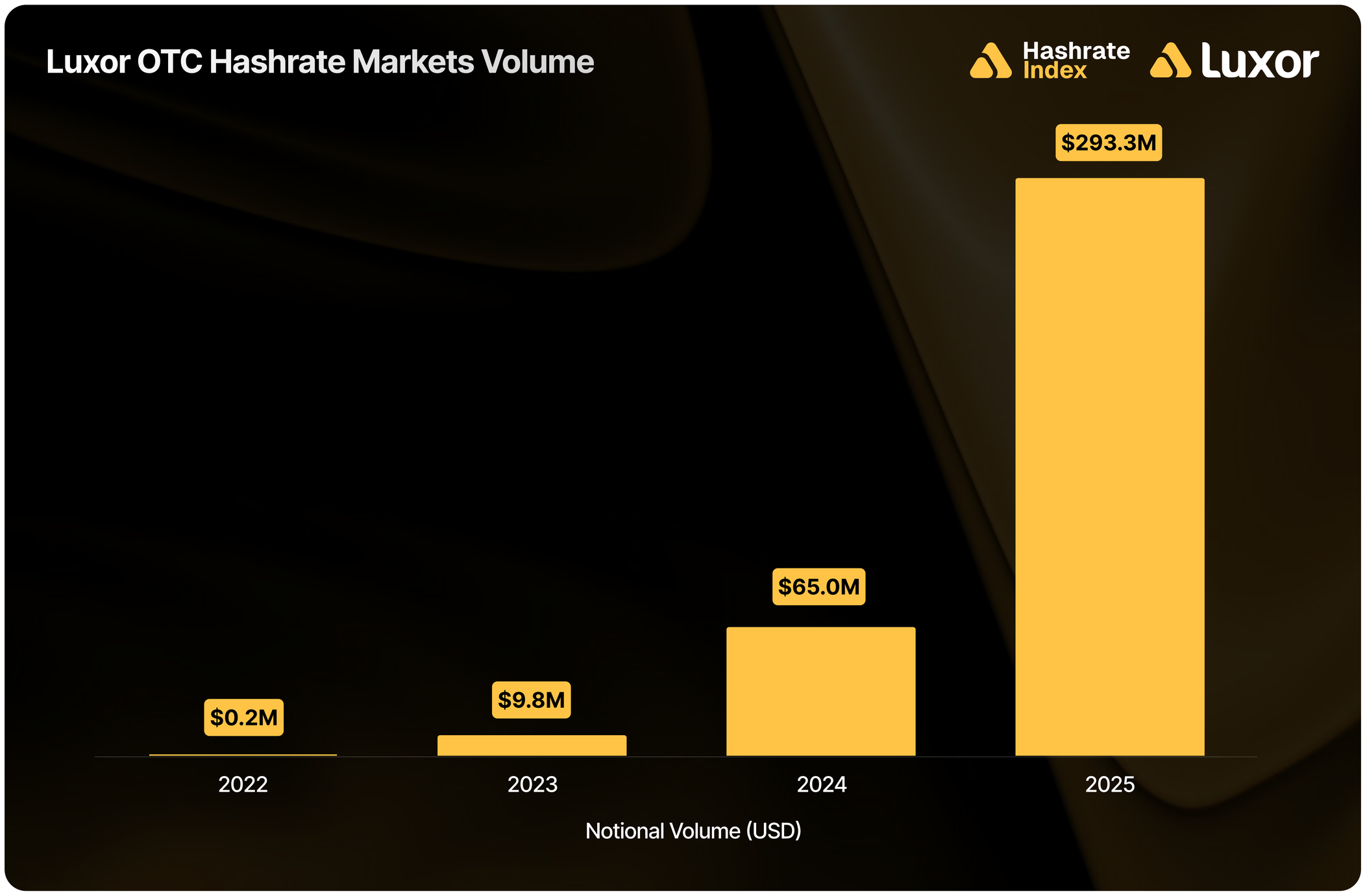
Hashrate Markets

2024 High (04/20/2024)	2025 High (07/11/2025)
$139.13 per PH/s/Day 0.00231 BTC per PH/s/Day	**$63.80 per PH/s/Day** 0.00059 BTC per PH/s/Day
2024 Low (05/08/2024)	**2025 Low (11/22/2025)**
$37.70 per PH/s/Day 0.00058 BTC per PH/s/Day	**$35.06 per PH/s/Day** 0.00040 BTC per PH/s/Day
2024 Average	**2025 Average**
$64.57 per PH/s/Day 0.00104 BTC per PH/s/Day	**$50.68 per PH/s/Day** 0.00050 BTC per PH/s/Day

2025 was brutal for bitcoin miners. The network entered the zettahash era in September, pushing difficulty above 139.7T and driving hashprice to record lows, even as bitcoin hit a new all-time high of $124,485. This margin squeeze accelerated adoption of forward hashrate markets, which reached true product-market fit as notional volumes more than quadrupled to nearly $300 million. The takeaway was clear: miners that secured fixed pool payouts — especially in BTC terms — consistently outperformed spot FPPS mining, cementing hashprice risk management as critical to fleet survival.



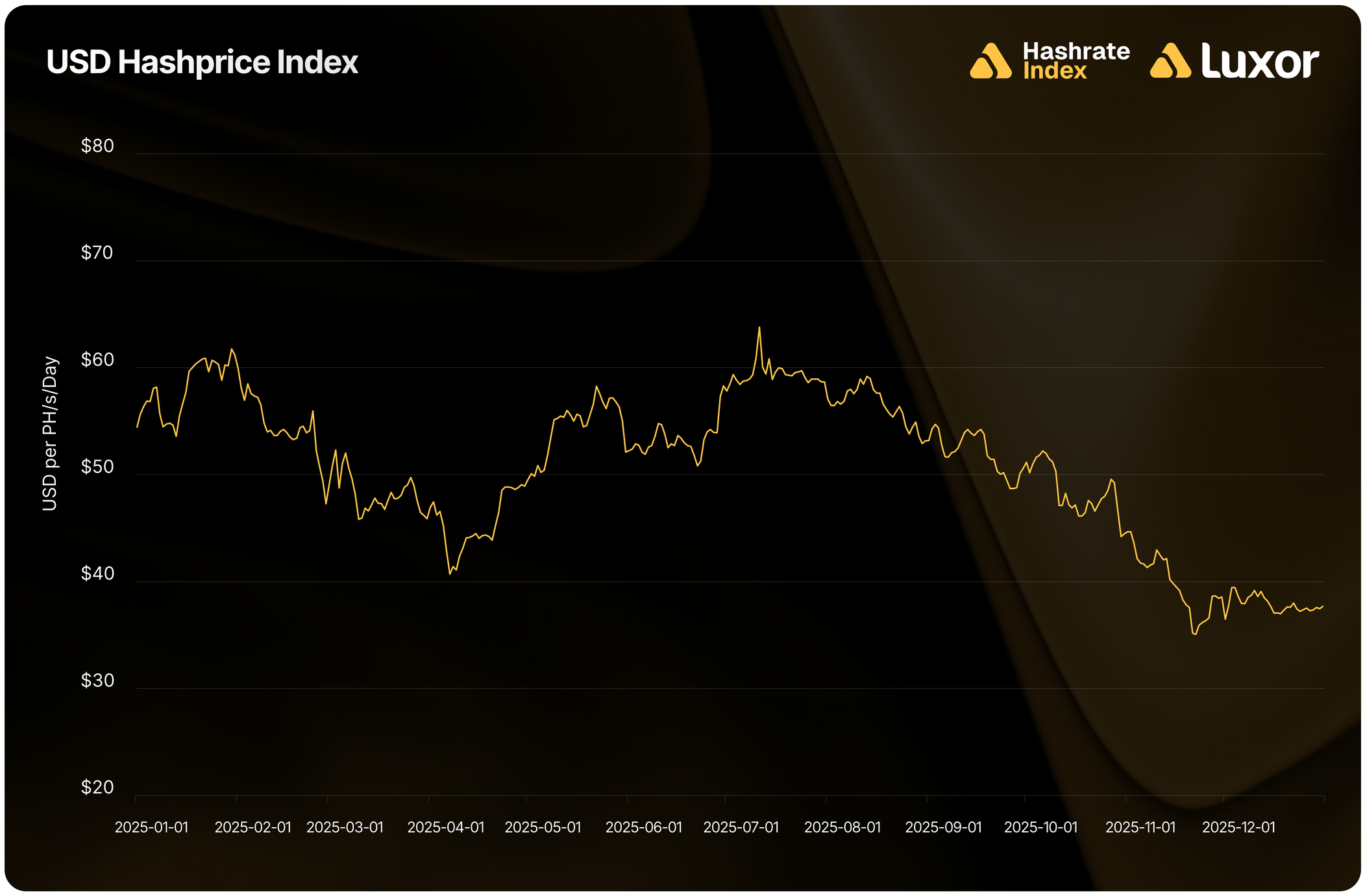
Spot Hashrate Markets in 2025

	Start	End	Average	Low	High
Hashprice USD	$54.45	$37.68	$50.68	$35.06	$63.80
Hashprice BTC	0.00058059 BTC	0.00042376 BTC	0.0050040 BTC	0.00040492 BTC	0.00058906 BTC
Bitcoin Price	$93,779	$88,179	$101,638	$77,774	$124,485
Network Hashrate	529 EH	803 EH	637 EH	482 EH	805 EH
Network Difficulty	109.78T	148.26T	128.63T	108.11T	155.97T
Avg. Tx Fees per Block	0.034 BTC	0.024 BTC	0.033 BTC	0.012 BTC	0.107 BTC

USD Hashprice

USD Hashprice opened 2025 at $54.45 per PH/s/Day and closed the year 30.8% lower at $37.68. On an annual basis, the average settled at $50.65, a 21.5% decline from 2024's average of $64.57.

USD hashprice started the year on soft footing, with a 15.7% decline in Q1, before finding momentum in Q2. A bitcoin rally from $94,504 to $111,000 in the spring provided enough support to reverse the downward hashprice trend in late April, which rebounded 19.1% from $48.93 to $58.26 in late May. The momentum paused in June before picking up again in July, due to a rare 7.48% drop in network difficulty on June 29 from seasonal curtailment. USD hashprice reached its annual peak daily price of $63.80 and the highest monthly average of the year at $59.38.

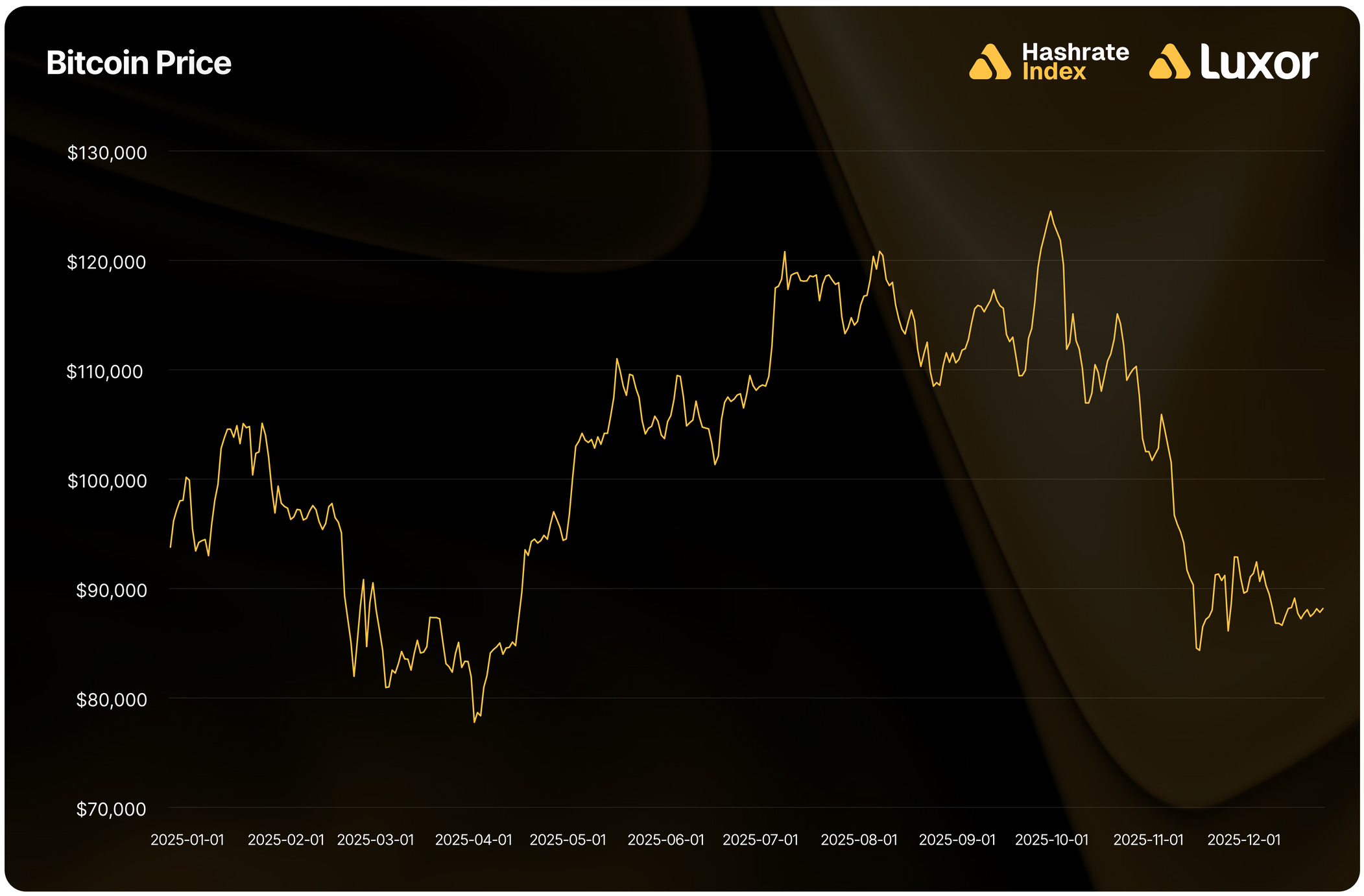


After setting the annual highs over the summer, the trend reversed in the latter half of the year, as the effects of seasonal curtailment diminished (see the 4CP effect explained below). Hashrate flooded back online in the fall and "Uptober" was swiftly followed by a 32.2% correction in BTC price, falling from an all-time high of $124,485 on October 6 down to $84,348 by late November. The crash in BTC price, rising difficulty, and virtually non-existent fee market pushed USD hashprice to a new daily all-time low of $35.06 on November 22, and concluded the year with a monthly average all-time low of $37.89 in December.

Bitcoin Price

For adherents of the 4-year cycle theory, 2025 was widely anticipated to be the year bitcoin ripped toward a "blow-off top." Drawing on post-halving patterns that delivered exponential returns in 2013 (57,400%), 2017 (12,450%), and 2021 (2,100%), and buoyed by institutional adoption, many analysts forecasted targets upwards of $200,000 in Q4. Reality, however, diverged sharply from these expectations.

Instead of a parabolic finish, bitcoin ended the year 6.0% lower than it started, opening January at $93,779 and closing December at $88,179. Despite the underwhelming 2025 close, BTC posted a higher annual average price of $101,638, up 54.2% from $65,894 in 2024.



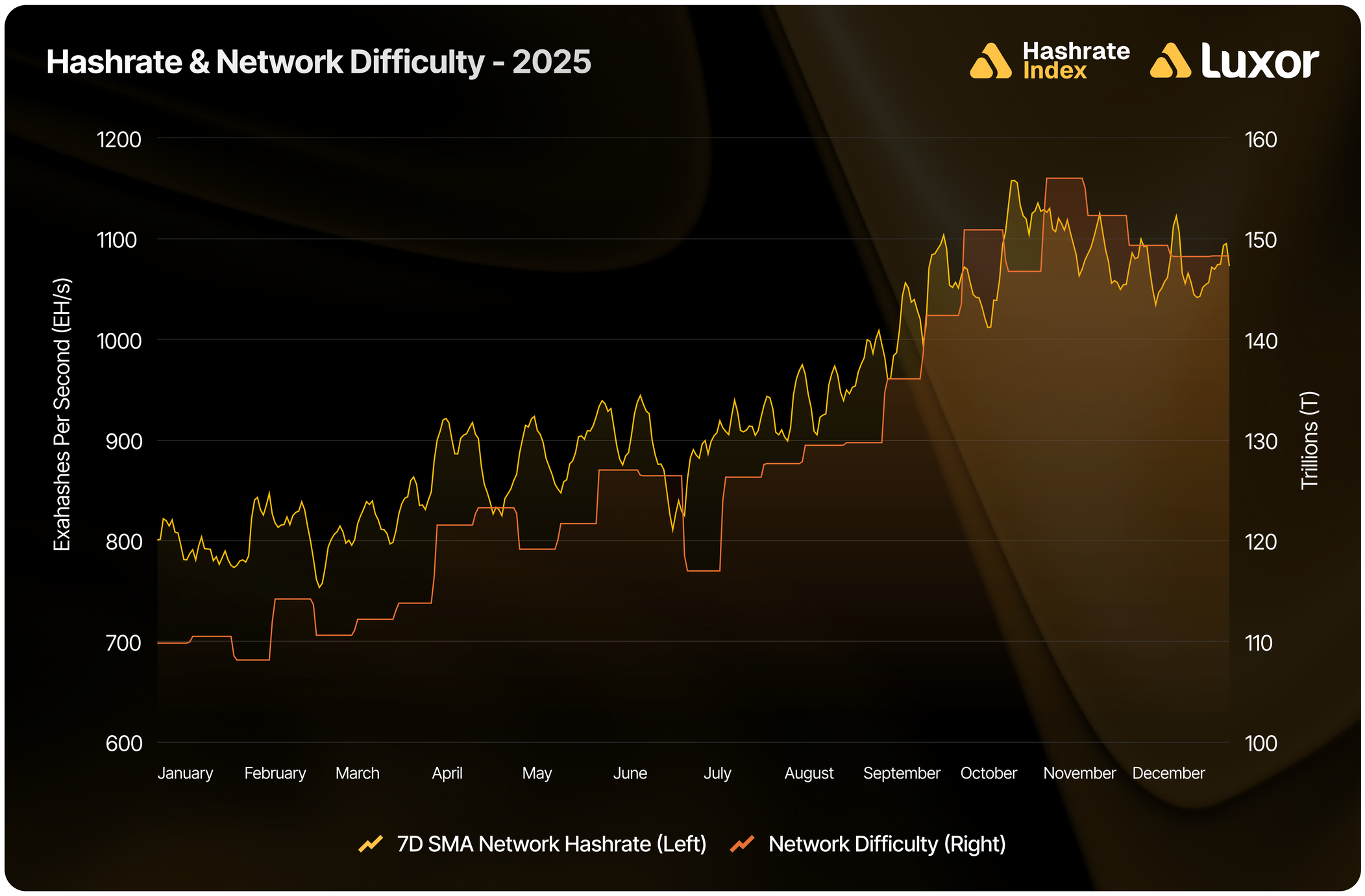
Bitcoin's year was defined by sharp risk-off episodes. Two corrections stood out: a 23.7% drawdown in Q1 (driven by macro uncertainty and tariff concerns) and a severe 32.2% collapse in Q4. The latter was precipitated by the largest futures liquidation event in the crypto-native market's history, where $19 billion in notional positions unwound within 24 hours.

Although the year featured bullish periods, including all-time highs in May, July, and October, the abrupt reversals that followed suggest that market dynamics have structurally changed. With increasing institutional adoption and a market capitalization near ~$2T, bitcoin appears to have outgrown the 4-year cycle framework.

The increased capital required to move the market, combined with routine institutional portfolio rebalancing, may be dampening volatility, potentially smoothing out the extreme peaks and valleys that once defined the asset class.

Network Difficulty & Hashrate

In 2025, network difficulty told a story of steady hashrate growth followed by a sharp and rare multi-factor contraction later in the year.

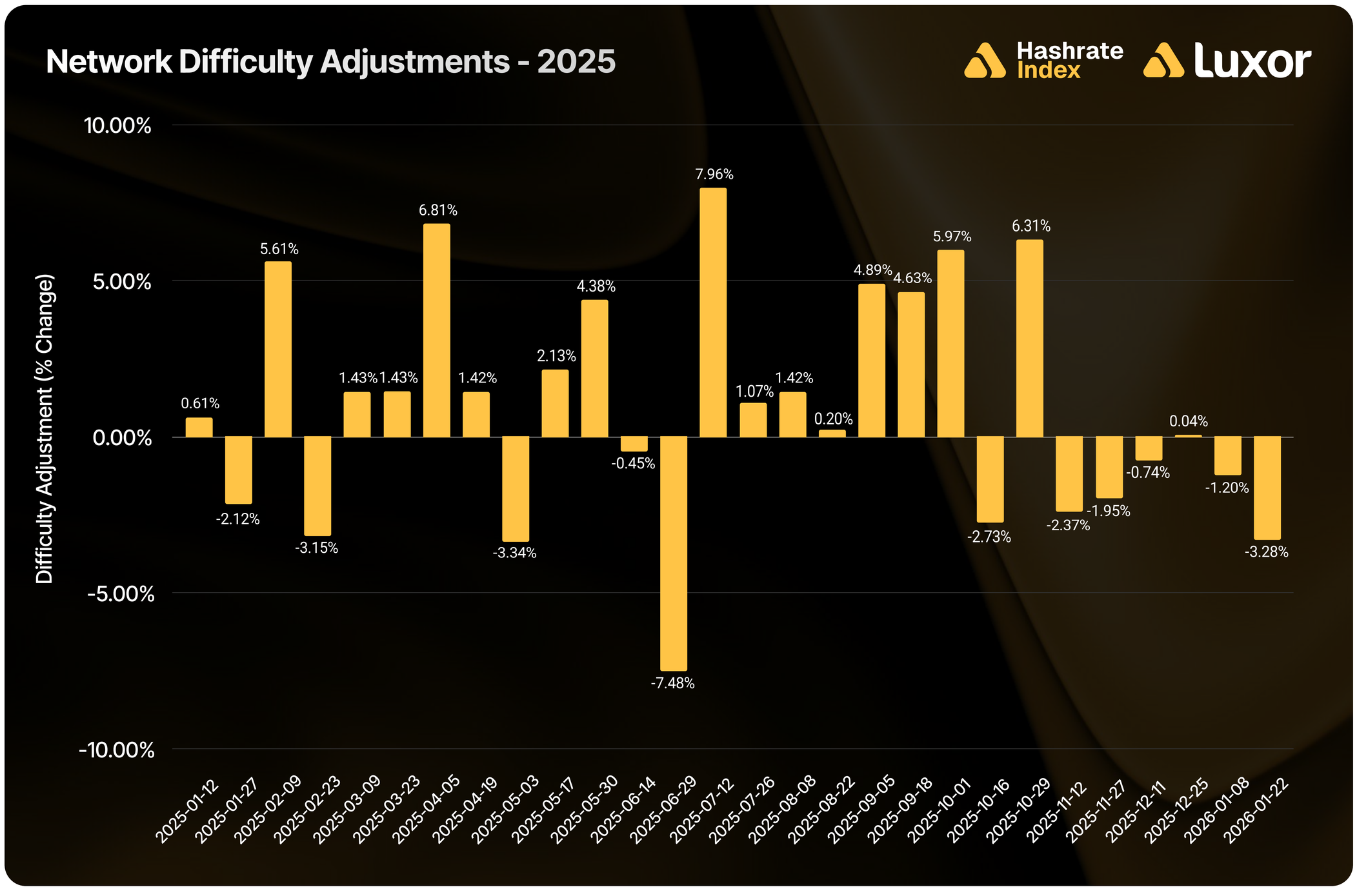


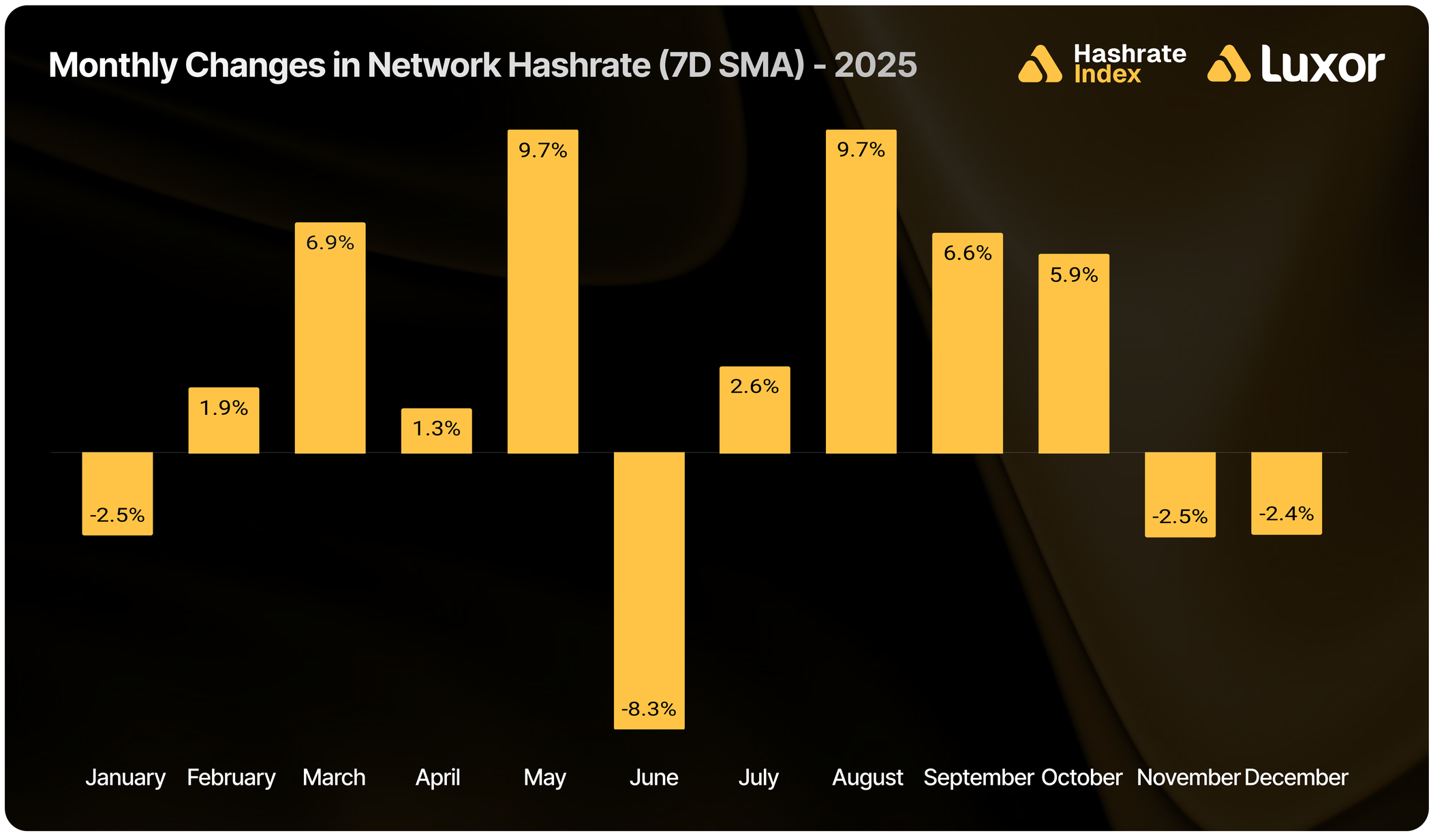
The year opened with a network hashrate of ~800 EH/s in January and endured a choppy Q1 due to Arctic winter blasts causing grid stress, resulting in brief contractions. Hashrate began to increase into Q2 as miners deployed new-generation fleets, leading to multiple consecutive all-time highs in network difficulty before a stall due to the seasonal effect of ERCOT's Four Coincident Peaks (4CP) program in Texas.

The 4CP program is a pricing mechanism used to allocate transmission costs in which industrial users, including bitcoin miners, are charged transmission fees based on their usage during the 15-minute intervals of highest grid demand in each of the four summer months (June, July, August, September). Texas miners account for ~15-20% of global capacity so when they aggressively curtail operations over the summer, the global hashrate is suppressed. This temporary summer curtailment acts like holding a ball underwater. Once the seasonal curtailment ends in late September, the ball is released and latent capacity rushes back online.

On September 2, the network hashrate breached 1 Zettahash (ZH/s) for the first time in history. On September 18 the first block in history was mined with a difficulty above 139.7T, officially putting the network in the Zettahash era. This momentum persisted into October, driving difficulty to an annual peak of 155.97T.

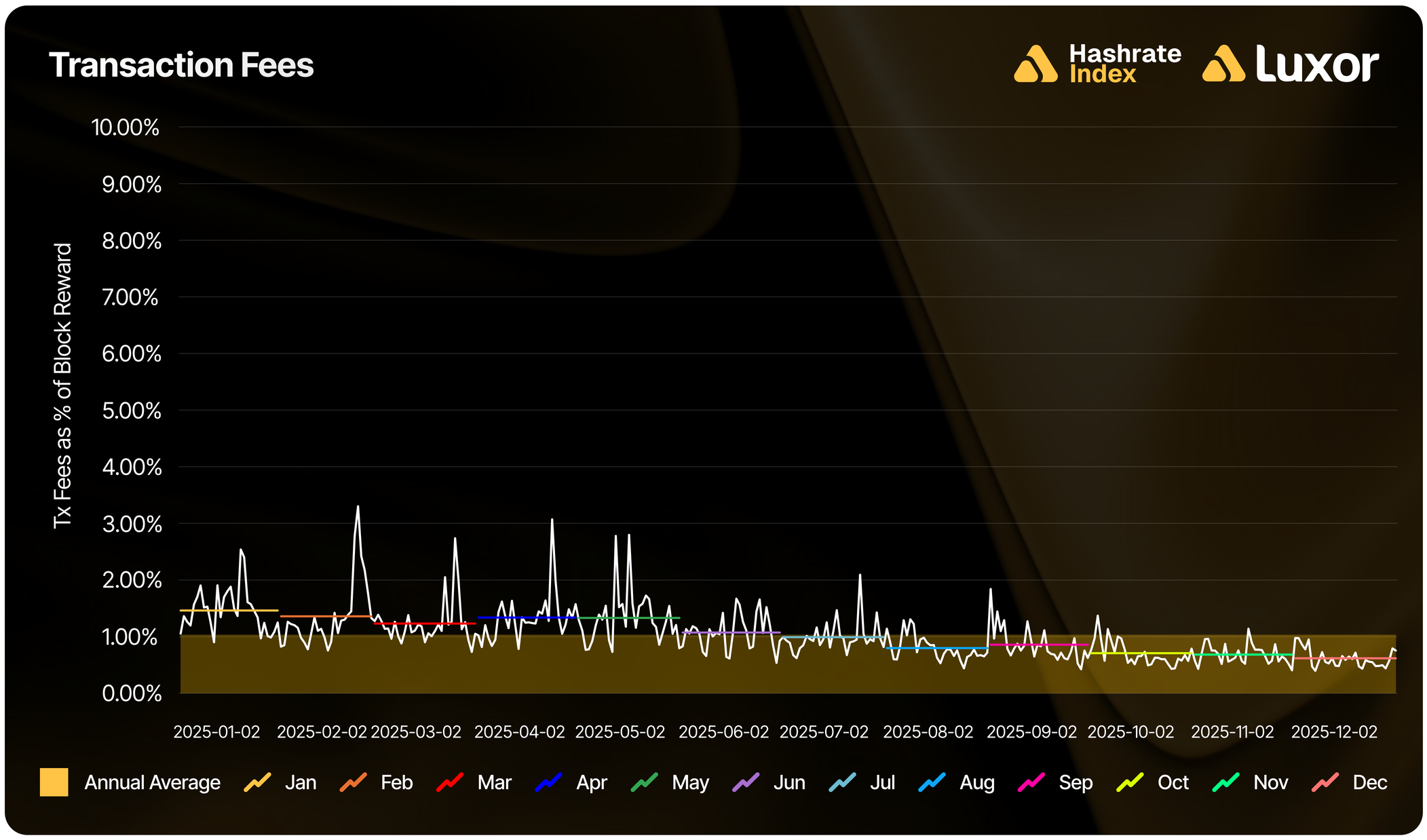
After the peak in October, the growth trend reversed abruptly in the second half of Q4. This "Great Unwind" was fueled by a trifecta of headwinds: a bitcoin price collapse, weather-induced economic curtailment in North America, and renewed regulatory enforcement in China and Russia. Collectively, these pressures forced three consecutive negative difficulty adjustments to close out the year, with contractionary momentum persisting into January 2026.





Transaction Fees

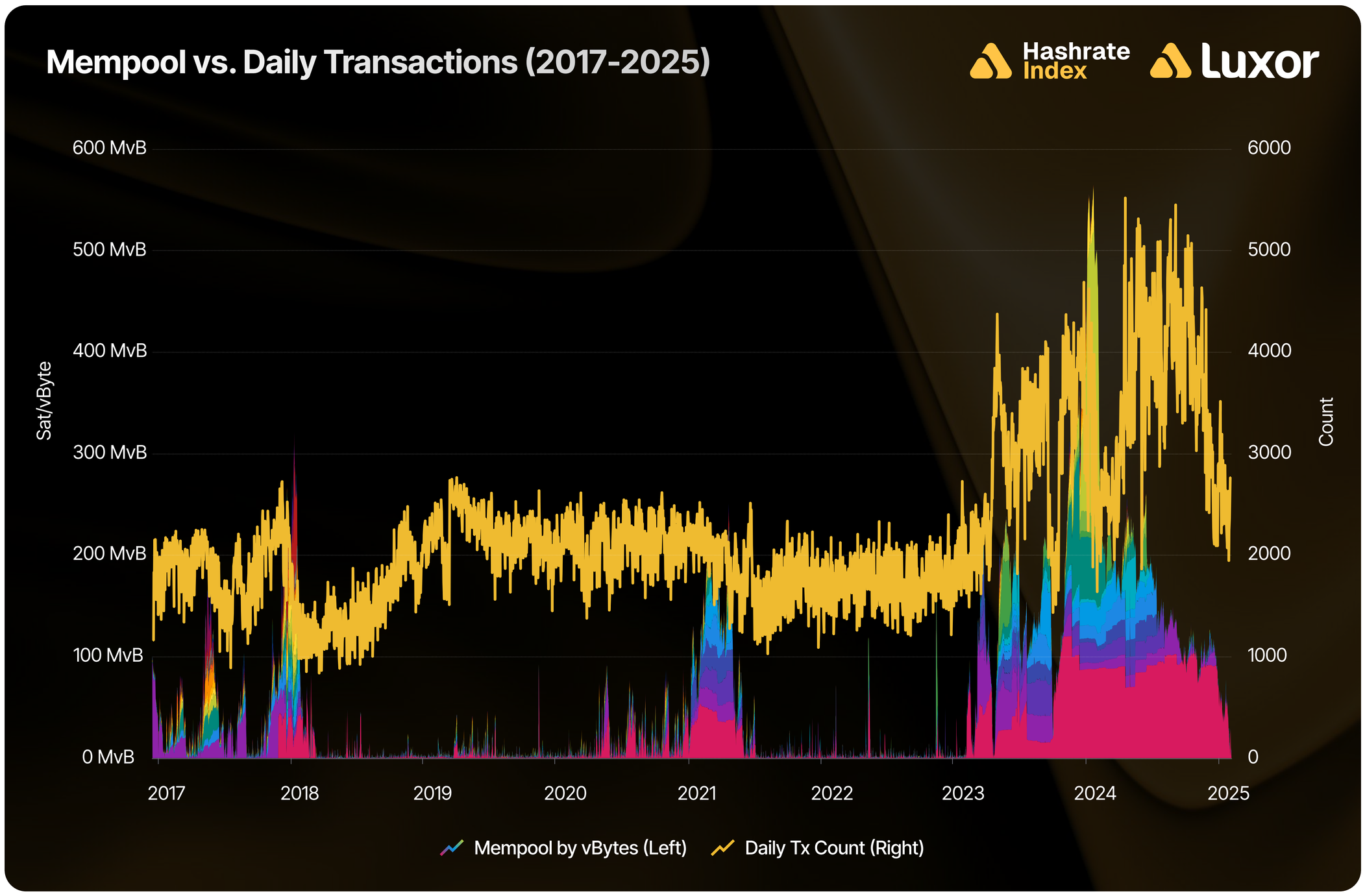
The Bitcoin fee market in 2025 was historically inactive. Following the frantic activity of 2023 and 2024 — driven by the emergence of Ordinals, BRC-20s, and Runes — transaction fees collapsed to levels not seen in over a decade. While bitcoin's price flirted with six figures, on-chain fee revenue nearly disappeared, turning what was recently a significant revenue source for miners into a negligible line item. Overall, transaction fees constituted 1.04% of the total block reward throughout the year, compared to 5.60% in 2024.

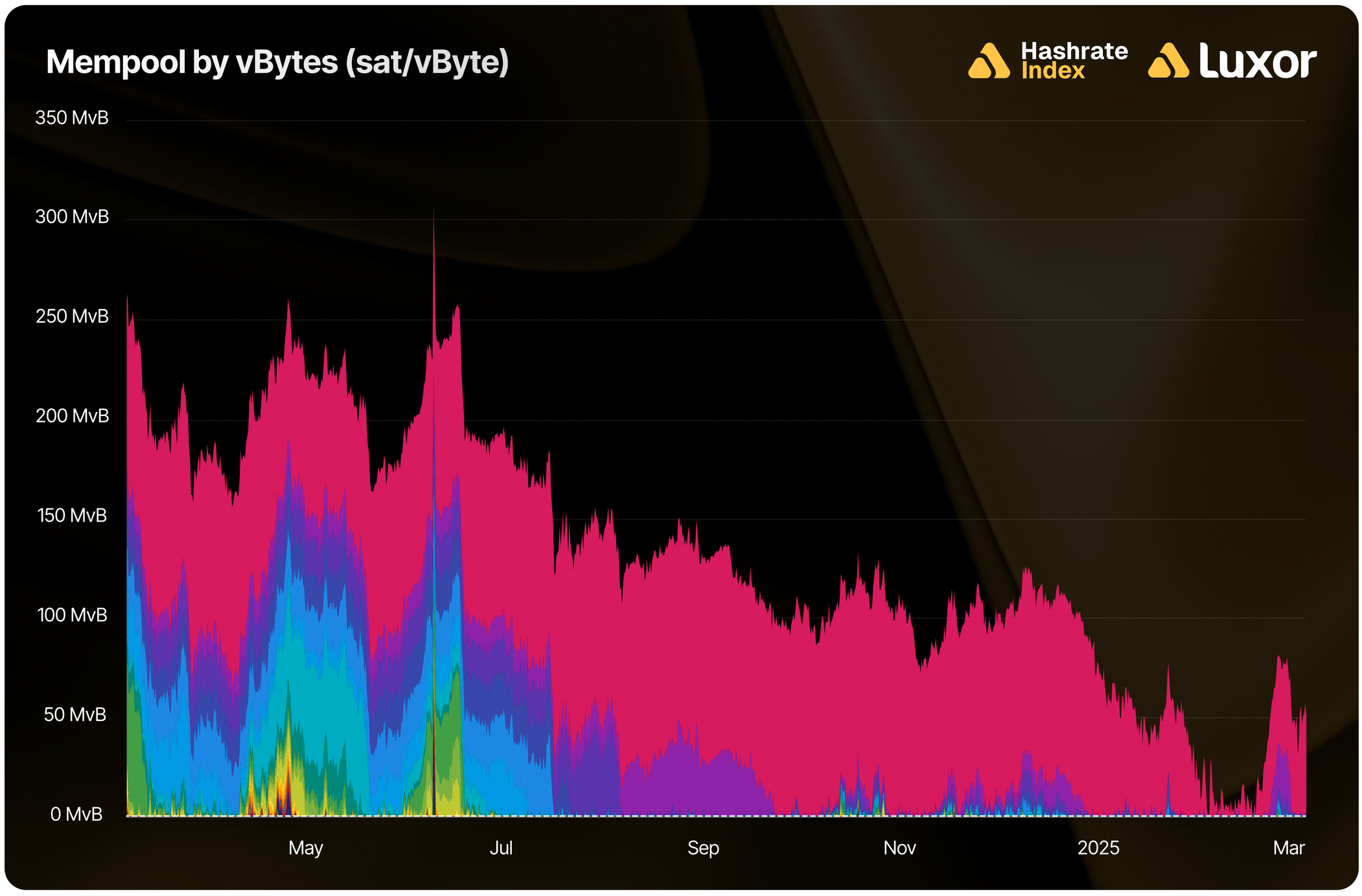


The year was defined by a gradual downward drift in fees. After starting January at already depressed levels (0.046 BTC per block), fees continued to slide, punctuated only by brief speculative spasms. By August, fees had fallen to 0.025 BTC per block. The bottom fell out in December, with miners collecting just 0.019 BTC per block — the lowest BTC-denominated level since February 2011. In USD terms, despite a higher annual average BTC price, average annual fee revenue per block dropped from $17,532 in 2024 to $3,302 in 2025, an 81.2% decline.

A prevailing theory for recent fee depression centers on the dominance of Spot Bitcoin ETFs. As institutional capital comes to dominate these products, a significant volume of transaction activity has shifted off-chain. Instead of retail users executing on-chain transfers to self-custody wallets or between exchanges — actions that consume blockspace — capital flows are increasingly managed off-chain. In this environment, billions of dollars in value could change hands via traditional financial rails without ever touching the blockchain, effectively siphoning demand away from the fee market.

On-chain data throughout the year corroborated this lack of demand. Bitcoin's mempool, which had been chronically congested during the Ordinals craze, cleared completely in early February for the first time since April 2023. It cleared again in March, signaling a structural absence of demand for blockspace.

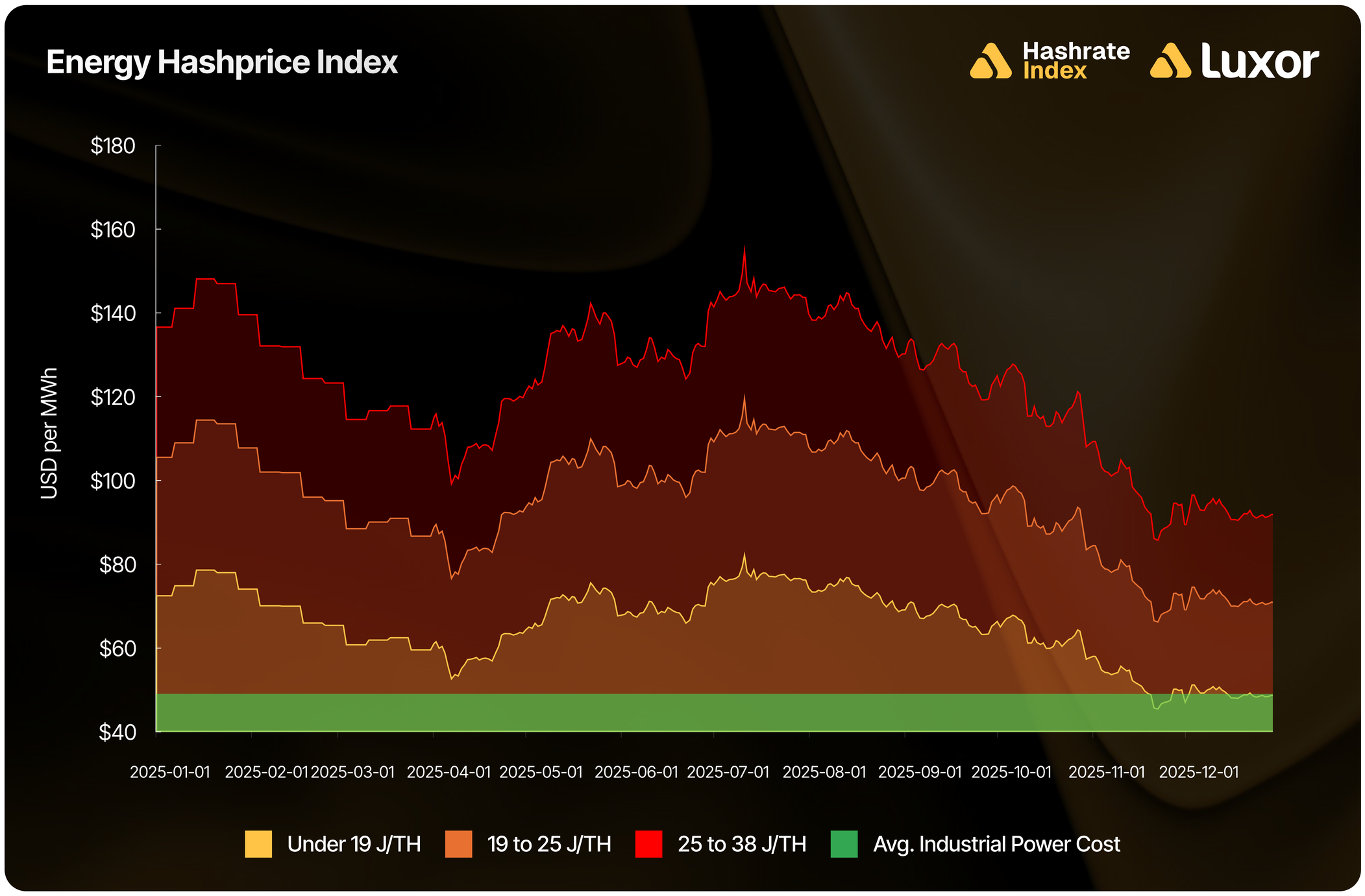




While there were isolated moments of activity — such as an 8.7% fee bump in April driven by Runes and "Alkanes" minting, and a temporary 123% spike in July due to BRC-20 2.0 activity — these events were fleeting. Unlike the sustained fee pressure seen in previous years, 2025's spikes lacked follow-through, leaving miners reliant almost exclusively on the block subsidy.

Energy Hashprice

In 2025, fleet efficiency — not just raw hashrate — became a critical determinant of survival. While standard hashprice measures USD or BTC revenue per unit of compute, energy hashprice incorporates ASIC efficiency into calculating the revenue earned per unit of electricity consumed. The annual average revenue per MWh of energy for each class of machines were: $120.76/MWh for top-tier fleets (<19 J/TH), $90.06/MWh for mid-tier fleets (19–25 J/TH), and $67.09/MWh for legacy fleets (25–38 J/TH).

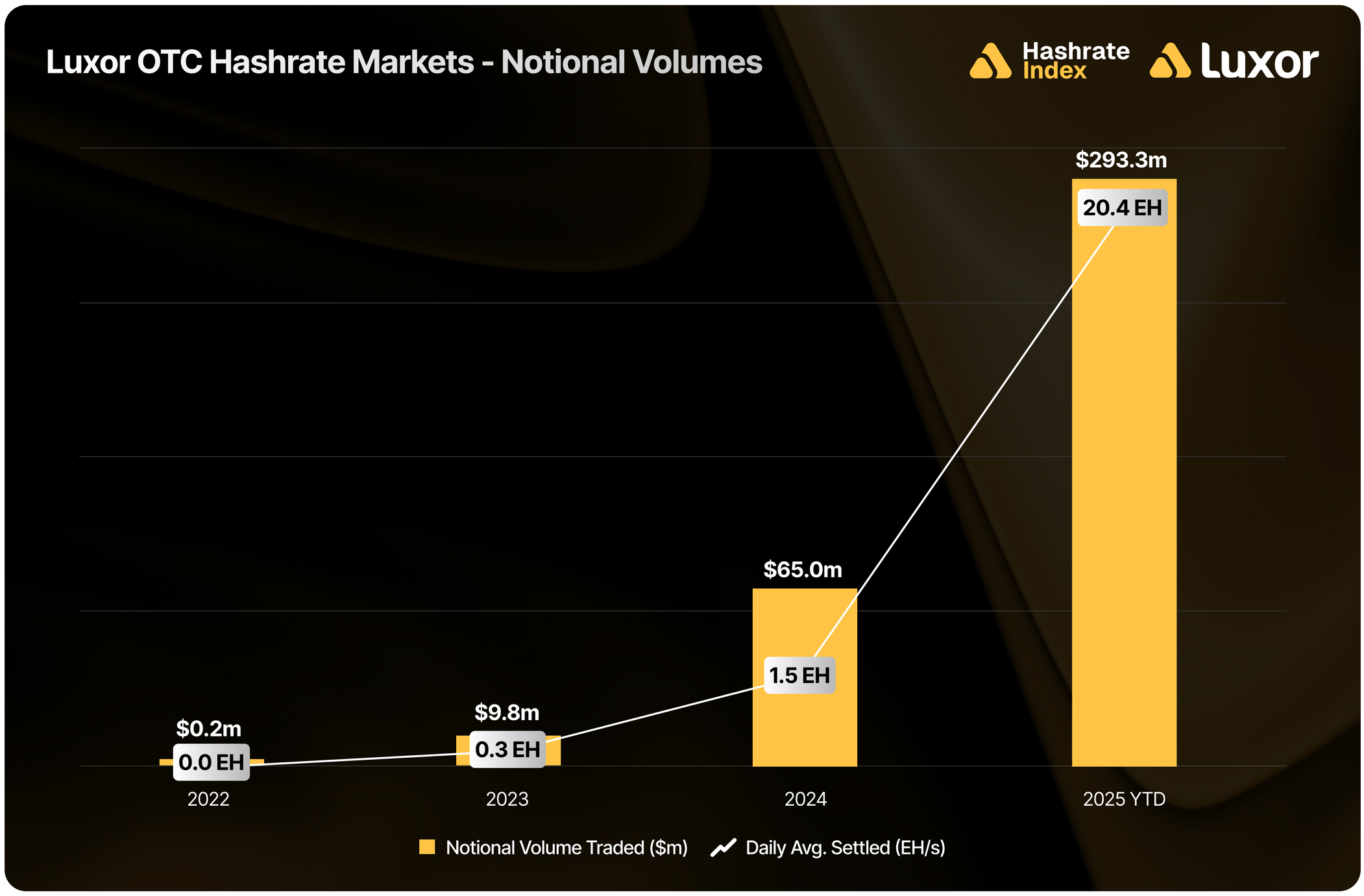


The chart above clearly shows the impact that efficiency has on gross margins and when the less efficient machines are at risk of shutdown. In December, as USD hashprice collapsed, legacy fleets (25-38 J/TH) saw their monthly average revenue per megawatt-hour fall to $49/MWh — dangerously close to, or below, the average industrial power cost, placing them at risk of imminent shutdown. In contrast, top-tier fleets (<19 J/TH) maintained healthy gross margins of $93/MWh even during the December lows. This buffer allowed efficient operators to sustain profitability and continue deploying hardware, while their less efficient competitors were effectively priced out of the market.

Forward Hashrate Markets in 2025

Forward markets have existed for centuries for a simple reason: they solve real problems. In every volatile commodity business, they form the backbone of risk management, price discovery, and capital allocation. By enabling producers to lock in revenue and buyers to lock in costs, forward markets provide the financial certainty required to unlock massive capital inflows.

Luxor recognized the need for a forward market, built the infrastructure, and has become the first and only mining pool to adapt this proven market structure to the world's first compute commodity (SHA-256). The Bitcoin mining industry is now beginning to understand what this unlocks. In 2025, hashrate derivatives became core infrastructure for institutional miners as liquidity deepened, adoption accelerated, and participation broadened.



The defining narrative of 2025 was the exponential growth in forward trading activity. Total notional volume in Luxor's OTC hashrate forward market climbed to nearly $300 million, a staggering 351% increase, fueled by a 429% surge in hashrate units traded. This growth was driven by institutional-scale deals, longer tenors, and a broadening of the participant base. No longer in the experimental phase, hashrate forwards became the Bitcoin standard risk and treasury management tool for public and private miners alike, clearing up to 25 EH/s of notional volume daily during peak activity.

In 2025, clear participant personas emerged on both sides of the forward hashrate market.

Contract / Side	Seller	Buyer
Non-Deliverable Forward	Market Makers Private Miners Lenders Prop Traders BTC Treasury Companies	Market Makers Private Miners Prop Traders Public Miners
Deliverable Forward	Private Miners Public Miners	Public Miners Private Miners Lenders BTC Treasury Companies Hosting Companies

The sell-side was dominated by public and private miners seeking to hedge revenue volatility and secure non-dilutive financing. By selling Deliverable Forwards (DF), miners could monetize future production upfront, effectively pulling forward cash flow to fund fleet expansion.

The buy-side attracted a diverse mix of participants, each with distinct mandates. Lenders and Bitcoin treasury companies were active buyers of Deliverable Forwards, using the discount between the DF and Non-Deliverable Forward (NDF) to lock in fixed, BTC-denominated yield ranging from 6% to 13% (annualized). Notably, the forward hashrate market is evolving into a critical operational backstop for miners and hosting companies who increasingly purchased deliverable forwards to meet delivery obligations regardless of physical fleet performance.

Spot and Forward Hashprice Settlements in 2025

The two tables below show the evolution of Luxor's USD and BTC-denominated forward hashrate markets in 2025. Rows represent specific monthly contracts, while columns represent each trading month. Cell values indicate the average monthly mid-market price — except for the bold highlighted main diagonal — which shows actual spot hashprice settlement during each month. These tables summarize both the forward curve in each trading month (columns) and the trading history of 2025 contracts (rows).

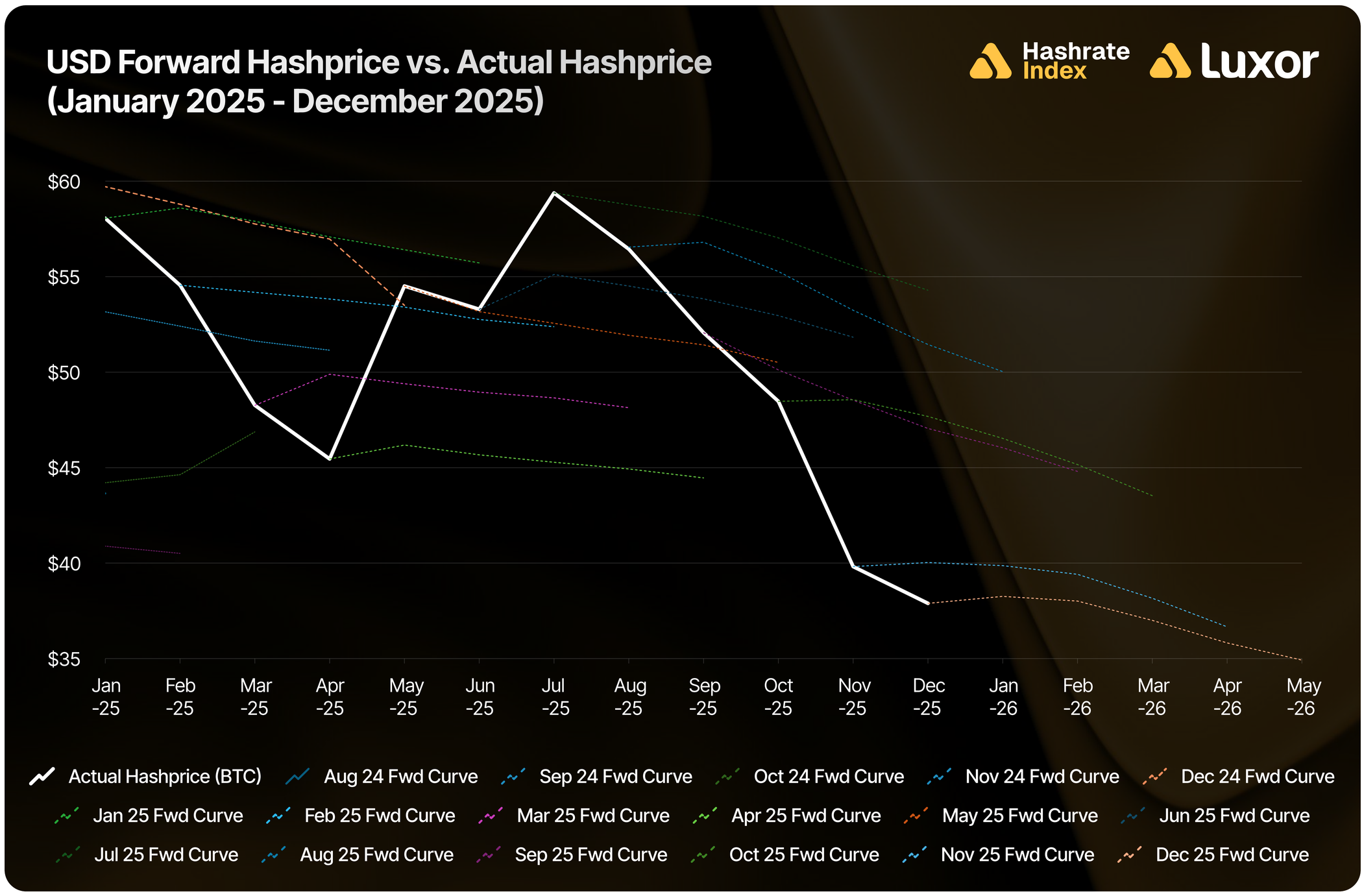
	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025	Jul 2025	Aug 2025	Sep 2025	Oct 2025	Nov 2025	Dec 2025
Jan 2025	**$58.06**											
Feb 2025	$58.60	**$54.55**										
Mar 2025	$57.90	$54.18	**$48.26**									
Apr 2025	$57.08	$53.83	$49.89	**$45.46**								
May 2025	$56.41	$53.41	$49.39	$46.18	**$54.51**							
Jun 2025	$55.72	$52.76	$48.95	$45.67	$53.17	**$53.29**						
Jul 2025		$52.38	$48.65	$45.28	$52.56	$55.11	**$59.38**					
Aug 2025			$48.14	$44.93	$51.93	$54.51	$58.76	**$56.44**				
Sep 2025				$44.46	$51.43	$53.84	$58.16	$56.80	**$52.06**			
Oct 2025					$50.51	$52.96	$57.03	$55.27	$50.12	**$48.47**		
Nov 2025						$51.83	$55.57	$53.24	$48.53	$48.56	**$39.82**	
Dec 2025							$54.29	$51.45	$47.05	$47.68	$40.03	**$37.89**

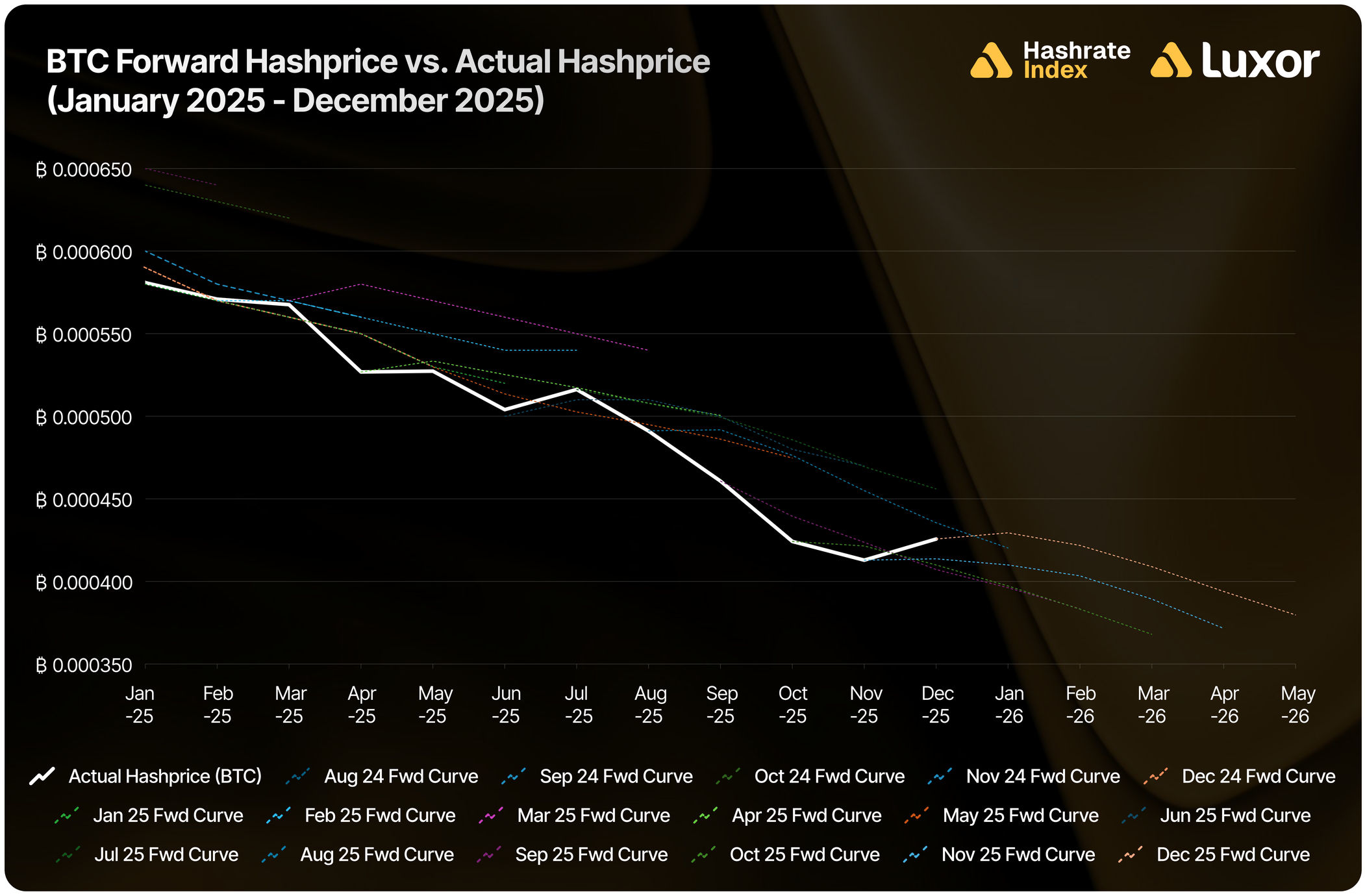
	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025	Jul 2025	Aug 2025	Sep 2025	Oct 2025	Nov 2025	Dec 2025
Jan 2025	**0.00058**											
Feb 2025	0.00057	**0.00057**										
Mar 2025	0.00056	0.00057	**0.00057**									
Apr 2025	0.00055	0.00056	0.00058	**0.00053**								
May 2025	0.00053	0.00055	0.00057	0.00053	**0.00053**							
Jun 2025	0.00052	0.00054	0.00056	0.00053	0.00051	**0.00050**						
Jul 2025		0.00054	0.00055	0.00052	0.00050	0.00051	**0.00052**					
Aug 2025			0.00054	0.00051	0.00050	0.00051	0.00051	**0.00049**				
Sep 2025				0.00050	0.00049	0.00050	0.00050	0.00049	**0.00046**			
Oct 2025					0.00047	0.00048	0.00049	0.00048	0.00044	**0.00042**		
Nov 2025						0.00047	0.00047	0.00046	0.00042	0.00042	**0.00041**	
Dec 2025							0.00046	0.00044	0.00041	0.00041	0.00041	**0.00043**

Note: all values shown in figures represent mid-market rates (the midpoint of the best bid and ask) on Luxor's Non-Deliverable Hashprice Forward market.

The Forward Curve in 2025

The performance of forward contracts relative to spot hashprice settlement in 2025 highlighted a clear divergence between USD and BTC-denominated strategies.





In USD-denominated markets, performance results versus spot hashprice were mixed, driven by bitcoin's erratic price action. While buyers won during early Q1 and Q3's summer rallies (June – August), sellers were the clear winners during downturns in late Q1 and Q4. Notably, during the BTC decline between November – December, early USD forward sales outperformed spot mining by 30–43%, acting as a vital lifeline for operators while spot hashprice collapsed to all-time lows.

In BTC-denominated markets, the year was defined by sustained difficulty growth and decreasing transaction fees. In this environment, selling forward hashrate in BTC terms proved to be the superior trade. With the network crossing the Zettahash milestone and fees contributing negligible revenue, spot BTC hashprice continuously eroded beyond expectations. This offered forward sellers with fixed pool payouts a premium above spot hashprice (FPPS). Miners who locked in future BTC-denominated revenues consistently outperformed those who remained exposed to spot hashprice, particularly in the second half of the year

Hashrate Hedging Performance in 2025

The tables below show the performance of each monthly hashrate contract from 2025 (rows), traded one to five months in advance (columns) of spot settlement. Positive values show when the monthly mid-market hashprice for a specific month's (row) contract was higher than spot hashprice, indicating when it was profitable to sell forward hashrate. Conversely, negative values show when the monthly mid-market hashprice for the month's contract was lower than spot, indicating when it was profitable to buy forward hashrate and/or mine at spot (FPPS).

Fixed Pool Payouts Performance (BTC)					
Contract	5-Mo Hedge	4-Mo Hedge	3-Mo Hedge	2-Mo Hedge	1-Mo Hedge
Jan-25	17%	12%	11%	3%	1%
Feb-25	12%	11%	2%	1%	0%
Mar-25	9%	0%	-1%	-2%	0%
Apr-25	6%	4%	4%	6%	9%
May-25	1%	1%	5%	8%	1%
Jun-25	5%	9%	12%	5%	3%
Jul-25	4%	7%	0%	-3%	-1%
Aug-25	10%	4%	1%	4%	4%
Sep-25	9%	6%	9%	8%	6%
Oct-25	12%	13%	15%	13%	4%
Nov-25	14%	14%	11%	3%	2%
Dec-25	7%	3%	-4%	-4%	-3%

Throughout 2025, BTC-denominated hashrate contracts traded in the forward market generally settled higher than spot. This means network difficulty and hashrate were higher, and/or transaction fees were lower than expectations. It was generally favorable for miners to hedge against network difficulty and transaction fees, and the further out the hedge horizon, the better the results were. December stood out as an exception, given a disturbance in hashrate growth.

Fixed Pool Payouts Performance (USD)					
Contract	5-Mo Hedge	4-Mo Hedge	3-Mo Hedge	2-Mo Hedge	1-Mo Hedge
Jan-25	-25%	-30%	-25%	-8%	3%
Feb-25	-26%	-20%	-4%	8%	7%
Mar-25	-11%	7%	20%	20%	12%
Apr-25	13%	25%	26%	18%	10%
May-25	3%	3%	-2%	-9%	-15%
Jun-25	5%	-1%	-8%	-14%	0%
Jul-25	-12%	-18%	-24%	-11%	-7%
Aug-25	-15%	-20%	-8%	-3%	4%
Sep-25	-15%	-1%	3%	12%	9%
Oct-25	4%	9%	18%	14%	3%
Nov-25	30%	40%	34%	22%	22%
Dec-25	43%	36%	24%	26%	6%

Performance of the USD-denominated hashrate contracts mostly reflected spot bitcoin price action. In early Q1 (following 2024's euphoria), it was generally profitable to be a purchaser of hashrate, and better to mine unhedged against BTC, and similarly during price rallies in Q3.

However, this reversed in Q4, when BTC crashed, and spot USD hashprice settled lower than the monthly hashprices traded in the forward market. At this stage, it became favorable for miners to hedge against BTC by selling forward.

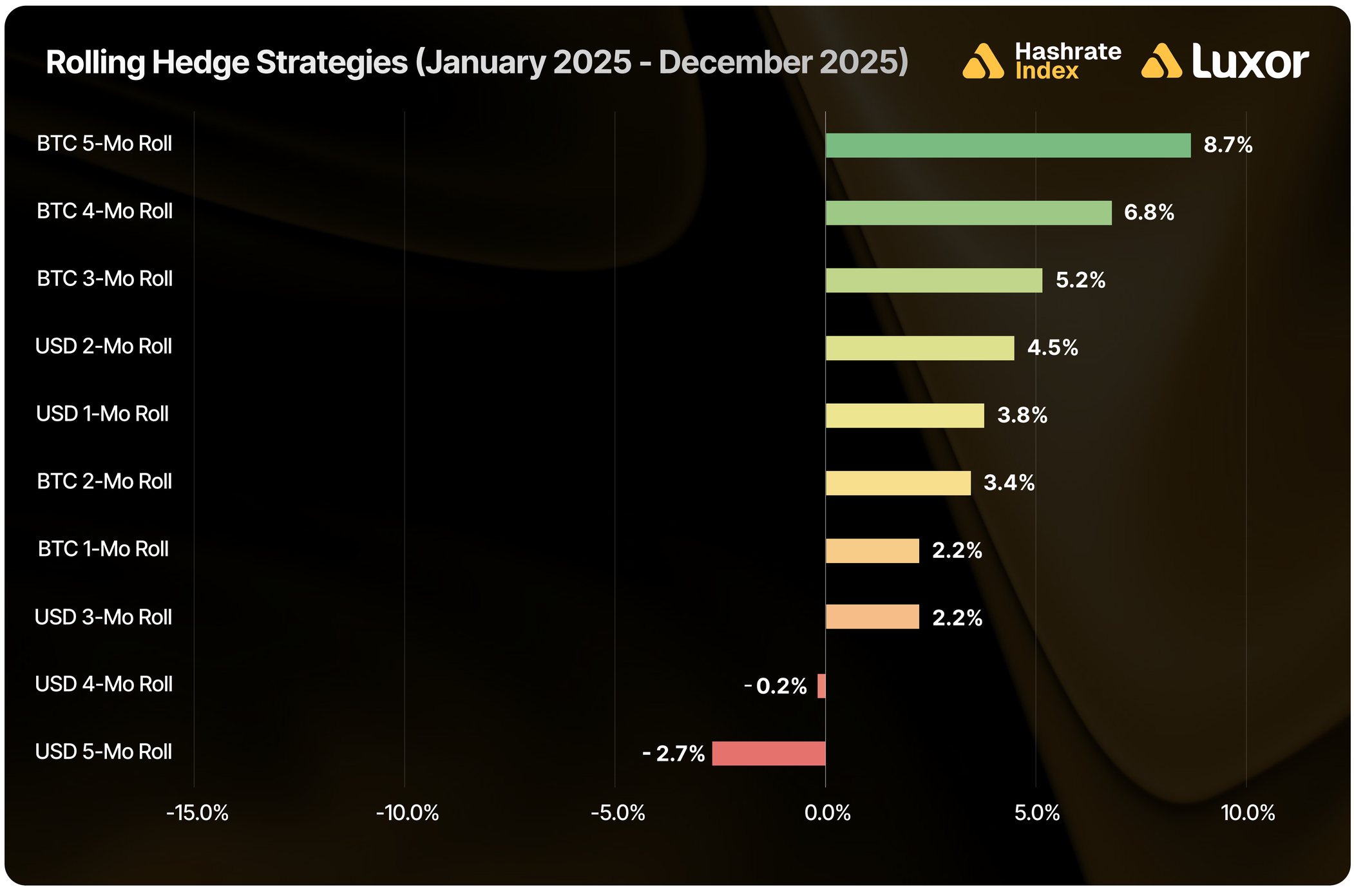
The tables and chart below compare different hashrate forward market strategies with spot bitcoin mining throughout 2025. Each table compares, by rolling hedge horizon, the average monthly hashprice and its standard deviation for January – December 2025.

Fixed Pool Payouts vs. FPPS (BTC)

	5-Mo Hedge	4-Mo Hedge	3-Mo Hedge	2-Mo Hedge	1-Mo Hedge	Spot
Avg. Hashprice	0.00054	0.00053	0.00053	0.00052	0.00051	0.00050
% From Spot	9%	7%	5%	3%	2%	0%
St. Dev Hashprice	0.00006326	0.00006326	0.00006228	0.00005891	0.00006103	0.00005905
% From Spot	18%	7%	5%	0%	4%	0%

Fixed Pool Payouts vs. FPPS (USD)

	5-Mo Hedge	4-Mo Hedge	3-Mo Hedge	2-Mo Hedge	1-Mo Hedge	Spot
Avg. Hashprice	$49.32	$50.59	$51.81	$52.95	$52.59	$50.68
% From Spot	-3%	0%	2%	4%	4%	0%
St. Dev Hashprice	$5.27	$5.17	$4.65	$4.34	$5.88	$6.88
% From Spot	-24%	-25%	-32%	-37%	-15%	0%



Overall, the ideal mining strategy in 2025 was to hedge against network difficulty and transaction fees, while staying long on bitcoin price, **by selling forward in the BTC-denominated hashrate market 5-months in advance.** Miners using this approach mined 8.7% more bitcoin, and obtained more predictable revenues. In contrast, miners who also hedged bitcoin price via USD-denominated forward sales saw, on average, 1.5% higher revenues, but significantly reduced volatility (-22% standard deviation).

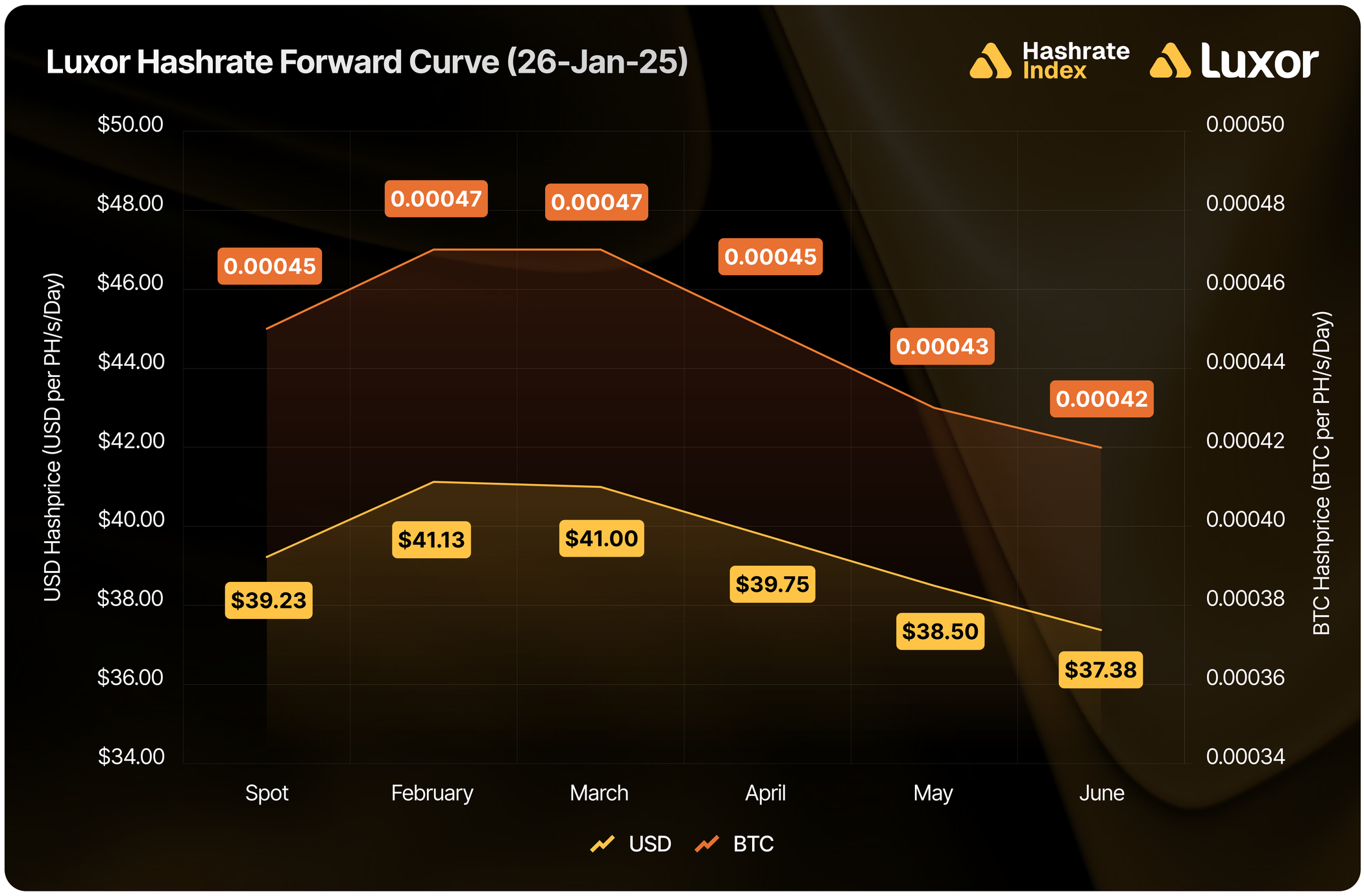
Note: these figures are strictly for demonstration purposes and exclude fees and bid/ask spreads associated with entering into hashrate forward contracts.

A second caveat: although selling forward proved to be favorable during timeframes shown above, it is critical to recognize that hedging is typically a cost of business rather than a revenue generation method. Hedgers willingly pay a price to buy certainty and obtain more predictable cash flows, which increases valuation, reduces cost of capital, and ultimately attracts investments.

Ultimately, 2025 proved that in a zettahash-scale network with thinning margins, hoping for a bull market was not a sustainable strategy. The miners who won were those who actively managed hashprice risk, using forward hashrate markets to obtain revenue certainty. Some even went a step further by front-loading revenue, getting access to non-dilutive capital for deploying more efficient hardware.

Looking Ahead to 2026

Looking forward, Luxor's Hashrate Forward Market is pricing in an average hashprice of $39.55 per PH/s/Day or 0.00045 BTC per PH/s/Day over the next six months. Sellers can currently secure this hashprice while buyers have the opportunity to lock in the same price through to June 2026.



We are keeping our eye on five key trends in 2026. The first is growth in difficulty and hashrate. With the network having firmly entered the Zettahash era, competition is intensifying. We expect hashrate to continue its persistent expansion, driven by the deployment of next-generation fleets and the energization of infrastructure delayed by 2025's supply chain bottlenecks. If bitcoin price does not keep up in pace, high-cost operators with older hardware (25-38 J/TH) will face shutdown risk, making fleetwide efficiency a primary survival metric.

The second key trend is mainstream maturity in forward hashrate markets. Following the material growth in trading volume in 2025, we expect hashprice hedging to become a standard mandate for public miners rather than an option. We anticipate seeing more use of fixed and upfront pool payouts to obtain predictable revenues and non-dilutive financing for growth.

The third and fourth key trends revolve around blockspace demand and bitcoin price action. On fees, the question is no longer whether blockspace markets can spike, but whether sustained demand will re-emerge as a structural revenue component for miners. Outside of episodic congestion driven by ordinals, inscriptions, or novel on-chain use cases, transaction fees have become a diminishing share of miner revenues. If blockspace demand fails to revive in a durable way, miners will be forced to rely almost entirely on block subsidies, making them increasingly sensitive to difficulty growth.

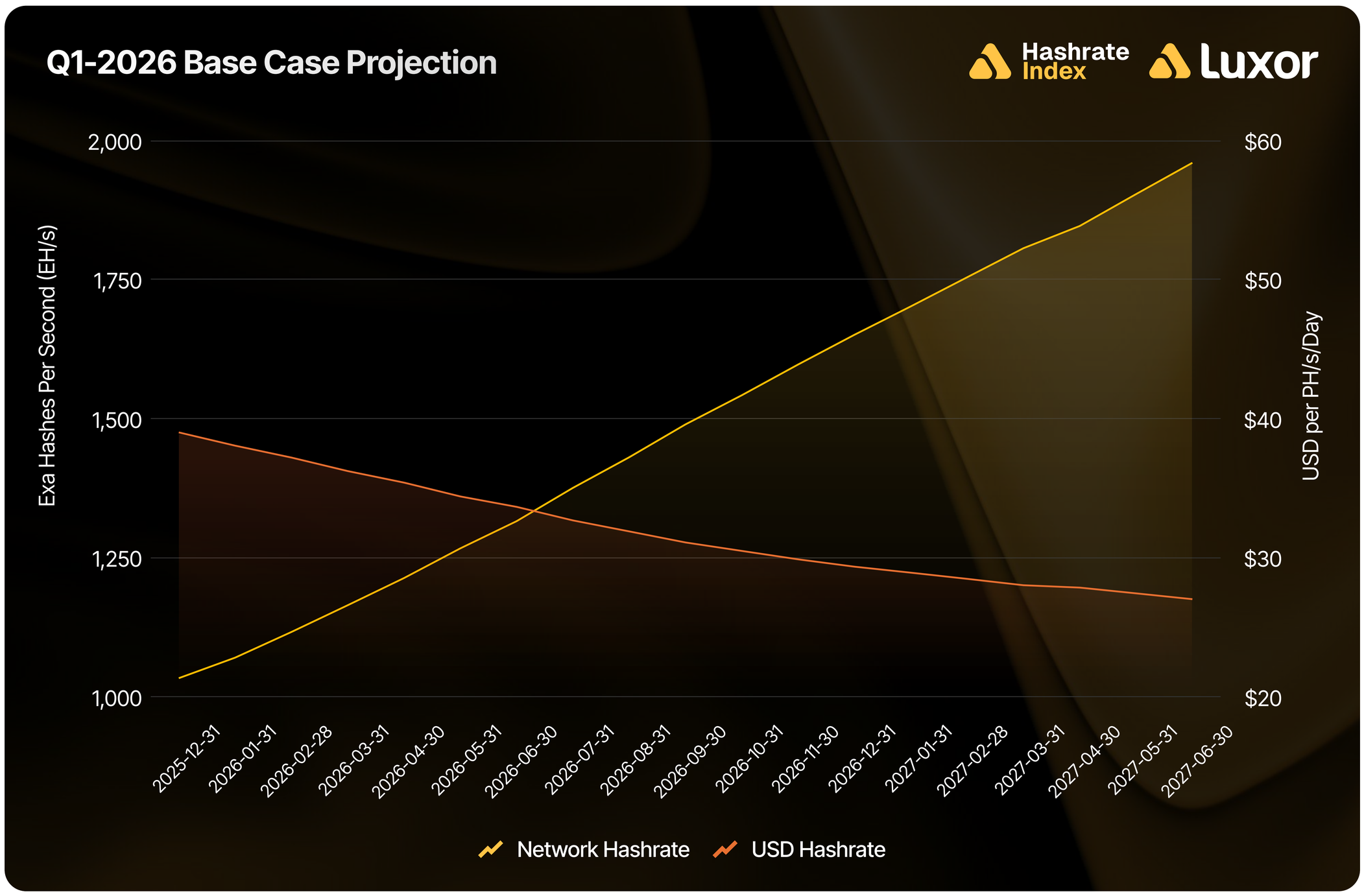
In parallel, bitcoin's price remains the dominant driver for USD-denominated mining economics. Price appreciation can mask inefficiencies, subsidize higher-cost fleets, and compress payback periods across the board, but stagnation and drawdowns have the opposite effect, rapidly exposing weak balance sheets and outdated hardware. In 2026, BTC will continue to act as the ultimate arbiter of who survives network expansion and who is forced to exit.

The final key trend is the collision of Bitcoin mining with AI and energy policy. The "energy war" is intensifying. We anticipate increased competition for power capacity from the AI/HPC sector, which may drive up electricity costs for miners. Simultaneously, the regulatory landscape is shifting; we are watching how U.S. tariffs on imported compute hardware and evolving grid policies in hubs like Texas will reshape the geographic distribution of hashrate. Miners who can navigate complex power markets — utilizing Intelligent Mining strategies — will have a distinct competitive advantage.

Below is a chart that projects our base case trajectory for Bitcoin's hashrate and hashprice throughout 2026 and into 2027. For those interested in the full analysis spanning multi-scenario projections on hashrate, difficulty, and hashprice, our quarterly Bitcoin Mining Economics Projections reports are available to Hashrate Index Premium Gold and Platinum subscribers.

Our Q1-2026 base case scenario anticipates a 60% increase in network hashrate over the next 12 months, and for USD hashprice to range between $29–39 per /PH/s/Day.

Q1-2026 Base Case Projection



3

Hardware Markets

Mining Machine (ASICs) Markets in 2025

Mining is the backbone of the Bitcoin network, and application-specific integrated circuits (ASICs) lie at the heart of it. Bitcoin mining machines are specialized computer hardware equipped with ASICs designed to exclusively perform SHA-256 hashing for Bitcoin's Proof-of-Work consensus mechanism. This process transforms raw computational power into decentralized cybersecurity, securing the blockchain by imposing a prohibitive economic cost.

Bitcoin is the most powerful computer network in the world, as demonstrated by its zettahash computational scale. If we were to assume a network hashrate of 1ZH/s and take the Antminer S19j Pro (100 TH/s | 29.5 J/TH) as a representative machine, this would be equivalent to ~10 million units being online and actively hashing across the world. This unprecedented scale of distributed computing is what makes Bitcoin special.

New ASIC Models in 2025

2025 saw a wide variety of mining machines being introduced, with manufacturers pushing further along in power density, specialized cooling, and data center compatibility.

Bitmain expanded aggressively beyond the S21 generation, announcing the S23 series across air, hydro, and immersion variants while doubling down on ultra-efficient hydro systems such as the U3S23H and multiple S21e and S21 XP derivatives.

MicroBT delivered one of the broadest product launches of the year, unveiling the M70 through M79 series spanning air hydro, and immersion, signaling a focus on flexibility.

Canaan advanced its roadmap with the Avalon A16 and A16XP, complementing late-cycle A15 deployments and reinforcing its position in high-efficiency air-cooled hardware.

Beyond the incumbents, 2025 also highlighted meaningful developments and departures from the traditional mining machine playbook. Bitdeer continued its maturation as a credible ASIC manufacturer with the SEALMINER A3 and A3 Pro families across air and hydro, building on the A2's market entry from the prior year. Proto's Rig introduced a modular mining system that challenged the status-quo "shoebox" model long dominated by major manufacturers. Auradine continued to position itself as a differentiated entrant with its Teraflux series, emphasizing enterprise-grade build quality and North American manufacturing. Together, these releases highlighted that demand is no longer focused solely on incremental efficiency gains, but also on total cost of ownership, and how mining hardware fits into an increasingly power-constrained, datacenter-oriented future.

Overall, the year saw an introduction of 40 models. This proliferation of SKUs and form-factor variants reflects a structural shift away from a "few flagship models per cycle" paradigm toward a more segmented hardware market, where cooling method and data center compatibility have become deliberate strategic differentiators rather than secondary design choices.

Manufacturer	Model	Release Date	Est. Shipping Date	Hashrate (TH/s)	Power (W)	Efficiency (W/TH)	Cooling Type
Bitmain	Antminer S19 XP Hyd 3U	Nov 2024	Jan 2025	514	10600	20.6	Hydro
Bitmain	Antminer S21+ (216TH)	Nov 2024	Feb 2025	216	3564	16.5	Air
Bitmain	Antminer S21+ Hydro	Nov 2024	Mar 2025	358	5370	15	Hydro
Bitmain	Antminer S21+ (235TH)	Mar 2025	Mar 2025	235	3878	16.5	Air
Bitmain	Antminer S21e XP Hydro	Nov 2024	Mar 2025	430	5590	13	Hydro
Canaan	Avalon Q	Feb 2025	Apr 2025	90	1674	18.6	Air
Bitmain	Antminer S21 XP+ Hydro	Jan 2025	Mar 2025	500	5500	11	Hydro
Bitdeer	SEALMINER A2 Pro Hydro	Mar 2025	Mar 2025	500	7450	14.9	Hydro
Bitdeer	SEALMINER A2 Pro Air	Mar 2025	Mar 2025	255	3790	14.9	Air
Auradine	Teraflux AH3880	Mar 2025	Mar 2025	450	6525	14.5	Air
Bitmain	Antminer S21e Hydro (288TH)	Apr 2025	May 2025	288	4896	17	Hydro
Bitmain	Antminer U3S23H	May 2025	Jan 2026	1160	11020	9.5	Hydro
Bitmain	Antminer S23	May 2025	Jan 2026	318	3498	11	Air
Bitmain	Antminer S23 Immersion	May 2025	Jan 2026	368	4048	11	Immersion
Bitmain	Antminer S23 Hydro	May 2025	Jan 2026	580	5510	9.5	Hydro
Bitmain	Antminer S19 XP+ Hyd 3U	Jul 2025	Jul 2025	586	10900	18.6	Hydro
Proto	Rig	Aug 2025	Aug 2025	819	12000	14.7	Air
Bitmain	Antminer S21e Hydro (310TH)	Aug 2025	Sep 2025	310	5270	17	Hydro
Bitdeer	SEALMINER A3 Air	Sep 2025	Oct 2025	260	3640	14	Air
Bitdeer	SEALMINER A3 Pro Air	Sep 2025	Oct 2025	290	3625	12.5	Air
Bitdeer	SEALMINER A3 Hydro	Sep 2025	Oct 2025	500	6750	13.5	Hydro
Bitdeer	SEALMINER A3 Pro Hydro	Sep 2025	Oct 2025	660	8250	12.5	Hydro
Canaan	Avalon A16	Oct 2025	Mar 2026	282	3900	13.8	Air
Canaan	Avalon A16XP	Oct 2025	Mar 2026	300	3850	12.8	Air
Canaan	Avalon A1566HA	Nov 2025	Mar 2026	480	8064	16.8	Air
MicroBT	Whatsminer M70	Dec 2025	Mar 2026	214	3140	14.7	Air
MicroBT	Whatsminer M70S	Dec 2025	Mar 2026	226	3140	13.9	Air
MicroBT	Whatsminer M70S+	Dec 2025	Mar 2026	244	3140	12.9	Air
MicroBT	Whatsminer M72	Dec 2025	Mar 2026	246	4000	16.3	Air
MicroBT	Whatsminer M72S	Dec 2025	Mar 2026	264	4000	15.2	Air
MicroBT	Whatsminer M73	Dec 2025	Mar 2026	470	7200	15.3	Hydro
MicroBT	Whatsminer M73S	Dec 2025	Mar 2026	500	7200	14.4	Hydro
MicroBT	Whatsminer M73S+	Dec 2025	Mar 2026	540	7200	13.3	Hydro
MicroBT	Whatsminer M76	Dec 2025	Mar 2026	336	5200	15.5	Immersion
MicroBT	Whatsminer M76S	Dec 2025	Mar 2026	362	5200	14.4	Immersion
MicroBT	Whatsminer M76S+	Dec 2025	Mar 2026	390	5200	13.3	Immersion
MicroBT	Whatsminer M78	Dec 2025	Mar 2026	440	7000	15.9	Immersion
MicroBT	Whatsminer M78S	Dec 2025	Mar 2026	472	7000	14.8	Immersion
MicroBT	Whatsminer M79	Dec 2025	Mar 2026	870	12615	14.5	Hydro
MicroBT	Whatsminer M79S	Dec 2025	Mar 2026	930	12555	13.5	Hydro

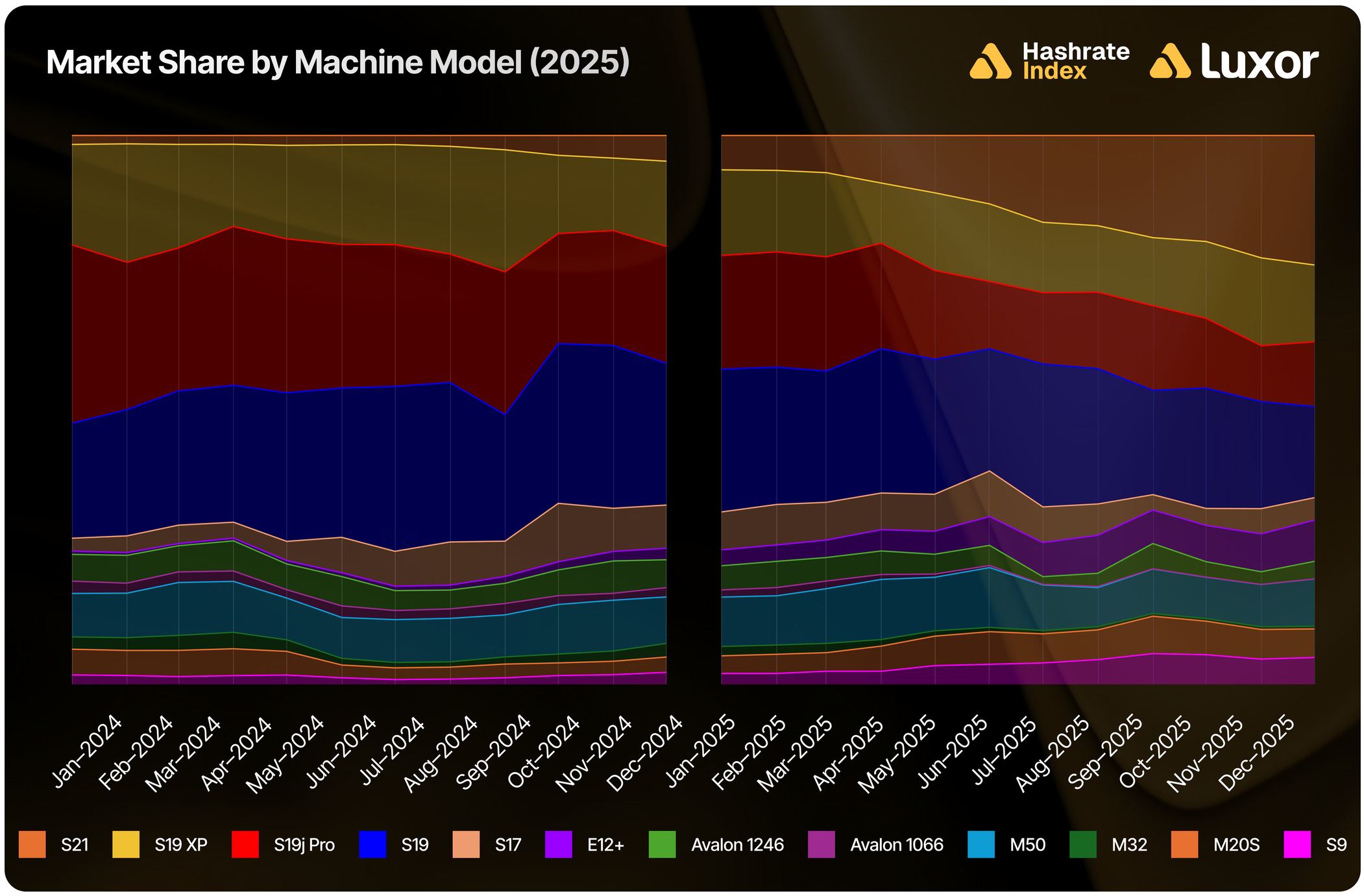
Hydro-cooled releases became a clear focus for manufacturers in 2025. In 2024, hydro offerings were relatively limited and concentrated around flagship extensions — most notably Bitmain's S21 XP Hydro and U-form-factor U3S21EXPH, alongside select hydro variants from MicroBT's M60 series and Bitdeer's first-generation Sealminer A2. These releases positioned hydro cooling as a premium, specialized option primarily for well-capitalized industrial operators.

However, this year marked a broad-based expansion of hydro variants across manufacturers and models. Bitmain alone released multiple hydro variants spanning the S21e, S21+, S21 XP, and S23 families, including more dense U-form-factor designs. Bitdeer followed with the A3 and A3 Pro Hydro, while MicroBT offered its lineup via M79 models.

This proliferation signals a structural shift. Manufacturers are now clearly optimizing for higher hashrate density and sustained performance under tighter thermal constraints, anticipating that future network growth will be driven by power and space efficient data center deployments.

Market share By Machine Models

The chart below shows an estimated breakdown of Bitcoin's network hashrate by machine model throughout 2024–2025, according to Coin Metrics' MINE MATCH data.



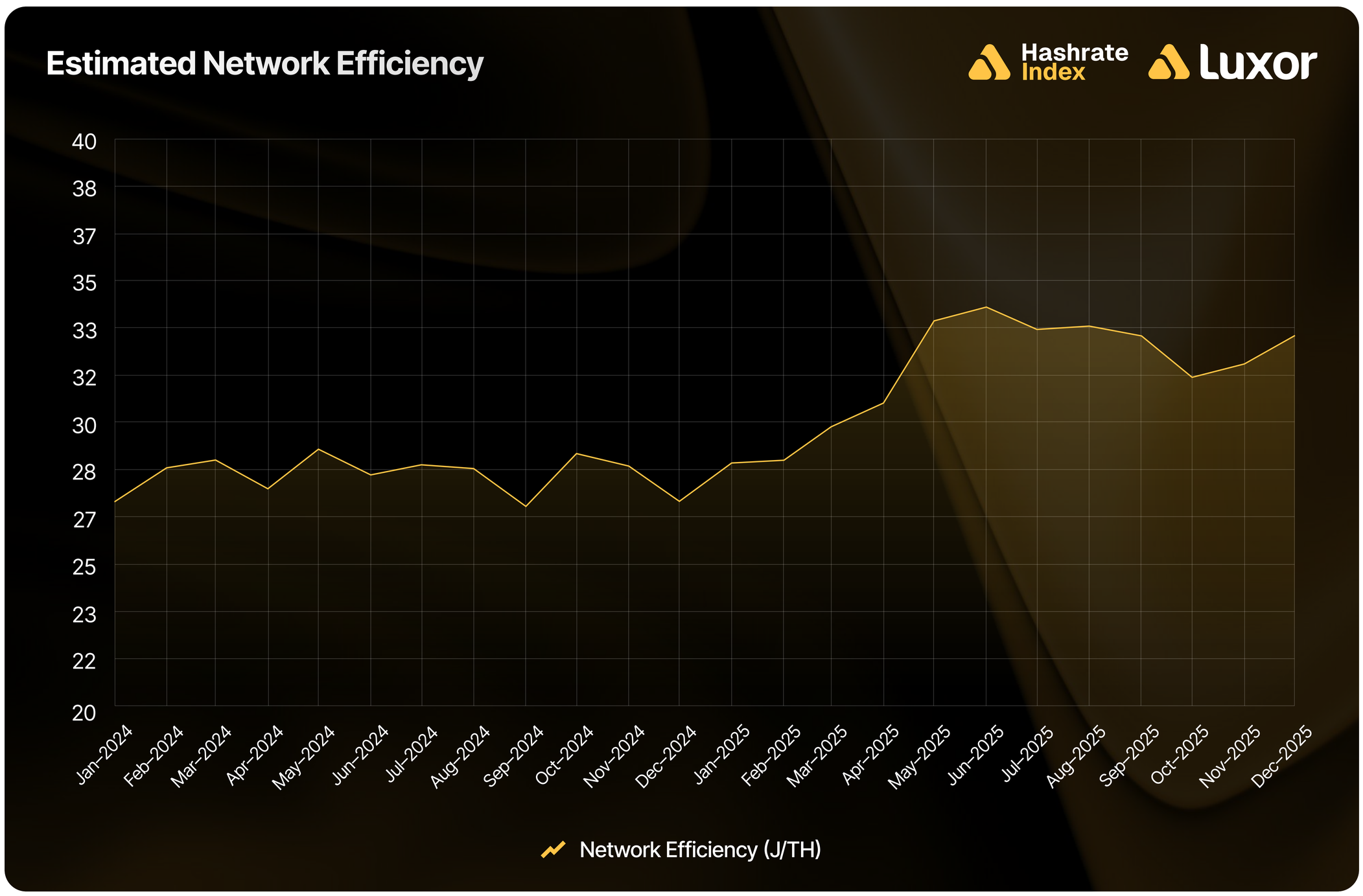
Bitcoin Mining Market Share by Machine Model | Source: Coin Metrics

Machine Model	Annual % Chg (2024)	Annual % Chg (2025)	Anual Average (2024)	Anual Average (2025)
Antminer S9	29%	145%	1.5%	3.7%
WhastMiner M20S	-39%	63%	3.3%	5.0%
WhatsMiner M32	14%	-71%	1.9%	0.9%
WhatsMiner M50	9%	-4%	8.3%	8.9%
Avalon 1066	-23%	-98%	1.8%	0.5%
Avalon 1246	6%	-27%	4.7%	3.5%
Ebang E12+	250%	159%	1.0%	5.2%
Antminer S17	243%	-41%	5.7%	5.8%
Antminer S19	26%	-36%	26.1%	23.1%
Antminer S19j Pro	-33%	-43%	25.4%	15.7%
Antminer S19 XP	-13%	-10%	17.6%	13.9%
Antminer S21	194%	278%	2.4%	14.0%

In 2025, the S21 firmly transitioned from an emerging model into a core component of the Bitcoin network. Entering the year at 6.3% of total network hashrate, S21 deployment steadily accelerated and reached 23.6% by year-end, a 278% increase. This represented the single largest source of incremental hashrate growth in 2025, driven by continued fleet refreshes and post-halving pressure for fleets to improve efficiency.

Prior-generation workers' market share gradually eroded. The S19 XP's declined by 10%, from roughly 15.6% in January to around 14.0% by December, reflecting both refresh cycles and reduced marginal deployment. Similarly, the S19j Pro fell by 43%, from 20.7% to 11.8%, and the S19 fell by 36%, from 26.0% to 16.6%. Although these older air-cooled fleets were increasingly sidelined by hashprice compression or decommissioned in favor of newer-generation hardware, the S19 series still constitutes a significant share of the network, at 52.7% of network hashrate.

Legacy models saw an interesting mix. The S17's share dropped by 43%, but it maintained its average annual market share at 5.8% (thanks to a 244% increase in deployment throughout 2024). Earlier Avalon 1066 and WhatsMiner M32 models faded into the long tail of the network. Notably, the E12+ and S9 both saw triple-digit percentage increases in deployment (159% and 145% respectively, and now each constitute around 5% of network hashrate. This is counterintuitive, but is corroborated by Coin Metrics' estimated network-wide efficiency.



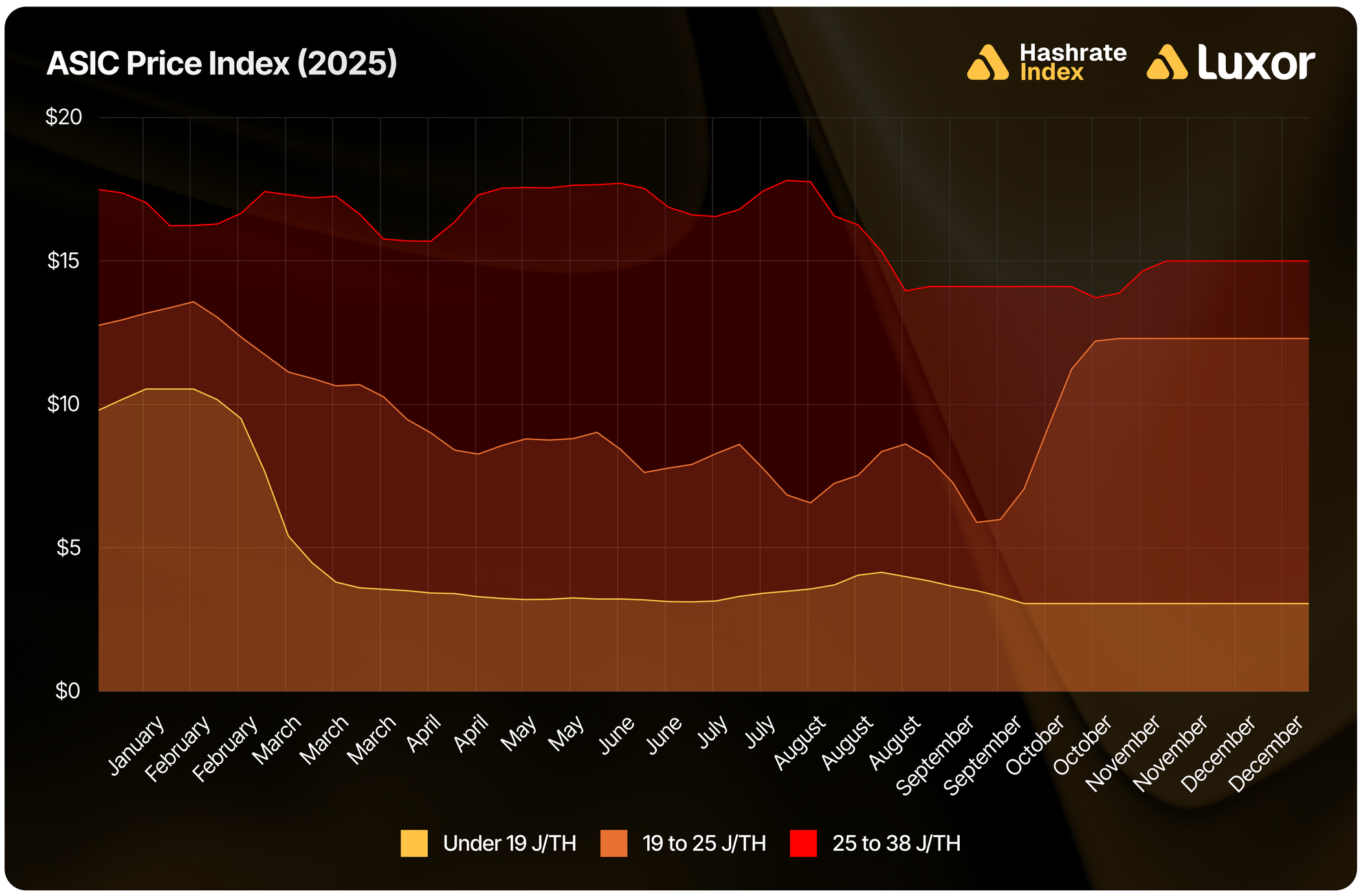
Estimated Network Efficiency | Source: Coin Metrics

In 2025, network-wide average efficiency worsened by 13.1%, moving up from 2024's annual average of 28.1 J/TH to 38.1 J/TH. An explanation for this trend could be the following: marginal machines in hashrate hotspots are being refreshed and priced out (due to tighter mining economics), which could be pushing these older rigs to find rackspace located in other low-cost energy regions around the world.

Overall, Coin Metrics' MINE MATCH data suggests a structural shift in network hashrate composition toward higher-efficiency, more power-dense models, but at the same time, points to older-generation machines still maintaining relevance by being re-deployed elsewhere.

Price Trends in 2025

In 2025, Hashrate Index's ASIC Price Index observed a significant price decline for old-generation machines, indicating a gradual phase-out of relatively outdated (25–38 J/TH) hardware. In contrast, newer-generation (under 19 J/TH) and mid-generation machines (19–25 J/TH) suffered from a relatively lighter decline, maintaining demand.



MoM % Change	Under 19 J/TH	19 to 25 J/TH	25 to 38 J/TH	BTC	USD Hashprice	BTC Hashprice
January	-7%	5%	8%	2%	-3%	-5%
February	7%	-14%	-27%	-4%	-6%	-2%
March	-9%	-8%	-34%	-11%	-12%	-1%
April	10%	-13%	-6%	1%	-6%	-7%
May	1%	3%	1%	20%	20%	0%
June	-6%	-12%	-3%	2%	-2%	-4%
July	8%	-17%	11%	9%	11%	2%
August	-14%	27%	16%	0%	-5%	-5%
September	1%	-31%	-17%	-2%	-8%	-6%
October	-3%	73%	0%	1%	-7%	-8%
November	8%	0%	0%	-16%	-18%	-3%
December	0%	0%	0%	-8%	-5%	3%
Annualized	-14%	-4%	-69%	-6%	-31%	-26%

The following pages — exclusive to Hashrate Index Premium members — summarize average ask price trends for a variety of new and used mining machines, sourced from Luxor's Hardware Trading Desk.

Hardware Investments

Industrial Hashcost Curve

Electricity is the most critical operational expense (OpEx) for Bitcoin mining, as it makes up the lion's share of costs and directly impacts profitability. Mining operations strive for maximal uptime, and constantly consume power, so even small differences in electricity rates can significantly affect overall margins. Those with access to cheap and reliable energy can operate at a lower cost per terahash (TH), allowing them to remain profitable during market stress. A sound energy strategy is a competitive advantage, enabling low-cost miners to survive longer cycles, reinvest in incoming hardware, and ultimately scale operations more aggressively.

The table below shows the breakeven hashprice (i.e., the hashcost curve) for a range of efficiencies (J/TH) under industrial power prices scenarios from $0.020/kWh to $0.10/kWh:

Hashprice: $50.68

Efficiency (J/TH) \ Power Price ($/kWh)	$0.020	$0.025	$0.030	$0.035	$0.040	$0.045	$0.050	$0.055	$0.060	$0.065	$0.070	$0.075	$0.080	$0.085	$0.090	$0.095	$0.100
38	$18	$23	$27	$32	$36	$41	$46	$50	$55	$59	$64	$68	$73	$78	$82	$87	$91
37	$18	$22	$27	$31	$36	$40	$44	$49	$53	$58	$62	$67	$71	$75	$80	$84	$89
36	$17	$22	$26	$30	$35	$39	$43	$48	$52	$56	$60	$65	$69	$73	$78	$82	$86
35	$17	$21	$25	$29	$34	$38	$42	$46	$50	$55	$59	$63	$67	$71	$76	$80	$84
34	$16	$20	$24	$29	$33	$37	$41	$45	$49	$53	$57	$61	$65	$69	$73	$78	$82
33	$16	$20	$24	$28	$32	$36	$40	$44	$48	$51	$55	$59	$63	$67	$71	$75	$79
32	$15	$19	$23	$27	$31	$35	$38	$42	$46	$50	$54	$58	$61	$65	$69	$73	$77
31	$15	$19	$22	$26	$30	$33	$37	$41	$45	$48	$52	$56	$60	$63	$67	$71	$74
30	$14	$18	$22	$25	$29	$32	$36	$40	$43	$47	$50	$54	$58	$61	$65	$68	$72
29	$14	$17	$21	$24	$28	$31	$35	$38	$42	$45	$49	$52	$56	$59	$63	$66	$70
28	$13	$17	$20	$24	$27	$30	$34	$37	$40	$44	$47	$50	$54	$57	$60	$64	$67
27	$13	$16	$19	$23	$26	$29	$32	$36	$39	$42	$45	$49	$52	$55	$58	$62	$65
26	$12	$16	$19	$22	$25	$28	$31	$34	$37	$41	$44	$47	$50	$53	$56	$59	$62
25	$12	$15	$18	$21	$24	$27	$30	$33	$36	$39	$42	$45	$48	$51	$54	$57	$60
24	$12	$14	$17	$20	$23	$26	$29	$32	$35	$37	$40	$43	$46	$49	$52	$55	$58
23	$11	$14	$17	$19	$22	$25	$28	$30	$33	$36	$39	$41	$44	$47	$50	$52	$55
22	$11	$13	$16	$18	$21	$24	$26	$29	$32	$34	$37	$40	$42	$45	$48	$50	$53
21	$10	$13	$15	$18	$20	$23	$25	$28	$30	$33	$35	$38	$40	$43	$45	$48	$50
20	$10	$12	$14	$17	$19	$22	$24	$26	$29	$31	$34	$36	$38	$41	$43	$46	$48
19	$9	$11	$14	$16	$18	$21	$23	$25	$27	$30	$32	$34	$36	$39	$41	$43	$46
18	$9	$11	$13	$15	$17	$19	$22	$24	$26	$28	$30	$32	$35	$37	$39	$41	$43
17	$8	$10	$12	$14	$16	$18	$20	$22	$24	$27	$29	$31	$33	$35	$37	$39	$41
16	$8	$10	$12	$13	$15	$17	$19	$21	$23	$25	$27	$29	$31	$33	$35	$36	$38
15	$7	$9	$11	$13	$14	$16	$18	$20	$22	$23	$25	$27	$29	$31	$32	$34	$36
14	$7	$8	$10	$12	$13	$15	$17	$18	$20	$22	$24	$25	$27	$29	$30	$32	$34
13	$6	$8	$9	$11	$12	$14	$16	$17	$19	$20	$22	$23	$25	$27	$28	$30	$31
12	$6	$7	$9	$10	$12	$13	$14	$16	$17	$19	$20	$22	$23	$24	$26	$27	$29
11	$5	$7	$8	$9	$11	$12	$13	$15	$16	$17	$18	$20	$21	$22	$24	$25	$26
10	$5	$6	$7	$8	$10	$11	$12	$13	$14	$16	$17	$18	$19	$20	$22	$23	$24

Note: calculation only incorporates power costs and excludes other direct operating expenses

The cell value for each combination of efficiency (rows) and power price (columns) indicates the daily direct cost associated with operating a particular bitcoin mining fleet. Comparing this value with a hashprice value allows a mining operator to ascertain whether or not running the fleet is economically rational. The hashcost table above references 2025's daily average of $50.68 per PH/s/Day, as measured by Luxor's Bitcoin Hashprice Index.

Now let's apply the same logic to specific rigs. The cell value for each combination of bitcoin mining machine model (rows) and power price (columns) indicates the daily cost associated with operating it. Comparing this value with current spot hashprice conditions allows a mining operator to ascertain whether or not running the rig is economically rational.

Hashcost ($ per PH/s/Day) per Machine Model	$0.020	$0.025	$0.030	$0.035	$0.040	$0.045	$0.050	$0.055	$0.060	$0.065	$0.070	$0.075	$0.080	$0.085	$0.090	$0.095	$0.100
M20 (68 TH/s | 49.4 J/TH)	$23.71	$29.64	$35.57	$41.50	$47.42	$53.35	$59.28	$65.21	$71.14	$77.06	$82.99	$88.92	$94.85	$100.78	$106.70	$112.63	$118.56
S17 Pro (56 TH/s | 45 J/TH)	$21.60	$27.00	$32.40	$37.80	$43.20	$48.60	$54.00	$59.40	$64.80	$70.20	$75.60	$81.00	$86.40	$91.80	$97.20	$102.60	$108.00
M30 (86 TH/s | 38 J/TH)	$18.24	$22.80	$27.36	$31.92	$36.48	$41.04	$45.60	$50.16	$54.72	$59.28	$63.84	$68.40	$72.96	$77.52	$82.08	$86.64	$91.20
S19 (90 TH/s | 34.2 J/TH)	$16.42	$20.52	$24.62	$28.73	$32.83	$36.94	$41.04	$45.14	$49.25	$53.35	$57.46	$61.56	$65.66	$69.77	$73.87	$77.98	$82.08
M30S+ (100 TH/s | 34 J/TH)	$16.32	$20.40	$24.48	$28.56	$32.64	$36.72	$40.80	$44.88	$48.96	$53.04	$57.12	$61.20	$65.28	$69.36	$73.44	$77.52	$81.60
S19J Pro (100 TH/s | 30.5 J/TH)	$14.64	$18.30	$21.96	$25.62	$29.28	$32.94	$36.60	$40.26	$43.92	$47.58	$51.24	$54.90	$58.56	$62.22	$65.88	$69.54	$73.20
S19 Pro (110 TH/s | 29.5 J/TH)	$14.16	$17.70	$21.24	$24.78	$28.32	$31.86	$35.40	$38.94	$42.48	$46.02	$49.56	$53.10	$56.64	$60.18	$63.72	$67.26	$70.80
M50 (114 TH/s | 29 J/TH)	$13.92	$17.40	$20.88	$24.36	$27.84	$31.32	$34.80	$38.28	$41.76	$45.24	$48.72	$52.20	$55.68	$59.16	$62.64	$66.12	$69.60
S19J Pro+ (122 TH/s | 27.5 J/TH)	$13.20	$16.50	$19.80	$23.10	$26.40	$29.70	$33.00	$36.30	$39.60	$42.90	$46.20	$49.50	$52.80	$56.10	$59.40	$62.70	$66.00
M50S (126 TH/s | 26 J/TH)	$12.48	$15.60	$18.72	$21.84	$24.96	$28.08	$31.20	$34.32	$37.44	$40.56	$43.68	$46.80	$49.92	$53.04	$56.16	$59.28	$62.40
M50S+ (136 TH/s | 24 J/TH)	$11.52	$14.40	$17.28	$20.16	$23.04	$25.92	$28.80	$31.68	$34.56	$37.44	$40.32	$43.20	$46.08	$48.96	$51.84	$54.72	$57.60
S19k Pro (120 TH/s | 23 J/TH)	$11.04	$13.80	$16.56	$19.32	$22.08	$24.84	$27.60	$30.36	$33.12	$35.88	$38.64	$41.40	$44.16	$46.92	$49.68	$52.44	$55.20
M50S++ (150 TH/s | 22 J/TH)	$10.56	$13.20	$15.84	$18.48	$21.12	$23.76	$26.40	$29.04	$31.68	$34.32	$36.96	$39.60	$42.24	$44.88	$47.52	$50.16	$52.80
S19 XP (134 TH/s | 21.5 J/TH)	$10.32	$12.90	$15.48	$18.06	$20.64	$23.22	$25.80	$28.38	$30.96	$33.54	$36.12	$38.70	$41.28	$43.86	$46.44	$49.02	$51.60
M60 (162 TH/s | 19.2 J/TH)	$9.22	$11.52	$13.82	$16.13	$18.43	$20.74	$23.04	$25.34	$27.65	$29.95	$32.26	$34.56	$36.86	$39.17	$41.47	$43.78	$46.08
M60S (186 TH/s | 18.5 J/TH)	$8.88	$11.10	$13.32	$15.54	$17.76	$19.98	$22.20	$24.42	$26.64	$28.86	$31.08	$33.30	$35.52	$37.74	$39.96	$42.18	$44.40
S21 (200 TH/s | 17.5 J/TH)	$8.40	$10.50	$12.60	$14.70	$16.80	$18.90	$21.00	$23.10	$25.20	$27.30	$29.40	$31.50	$33.60	$35.70	$37.80	$39.90	$42.00

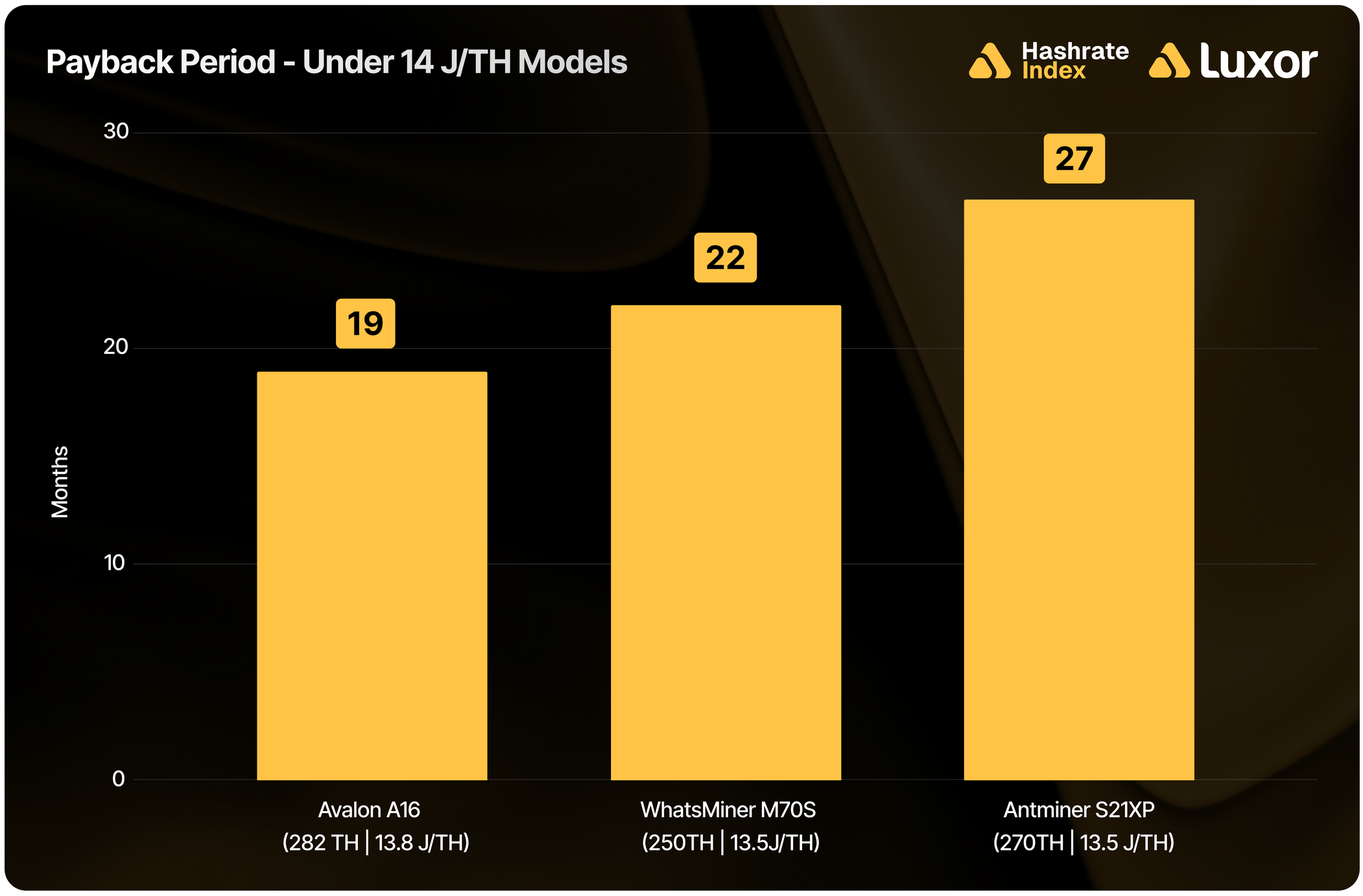
Note: calculation only incorporates power costs and excludes other direct operating expenses

These fleetwide and model-specific hashcost tables demonstrate an obvious concept: next-generation ASICs future-proof operations against tighter mining economics. Let's assume, for instance, that hashprice trends toward $30 per PH/s/Day. Under this scenario, machines with sub 20 J/TH will be able to afford electricity costs of up to around 6–7 cents per kWh and still justify hashing. In contrast, rigs boasting efficiencies between 25-30 J/TH will only be able to afford electricity costs of up to 4-5 cents per kWh and still justify hashing, which is comparable to the average industrial mining power cost in the U.S. at $0.0490/kWh.

Estimating Returns on Mining Hardware Investments

The payback period is a crucial investment return metric for mining operators. This metric measures how long it takes for the revenue generated by a machine to recoup its initial capital expenditure. Since ASIC hardware depreciates quickly due to technological innovation, miners aim to achieve payback before their ASICs become obsolete or less competitive. A shorter payback period reduces risk across the board, whereas a longer payback period increases exposure to hashprice, energy costs, or the many other variables which could render the initial investment unprofitable before full cost recovery.

In the table below, we estimate payback periods based on the current hashprice environment for two incoming next-generation (sub-14 J/TH) models, and compare it to Bitmain's Antminer S21 XP. The calculation assumes 100% uptime and $0.040/kWh all-in power costs. Purchase prices are based on manufacturers' asking prices listed on their websites, as of January 2026, and hashprice is held constant at January 2026's daily average ($39.60 per PH/s/Day).



At first glance, the answer seems obvious, however it is more complicated than that. Static payback period calculations materially understate risk and overstate certainty when used to evaluate mining hardware returns.

While static payback periods are often useful as a heuristic for quick comparisons, they provide an incomplete and frequently misleading picture. These calculations assume fixed future cash flows, ignoring the reality that mining revenues are influenced by rising network difficulty, fee variability, and curtailment risk. They further assume constant machine performance, despite increasing failure rates in practice, and omit other environmental constraints that may reduce realized hashrate output over time. As a result, static paybacks function best as an initial screening tool.

To alleviate some of these concerns, we prefer to utilize hashprice projection scenarios using empirical data derived from Luxor's Bitcoin Hashprice Index, combined with Hashrate Index Premium's quarterly Bitcoin Mining Economics Projections Reports. This method provides a simple and realistic framework for projecting long-term mining economics without relying on separate assumptions for hashprice components (BTC price, network difficulty, and transaction fees). Additionally, it takes fleet failure rates into account.

In the following section, we demonstrate this analysis for the middle of the pack from above, MicroBT's WhatsMiner M70S.

Projection Scenario

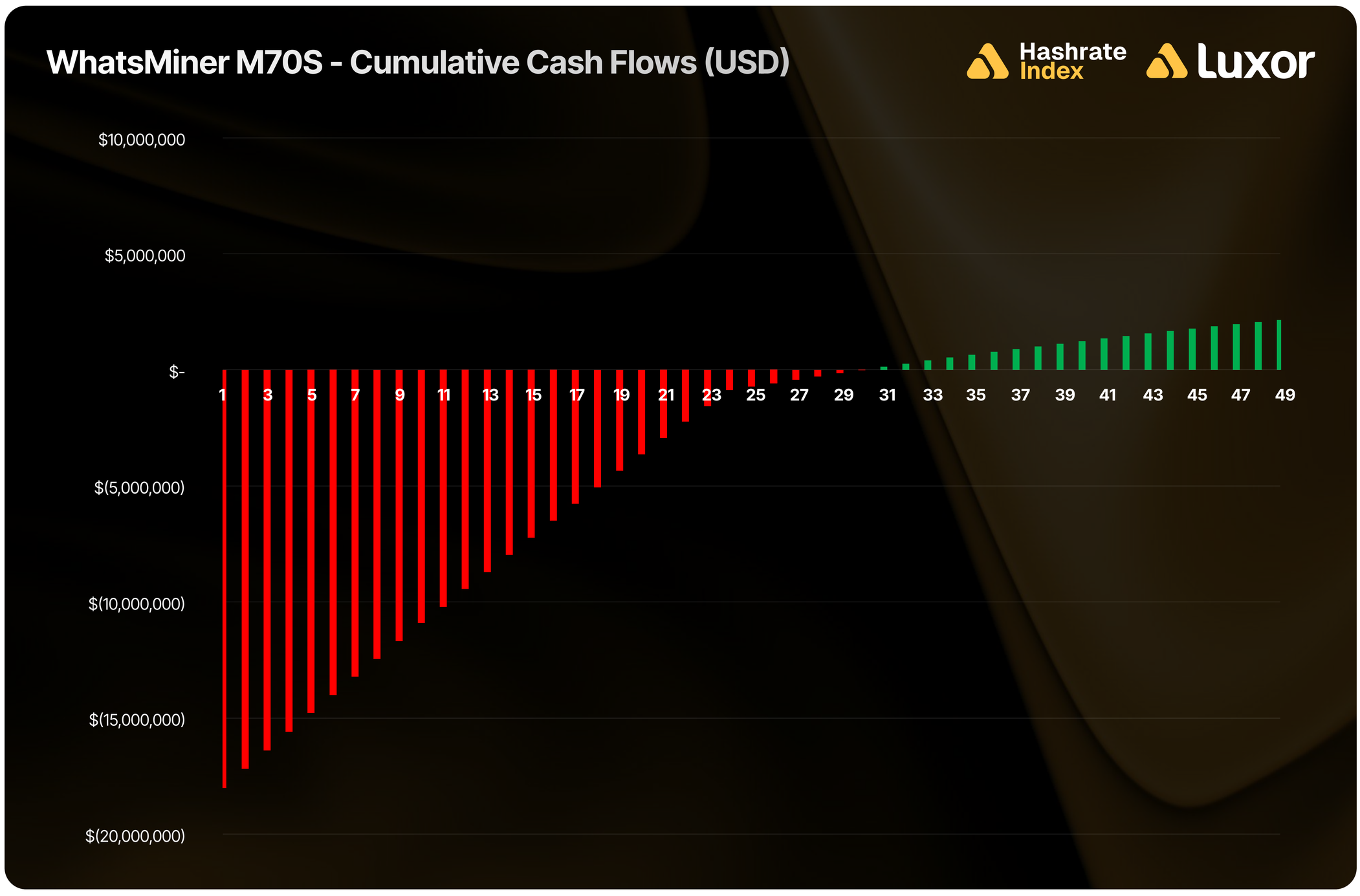
This model evaluates the projected performance and payback period of a 4,000-unit WhatsMiner M70S fleet, representing 1 EH/s of hashrate capacity. Each unit delivers 250 TH/s at 13.5 J/TH, consuming approximately 3.4 kW at the wall. The total capital expenditure is $18.8 million, or $4,700 per unit ($18.80/T). Operations assume 95% uptime and a fixed power cost of $40/MWh ($0.040/kWh).

Inputs:

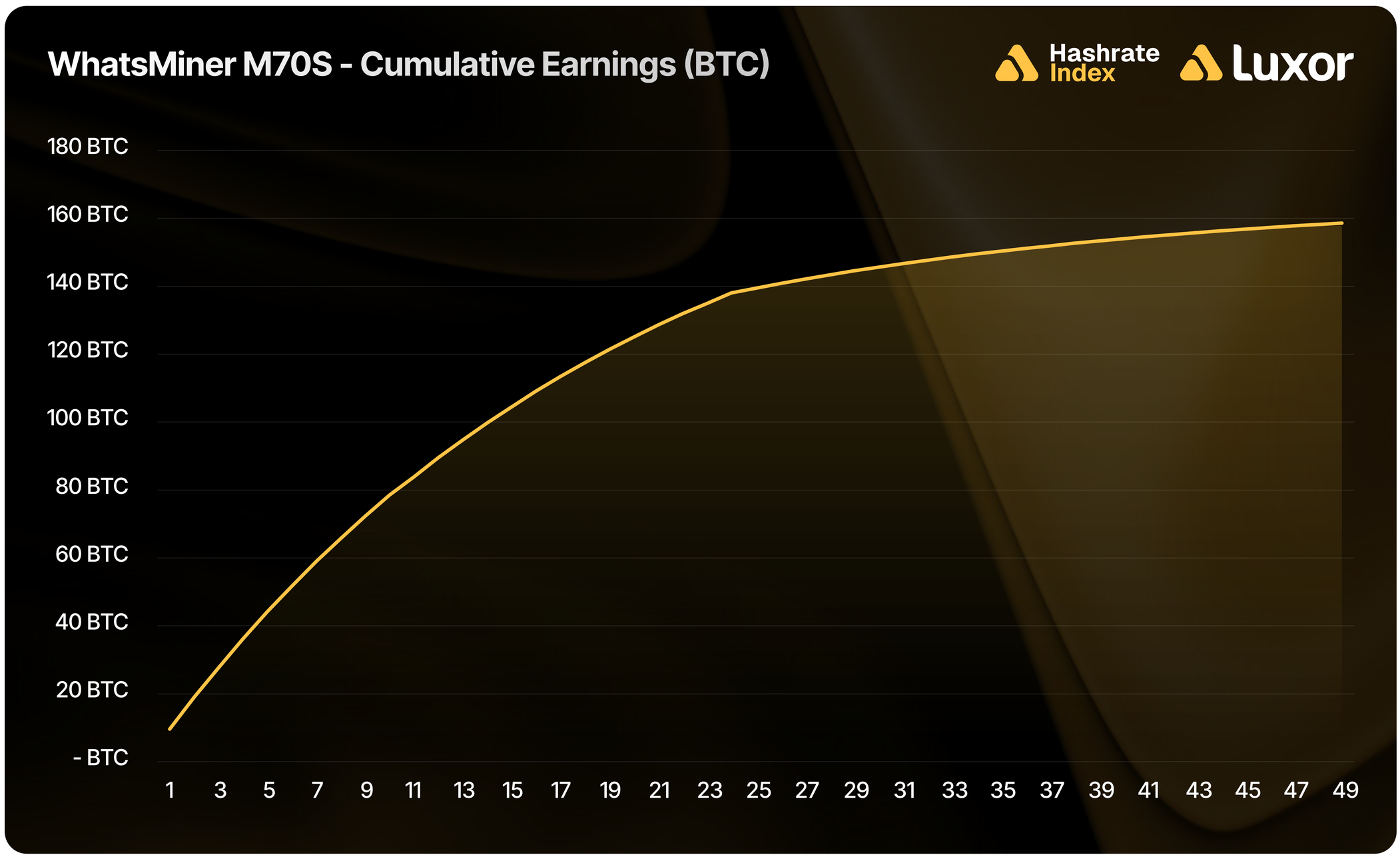
- **Fleet Composition:** 4,000 x M70S (250 TH/s | 13.5 J/TH)
- **Capital Expenditure:** $18,800,000 ($18.80/T or $4,700/unit)
- **Power Cost ($/MWh):** $40, flat rate
- **Uptime:** 95%
- **Hashprice Scenario(s):**
  - USD Hashprice Monthly % Change: -0.5%
    i. Start (April 2026): $39.00 per PH/s/Day
    ii. End (April 2030): $15.41 per PH/s/Day
  - BTC Hashprice Monthly % Change: -5%
    i. Start (April 2026): 0.00032000 BTC per PH/s/Day
    ii. End (April 2030): 0.00001436 BTC per PH/s/Day

Hashprice trajectories are modeled using empirical month-over-month (MoM) percentage changes derived from data on Luxor's Bitcoin Hashprice Index since 2021. Starting hashprice values are derived from Hashrate Index's latest projection report's (Q1-2026) Base Case.

In this model, USD hashprice declines 0.5% per month from roughly $39 to $15 per PH/s/Day between April 2026 and April 2030, while BTC hashprice falls 5% per month. This reflects expected compression from network difficulty growth. The incoming 2028 halving is also accounted for. Under these assumptions, the modeled fleet projects the following results:



Cumulative cash flow analysis (USD) shows an initial $18.8M CapEx drawdown, followed by steadily recovering revenues through mid-2027 and full capital recovery by month 30 (October 2028). Despite the projected 2028 halving, an estimated 60% decline in USD hashprice, and an estimated 96% decline in BTC hashprice across the four-year horizon, the WhatsMiner M70S fleet remains profitable through the projection period, earning a total 158.6 BTC.



Hashprice sensitivity analysis shows that the WhatsMiner M70S fleet remains resilient under moderate compression, with payback periods ranging from 23–30 months as USD hashprice decay ranges between 0% and -0.5% per month. Beyond this range, capital recovery becomes unviable. In BTC terms, cumulative production varies up to ~355.5 BTC at a flat BTC hashprice, versus ~158.6 BTC at a -5% monthly decay.

Monthly % Chg (USD Hashprice)	Payback Months
0%	23 Months
-0.5%	30 Months
-1.0%	Never
-1.5%	Never
-2.0%	Never
-2.5%	Never
-3.0%	Never
-3.5%	Never
-4.0%	Never
-4.5%	Never
-5.0%	Never

Monthly % Chg (BTC Hashprice)	Payback Months
0%	355.5 BTC
-0.5%	322.6 BTC
-1.0%	293.8 BTC
-1.5%	268.7 BTC
-2.0%	246.7 BTC
-2.5%	227.3 BTC
-3.0%	210.1 BTC
-3.5%	194.9 BTC
-4.0%	181.4 BTC
-4.5%	169.4 BTC
-5.0%	158.6 BTC

In terms of power cost sensitivity, a 25% higher power rate ($0.050/kWh) extends the M70S fleet's payback period by 13 months (from 23 to 36). Beyond $0.055/kWh, capital recovery becomes unviable.

Electricity cost ($/kWh)

Monthly % Chg (USD Hashprice)	$0.300	$0.350	$0.400	$0.450	$0.500	$0.550
0%	20 Months	21 Months	23 Months	26 Months	36 Months	Never
-0.5%	22 Months	23 Months	30 Months	Never	Never	Never
-1.0%	24 Months	34 Months	Never	Never	Never	Never
-1.5%	40 Months	Never	Never	Never	Never	Never
-2.0%	Never	Never	Never	Never	Never	Never
-2.5%	Never	Never	Never	Never	Never	Never
-3.0%	Never	Never	Never	Never	Never	Never
-3.5%	Never	Never	Never	Never	Never	Never
-4.0%	Never	Never	Never	Never	Never	Never
-4.5%	Never	Never	Never	Never	Never	Never
-5.0%	Never	Never	Never	Never	Never	Never

Using Hashrate Forwards to Finance ASICs

Miners planning fleet refreshes or expansion can utilize Luxor's Upfront Payouts to secure access to capital in advance. In exchange for an upfront lump sum payment, miners can choose between two repayment structures depending on their market outlook: Fixed Hashrate or Fixed Bitcoin.

	Fixed Hashrate Delivery	Fixed Bitcoin Delivery
Strategy	Financing + Hashprice Hedge (Defensive)	Financing + Hashprice Exposure (Offensive)
How it Works	You deliver a set amount of hashrate daily.	You deliver a set amount of bitcoin daily.
Market Position	"I want to remove hashprice volatility and lock in my revenue rate."	"I want to maintain hashprice exposure."
Daily Repayment	Fixed Daily Hashrate	Fixed BTC Amount

1. Fixed Hashrate Repayment (The Hedge)

Best for: Miners looking to reduce volatility or protect against market downturns.

Under this model, you commit a specific amount of hashrate to Luxor for a set term. In return, you receive cash today based on a locked hashprice.

The Benefit: This effectively "locks in" your revenue. If market conditions change, (bitcoin price drops or difficulty spikes), your repayment obligation does not increase. You are protected.

2. Fixed Bitcoin Repayment (The Long Position)

Best for: Miners who are bullish and want to maintain exposure to Bitcoin's upside.

Under this model, you receive cash today but agree to repay a fixed amount of Bitcoin daily via your hashrate.

The Benefit: This creates a leveraged position. If hashprice increases (e.g., bitcoin price goes up), your fixed BTC repayment becomes easier to satisfy relative to your revenue, allowing you to capture that upside.

The Luxor Advantage

Once your Upfront Payout is funded, you can immediately deploy that capital.

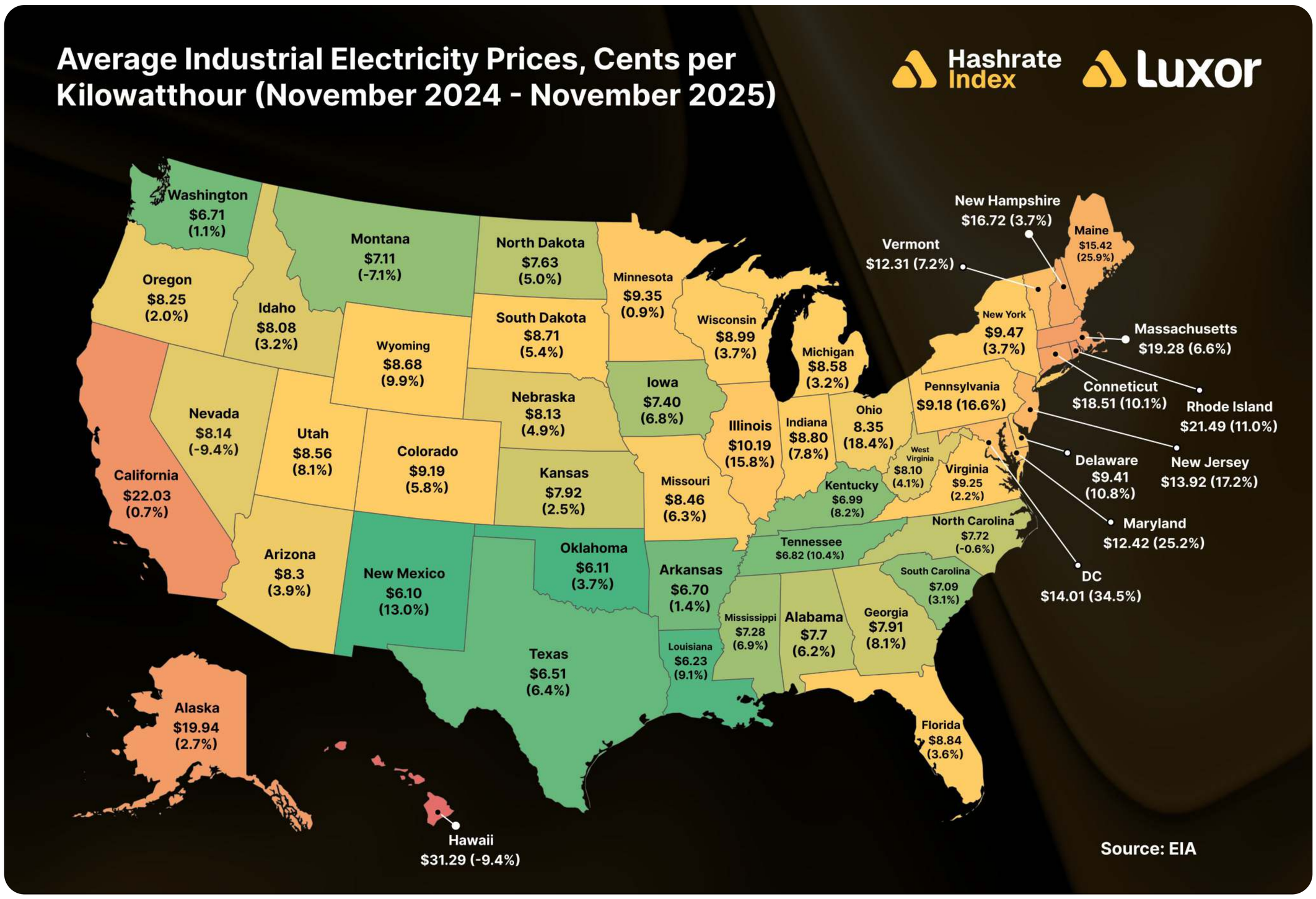
- **Integrated Sourcing:** Luxor's Hardware Trading Desk can help you reinvest these funds directly, giving you access to exclusive deals and bulk pricing.
- **Competitive Rates:** As the market has matured, the implied cost of capital for these structures has dropped significantly — moving from **18–21% down to 6–13% annualized** — making it one of the most efficient ways to fund growth.

4

Energy Markets

Power Price Trends in 2025

According to the Energy Information Administration (EIA), power prices in the U.S. rose over the year, with the average wholesale price for industrial consumers increasing 5.6% from $81.2/MWh to $86.3/MWh between January–November 2024 to 2025.



Average wholesale electricity prices rose across much of the Northeast and Mid-Atlantic. New England and parts of PJM ranked among the highest-cost regions, with double-digit increases.

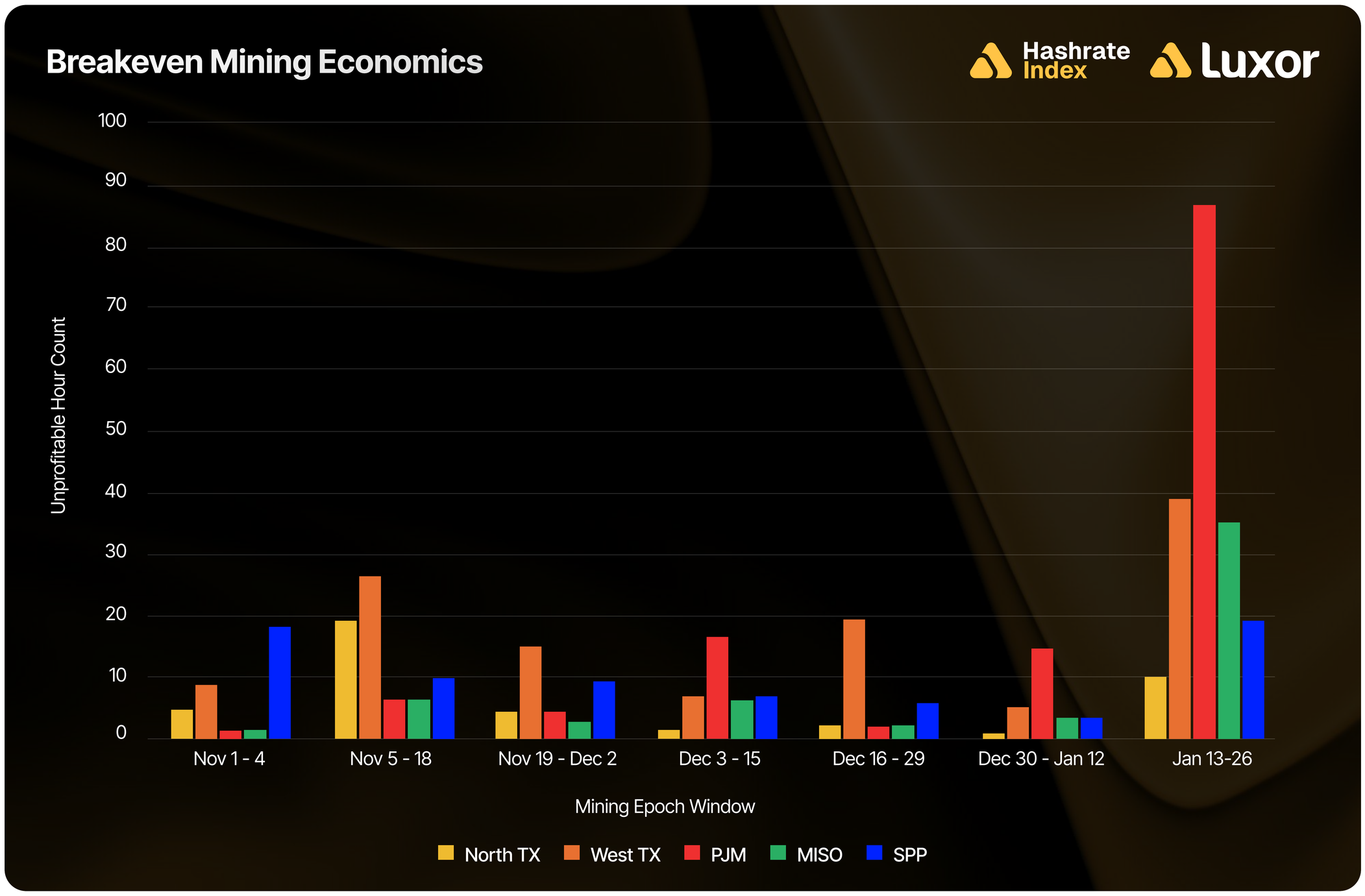
In contrast, the central U.S. retained a clear cost advantage. ERCOT remained one of the most attractive power markets for miners, benefiting from abundant wind and solar generation, and persistent periods of low-to-negative price periods during oversupply. Similarly, SPP continued to offer some of the lowest average power prices in the country, supported by surplus generation capacity.

Power Price Impacts on Bitcoin Mining in 2025

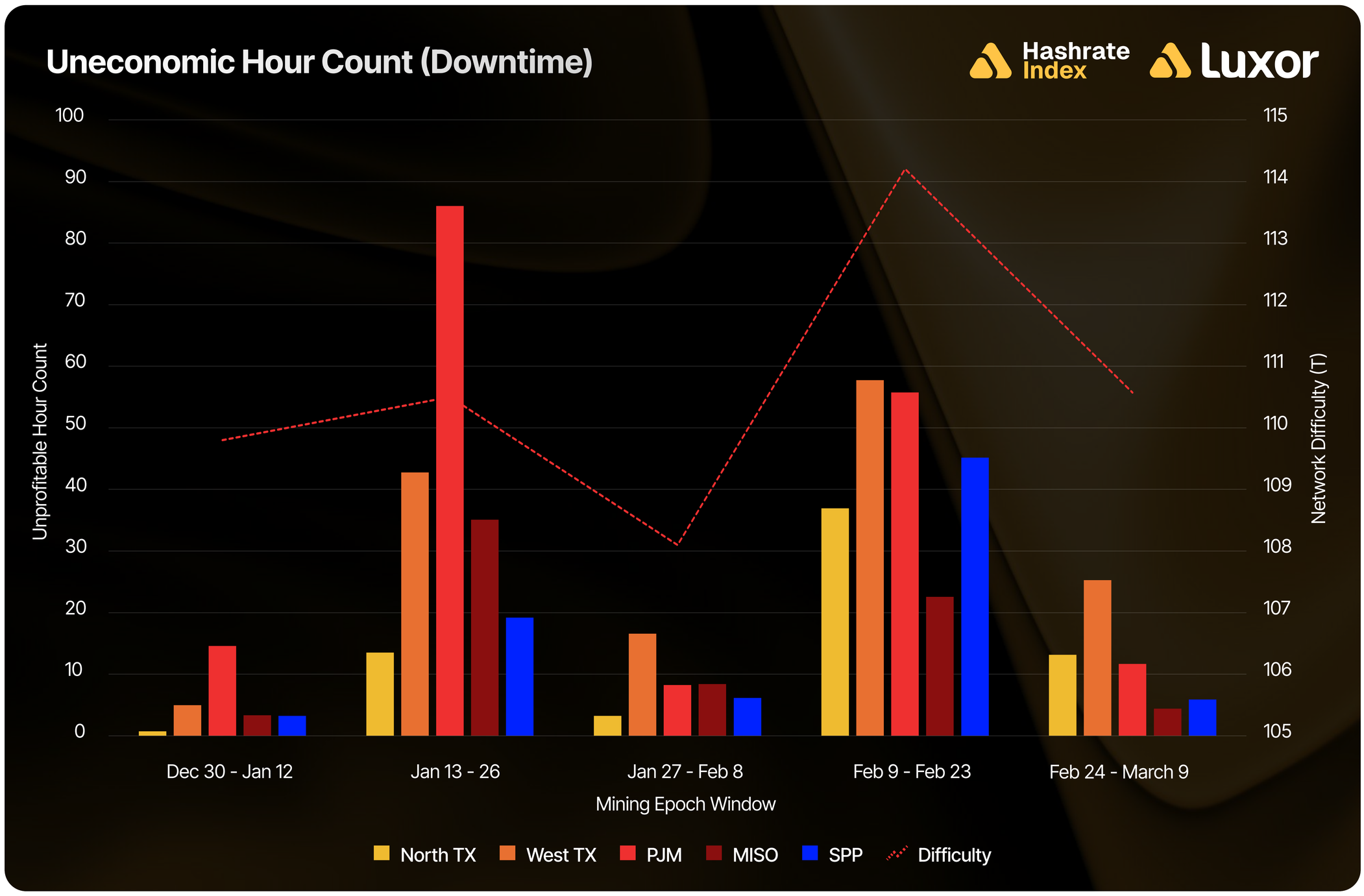
H1-2025

In January 2025, Arctic air swept across the U.S., causing a sharp drop in temperatures from the Midcontinent to the Southeast. This cold front brought freezing conditions and rare snowfall to regions like Texas and the Deep South. The Arctic blast sharply increased U.S. natural gas demand for heating and power, which directly translated to higher electricity costs. Texas, SPP, MISO, and PJM all experienced significant increases in average real-time prices during the January 13–January 26 mining epoch. Higher power prices created uneconomic mining intervals, as cold weather drove up energy costs and reduced mining uptime (particularly in the East, Southeast, and Texas). An uneconomic mining hour is defined as any interval period in which energy hashprice ($/MWh) falls below the average locational marginal price (LMP).

This trend contributed to reduced hashrate and a -2.12% adjustment on January 26, the first drop in network difficulty since September 2024, at the time.



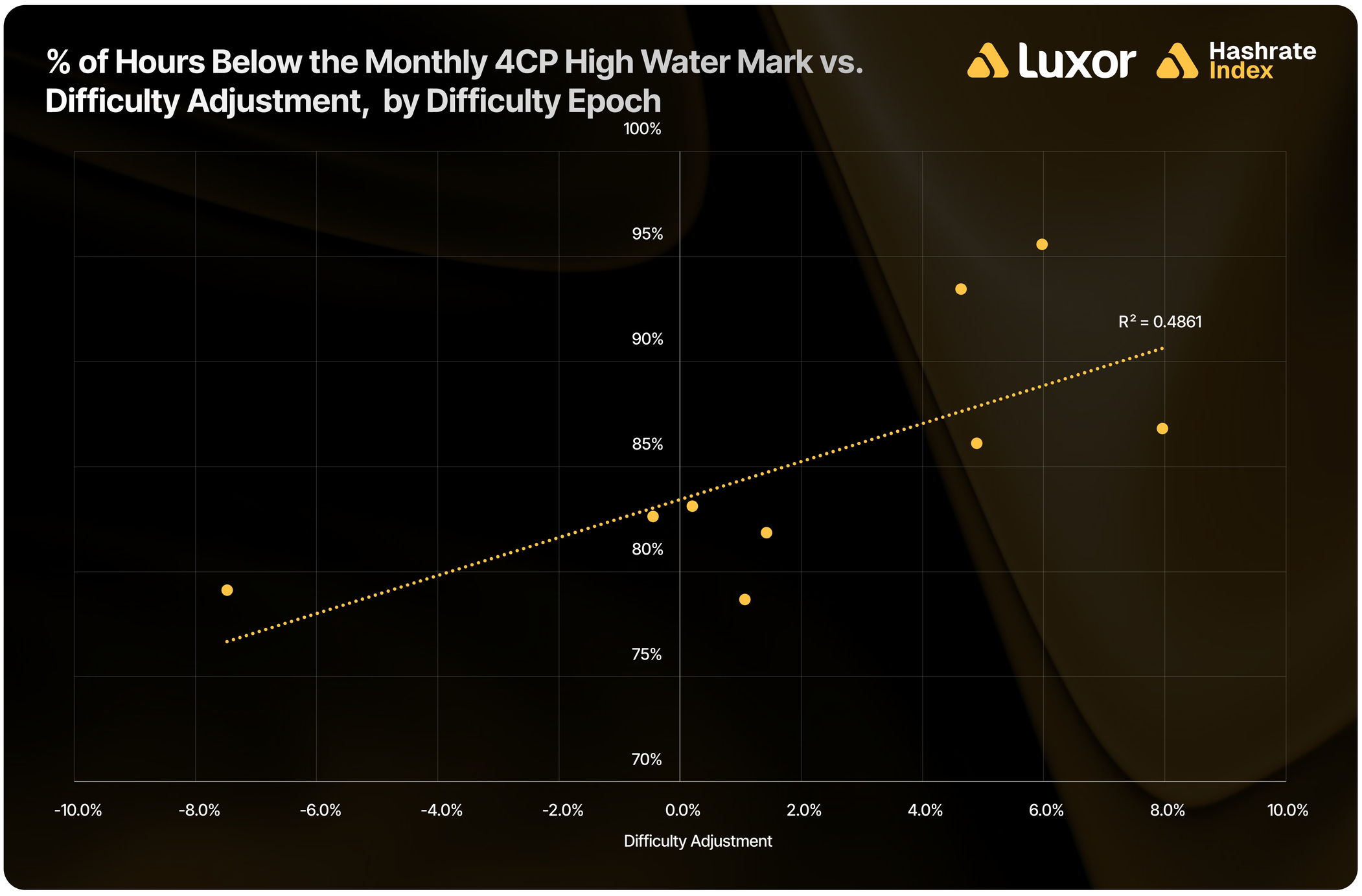
January 2025's weather event was temporary. Throughout the January 27–February 8 epoch, power prices came down and miners reduced curtailment. On February 9, a large 5.61% upward adjustment sent network difficulty up to 114.17T, a new all-time high at the time. However, during the following February 9–February 23 epoch, block times slowed, prompting a -3.15% downward adjustment on February 24 to 110.57T. Like January's, February's cold weather disrupted U.S. power markets, impacting the February 24 difficulty adjustment.



H2-2025

Over the summer, ERCOT's Four Coincidence Peaks (4CP) program was a major driver of network difficulty and hashrate. 4CP measures large industrial customers' demand during the grid's peak-load hours from June – September, typically late afternoons on the hottest weekdays. The benchmark for these intervals is known as the high-water mark, representing the highest observed system load each month. The higher a customer's load during those intervals, the more they pay in transmission charges the following year. To avoid these penalties, many large miners in ERCOT curtail during potential 4CP hours, and the impact is significant: full curtailment during high-risk hours can represent ~6–7% of global network hashrate going offline over the course of a difficulty epoch. On days when grid demand runs well below the monthly 4CP high-water mark, miners often stay online (or even overclock) to maximize revenue.

The chart below illustrates this dynamic:

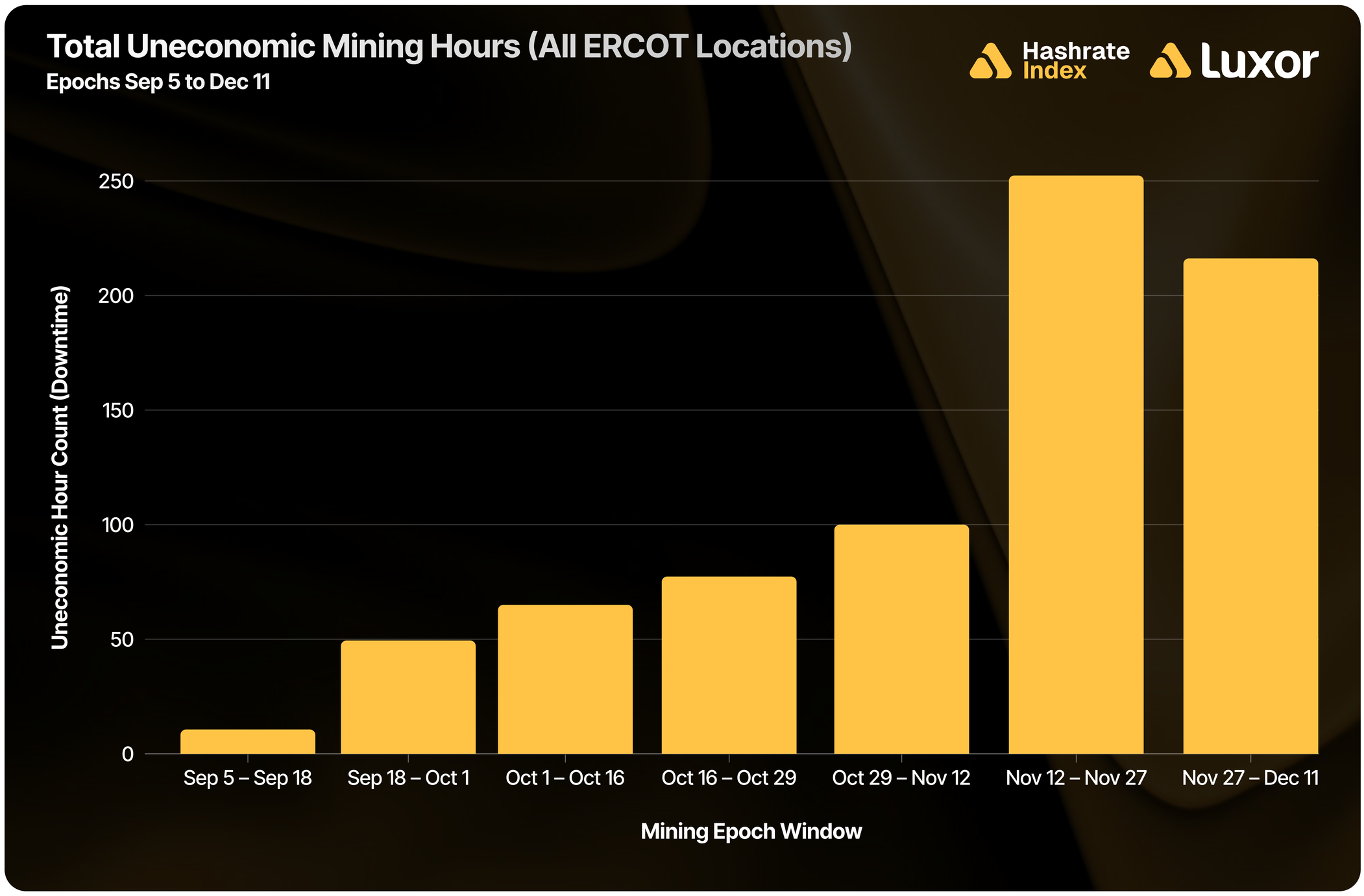


Throughout June – September 2025, we estimate 4CP conditions explained nearly half of the variation in difficulty adjustments ($R^2 \approx 0.49$). The more hours spent four percent or more (≥ 4%) below the rolling monthly 4CP high-water mark, the higher the subsequent difficulty adjustment was. In other words, the more time the grid spent well below the 4CP high-water mark, the more miners stayed online.

In December, a cold snap spanning the Eastern Interconnection pushed the Southeast and Middle South into synchronized load stress. Tennessee Valley Authority (TVA), Duke Energy Progress East (CPLE) and West (CPLW), the South Carolina Public Service Authority (SC), and Southern Company (SOCO) all operated near year-to-date peak demand levels, while Associated Electric Cooperative (AECI) in Missouri exceeded 80% of its annual peak.

This winter synchronicity compressed regional differences that typically provide relief during other seasons. Electric heating demand acted as a common forcing function, pushing load profiles in lockstep. During the cold snap, demand for natural gas also increased, further amplifying power price volatility. For miners, these conditions translated into higher marginal power costs, increased curtailment, and additional short-term downward pressure on network difficulty and hashrate.

The chart below shows the aggregate number of uneconomic mining intervals across September to December's difficulty epochs for all ERCOT settlement points.

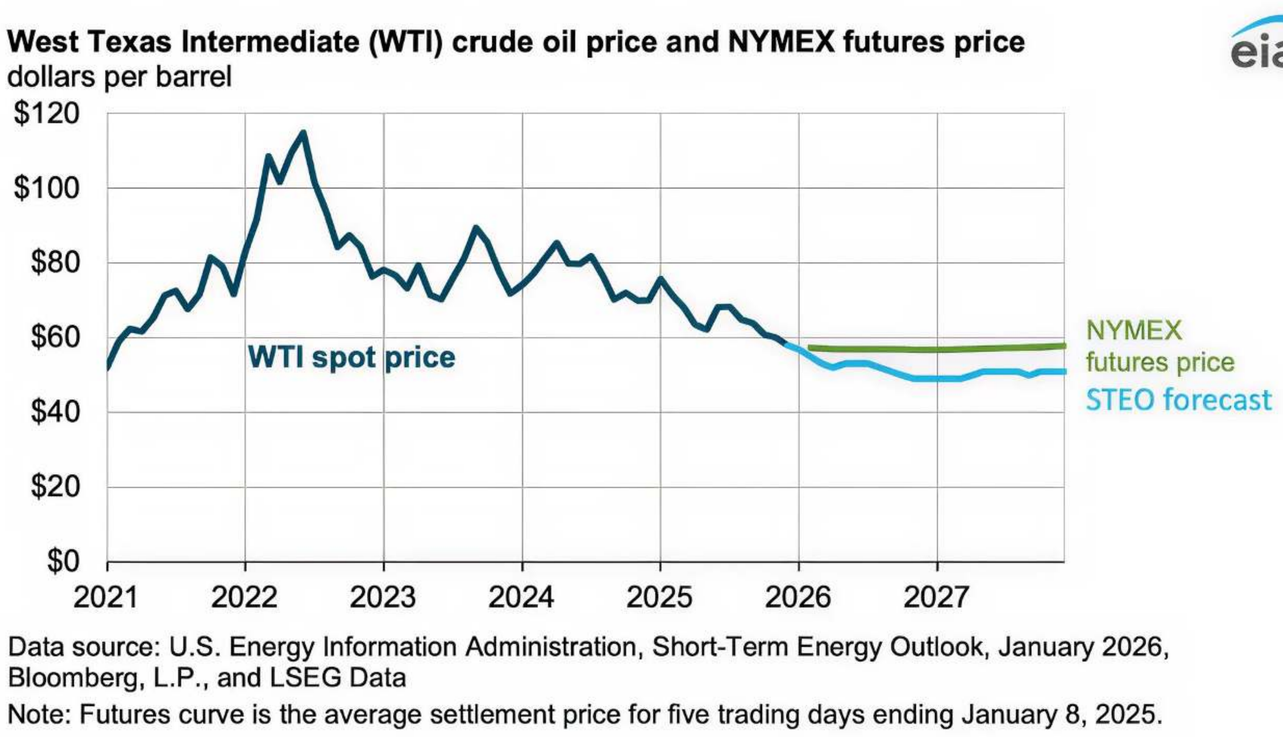


A sharp escalation in uneconomic mining hours was observed over November and December's difficulty epochs, following a steady buildup earlier in the fall. As power prices rose throughout this period, an increasing number of intervals were pushed above miners' breakeven thresholds, forcing operations to curtail.

Short-term Energy Outlook

The EIA's January 2026 Short-Term Energy Outlook anticipates a near-term easing in fuel markets, but structurally higher electricity costs.

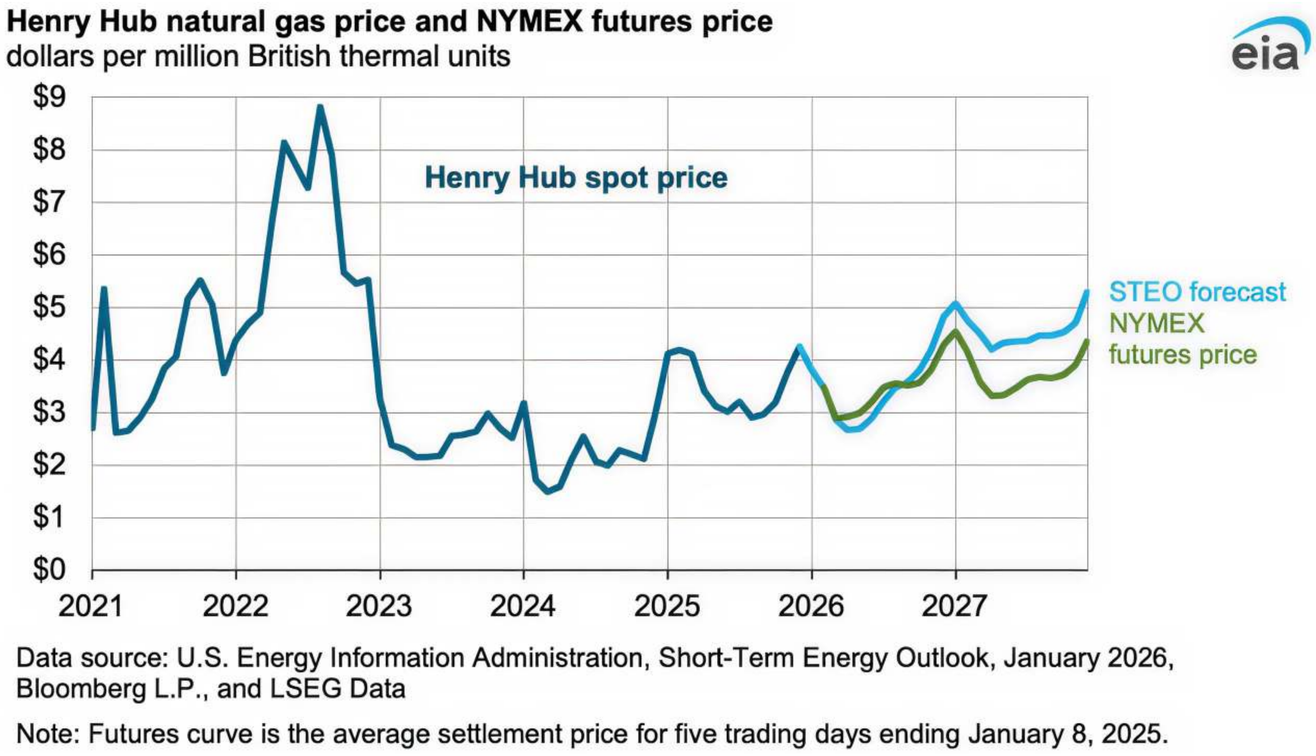
Crude oil prices are forecast to trend lower through 2026 as global supply growth outpaces demand, with WTI falling from an average of roughly $65/bbl in 2025 to the low-$50s in 2026, reflecting rising non-OPEC production and rebuilding inventories.



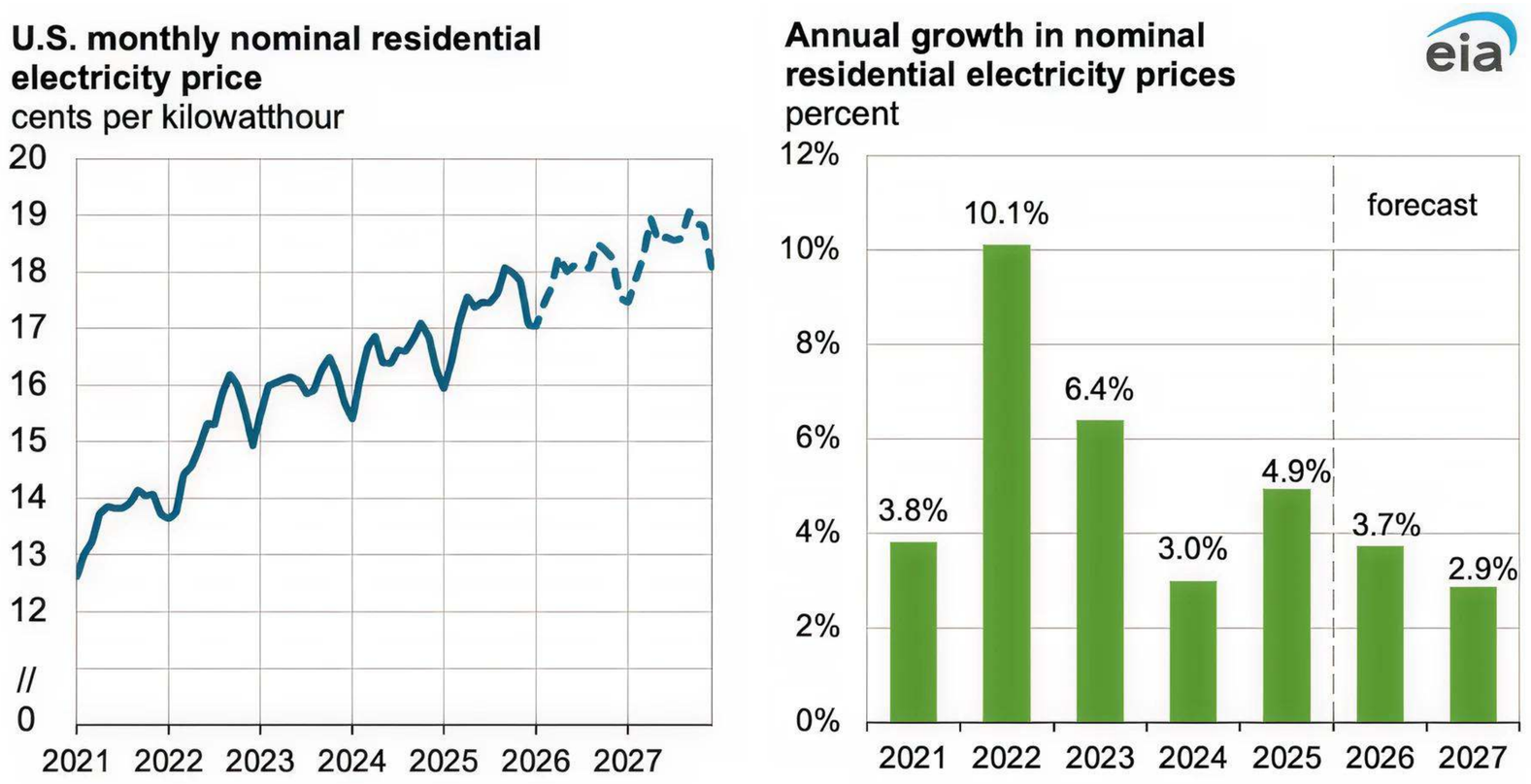
Data source: U.S. Energy Information Administration, Short-Term Energy Outlook, January 2026, Bloomberg, L.P., and LSEG Data

Note: Futures curve is the average settlement price for five trading days ending January 8, 2025.

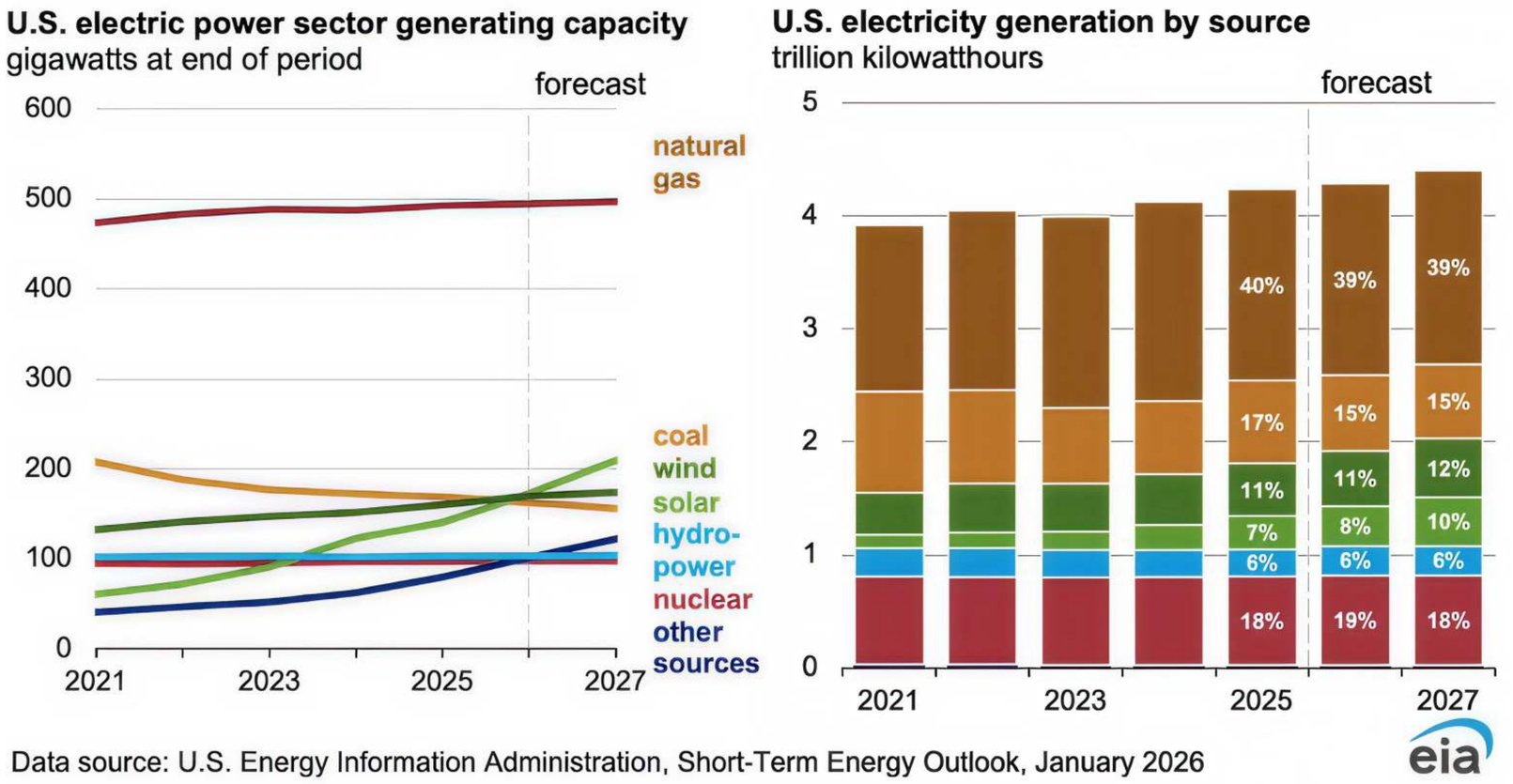
Natural gas is forecasted to tell the opposite story: after a weak 2024, Henry Hub prices rebound sharply in 2025 on stronger power burn and LNG exports, then stabilize in 2026 as production growth catches up and storage normalizes.



Despite lower fossil fuel prices, U.S. retail electricity prices continue to rise, with residential rates increasing ~4–5% in 2025 and remaining elevated into 2026, reflecting grid congestion, transmission investment, and growing demand from data centers and industrial loads.



Generation growth is forecast to remain concentrated in gas, wind, and solar, but rising cooling degree days and steady load growth is anticipated to keep power markets tight in key regions.



Luxor Launches Energy Business to Service 1GW+ of Bitcoin Mining and Data Center Clients

In October 2025, Luxor Technology announced the launch of its new Energy business, Luxor Energy, providing Bitcoin miners with a full suite of energy services, including a Retail Electricity Provider (“REP”) business with Level 4 QSE support, demand response signals, and Intelligent Mining. Luxor, which already manages over one gigawatt of Bitcoin mining machines through LuxOS firmware, has expanded to bring these new energy capabilities to its partners.

Luxor Energy’s REP is positioned as the market-leading franchise, able to accept collateral in bitcoin, with reduced collateral requirements for Luxor Pool users. Luxor will soon be able to auto-pay energy bills for clients, netted against their mining pool balance. Luxor Energy offers clients a holistic view of their mining revenue, miner performance, and power cost in a single, unified dashboard, minimizing operational complexity.

Luxor Energy puts miners on offense by unlocking Demand Response, Ancillary Services, and Peak Avoidance with a single Dispatch Signal. Its plug-and-play signal snaps into any mine-management stack through a simple integration with onsite software.

One of Luxor’s most transformative innovations is Intelligent Mining, a system that continuously tunes mining machines to their optimal performance profile, ensuring every unit of hashrate is deployed for maximum profitability. The system integrates Luxor’s Dispatch Signal with Hashrate Index’s API, feeding this logic into LuxOS firmware. Field results in ERCOT’s West Texas demonstrate an 8–14% improvement in profitability over legacy binary mining operations.

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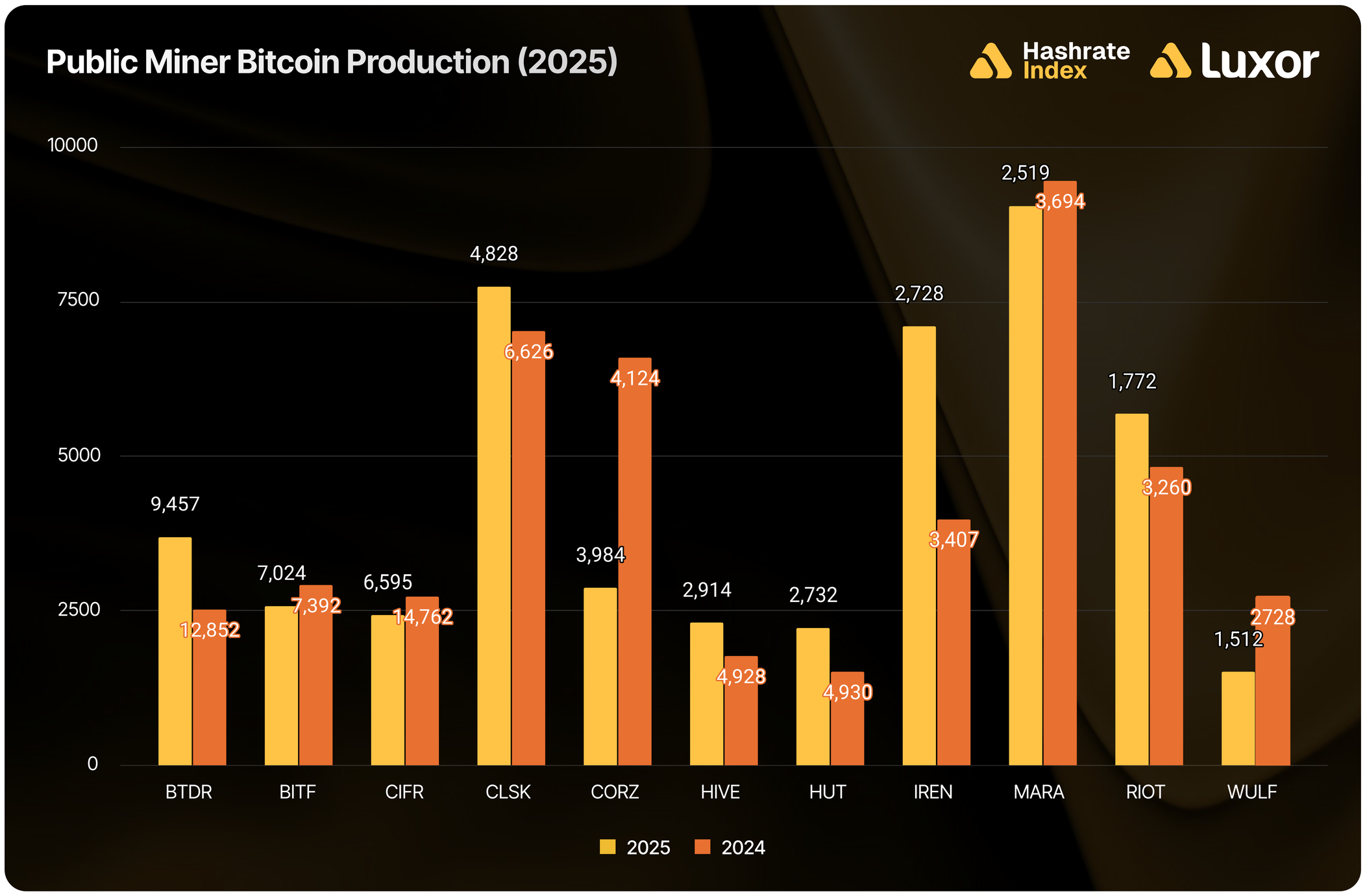
Public Bitcoin Mining Equities

As the public Bitcoin mining market continues to evolve, miners have expanded their compute operations beyond SHA-256, driven by the continued compression in mining economics on the one hand, and an influx of investment capital for artificial intelligence (AI) and high-performance computing (HPC) data center demand on the other.

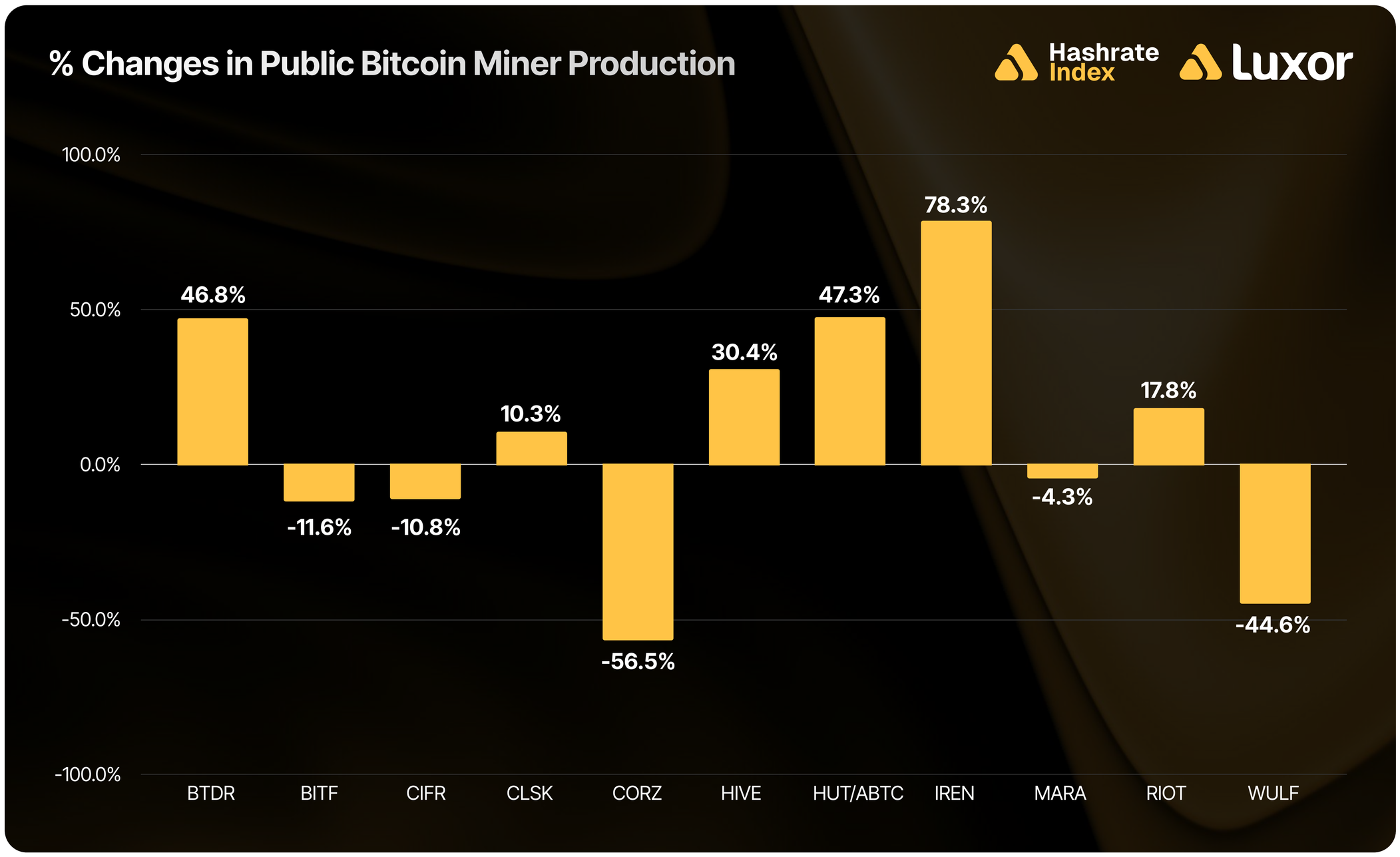
Operational Updates

Bitcoin Production

The cohort of 11 publicly traded bitcoin miners we track produced a total of 47,217 BTC in 2025 compared to 46,065 BTC in 2024, a 2.5% increase overall.

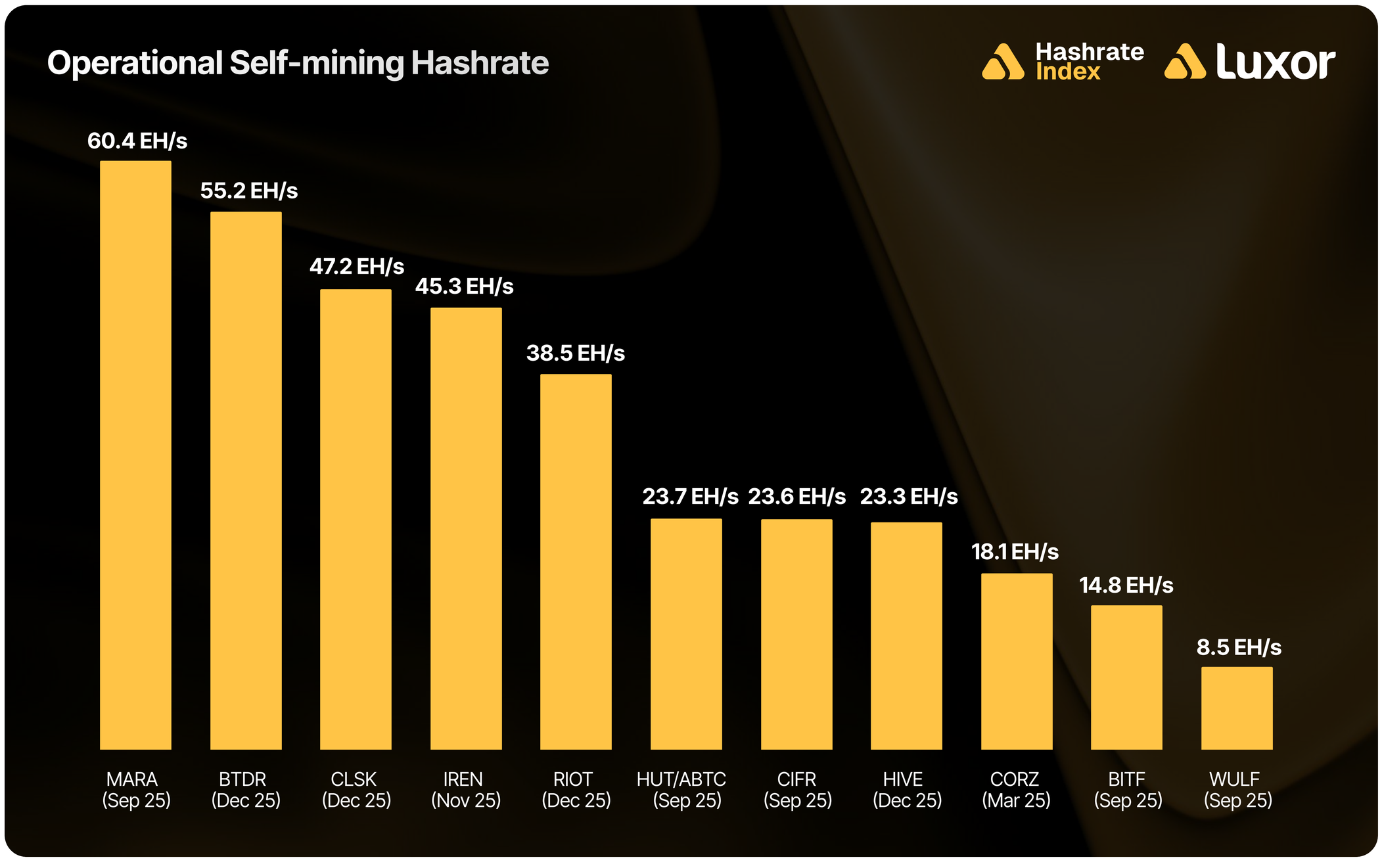


From a percentage change perspective, a few miners stood out, namely BTDR, HIVE, HUT, and IREN.

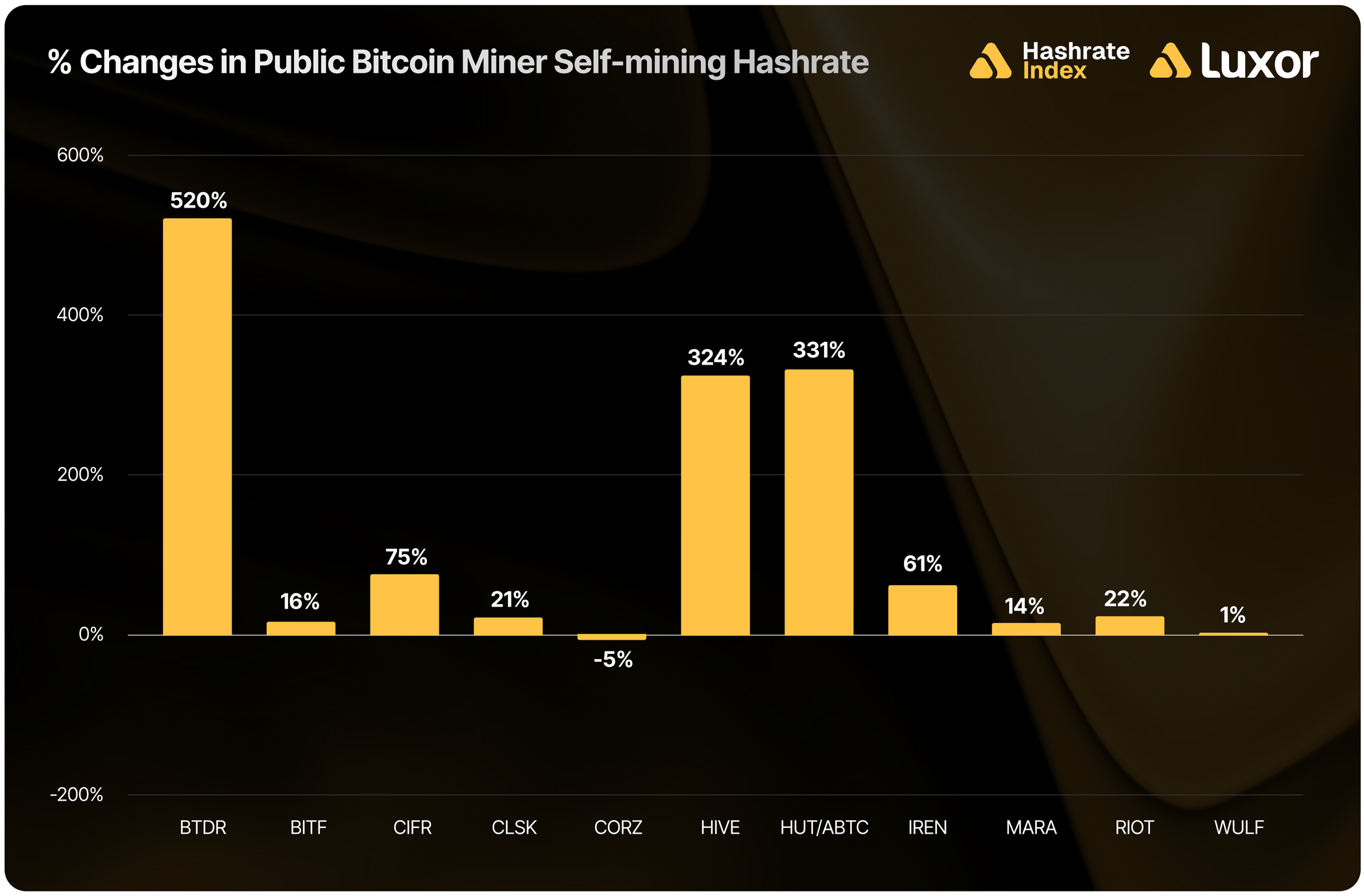


Hashrate Growth

Our cohort of bitcoin miners expanded self-mining hashrate substantially over 2025. Starting the year at ~229.9 EH/s, these 11 miners boasted a total capacity of ~358.6 EH/s by year-end, a 56.0% increase. Their proportion of the global network hashrate increased from 28.7% to 33.4%, a 4.7 percentage point gain.



Note: Figures based on latest publicly available data based on monthly production updates



AI/HPC Pivots

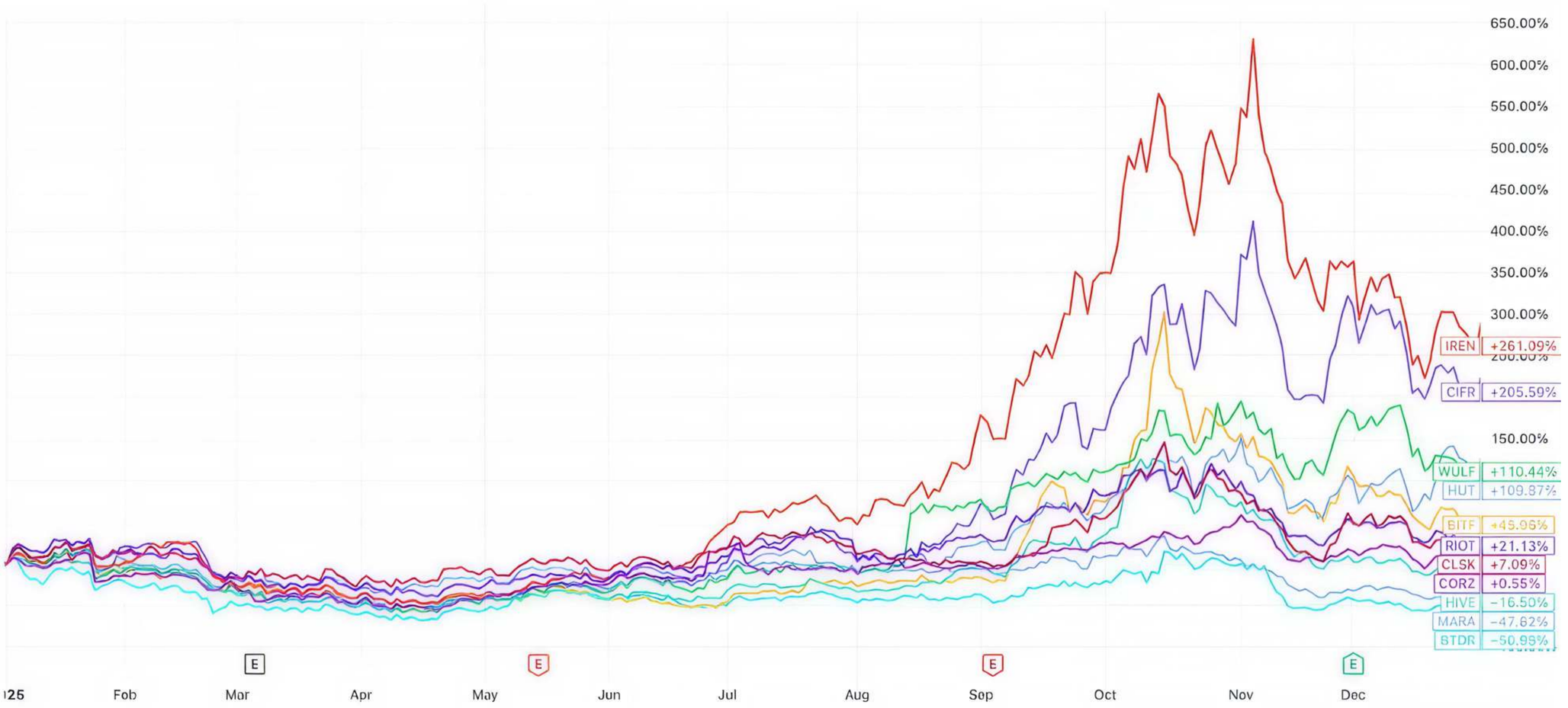
Bitcoin mining is increasingly functioning as a bootstrap mechanism for digital infrastructure buildouts. It is the first buyer of power, bringing capital, grid access, and demand together. ASICs can tolerate volatility, imperfect infrastructure, and interruptibility, allowing projects to energize land, substations, and generation years before traditional compute can justify deployment. This turns speculative infrastructure sites into cash-flowing assets.

In 2025, some publicly traded bitcoin mining companies proved this thesis as a front-loaded monetization layer while engineering sites for downstream AI/HPC conversion. By de-risking early capital deployment with mining revenues, they gave investors a chance to gain exposure to AI infrastructure without immediate execution risk, shortening payback periods, and stabilizing balance sheets during permitting, construction, and tenant onboarding stages. This has created an opportunity in capital markets, and credible candidates have been awarded. As AI demand globalizes and power scarcity intensifies, capital will favor players that can move from electrons to earnings immediately.

Financial Performance

2025 was a mixed bag for Bitcoin mining equities. Instead of high-beta bitcoin plays, investors now perceive Bitcoin mining equities as an opportunity to gain exposure to AI/HPC buildouts. However, not all miners saw the same treatment. In 2025, credible pivots stood out, whereas pure-play and transitioning operators saw divergent outcomes.

Among the 11 publicly traded miners we track, share price performance varied significantly. Some miners in our cohort experienced remarkable gains, while many others suffered notable declines. The market capitalizations of these companies range from under $1.0 billion to over $15.50 billion, highlighting the size and scale of competition in the industry.



Generally speaking, public Bitcoin miners experienced divergent fortunes in 2025: AI/HPC pivots won, whereas pure-play miners suffered.

The table below summarizes annual changes in share price and current market capitalizations for the 11 public miners we track.

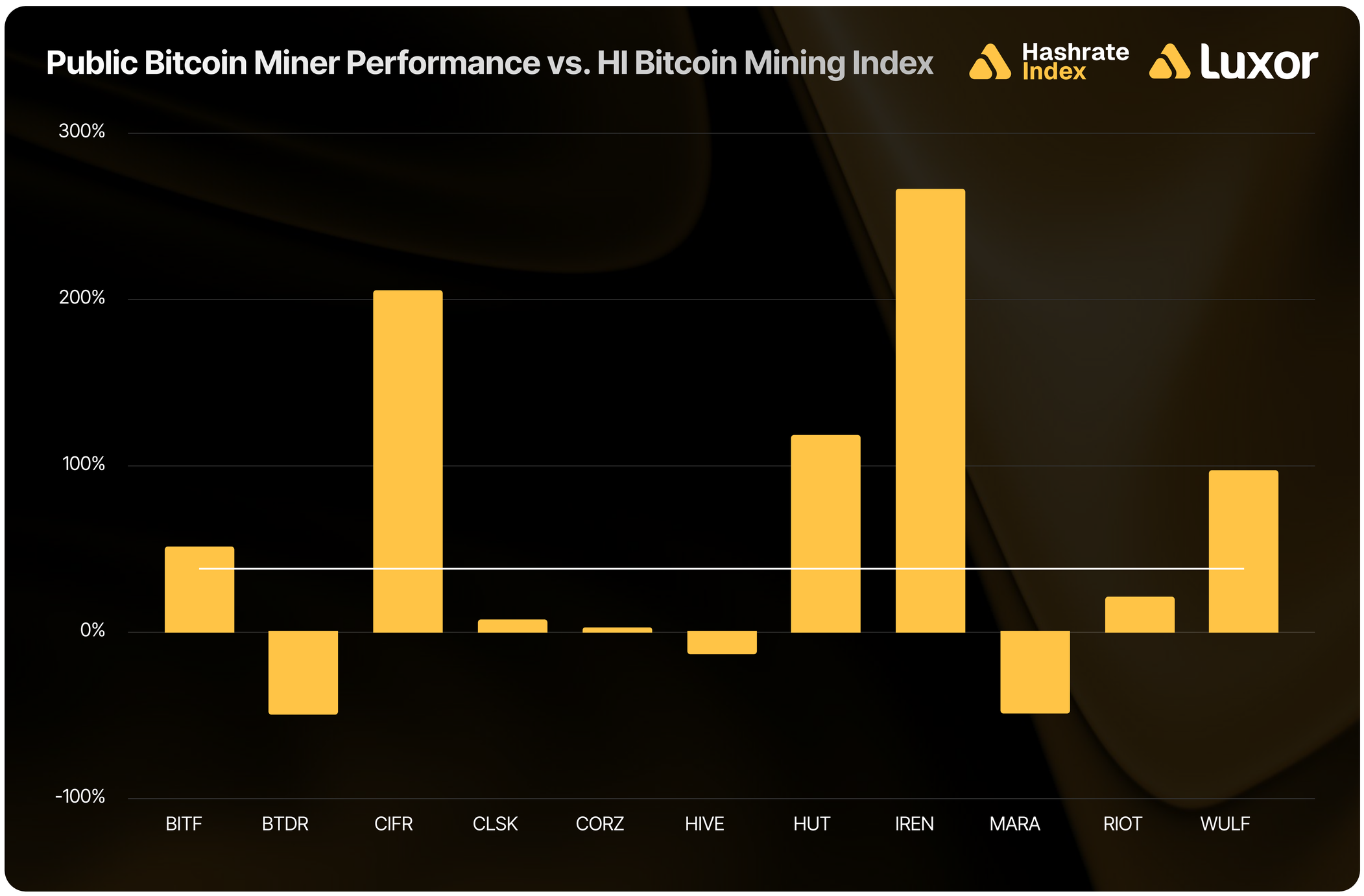
Ticker	Share Price, % Change (YoY)
BITF	$2.35 (+50.6%)
BTDR	$11.21 (-49.1%)
CIFR	$14.76 (+205.0%)
CLSK	$10.12 (+7.1%)
CORZ	$14.56 (+2.0%)
HIVE	$2.58 (-13.1%)
HUT	$45.94 (+117.7%)
IREN	$37.77 (+266.3%)
MARA	$8.98 (-48.6%)
RIOT	$12.67 (+20.8%)
WULF	$11.49 (+20.8%)

IFR (+205.0%) and IREN (+266.3%) led the group with outsized gains, reflecting strong operations and improving investor confidence. HUT (+117.7%) also delivered a strong year, while BITF (+50.6%), RIOT (+20.8%), and WULF (+20.8%) posted more moderate but positive returns. The common denominator among these companies was a general success story towards the AI/HPC transition.

Performance was more muted for CLSK (+7.1%) and CORZ (+2.0%). On the downside, BTDR (-49.1%), MARA (-48.6%), and HIVE (-13.1%) lagged peers, highlighting divergent outcomes.

Hashrate Index's Bitcoin Mining Stock Index

Hashrate Index's Bitcoin Mining Stock Index uses a quantitative hashrate-weighted methodology to identify and weigh a portfolio of approximately 30 publicly listed Bitcoin mining companies. Using this data we can benchmark stock price performance relative to the industry average.
In 2025, eight miners we track outperformed the index, whereas others underperformed.



Hashrate Index's Bitcoin Mining Stock Index posted a 38.1% return; the average return from our cohort was 60.0% in comparison, with the majority of outperformance driven by AI/HPC pivots.

Correlations

Public mining equities have historically had a positive correlation to not only the price of bitcoin but also with each other. However, there has been a divergence between BTC and mining markets since 2024, suggesting that equity market perceptions are driving valuations rather than mining economics.

The table below summarizes the correlation matrix between the 11 miners we track and bitcoin:

Correlations Matrix	BTDR	BITF	CIFR	CLSK	CORZ	HIVE	HUT	IREN	MARA	RIOT	WULF	Bitcoin
BTDR	1											
BITF	0.47	1										
CIFR	0.56	-0.05	1									
CLSK	0.43	-0.03	0.72	1								
CORZ	0.49	-0.03	0.59	0.51	1							
HIVE	0.40	0.01	0.55	0.53	0.39	1						
HUT	0.68	0.04	0.46	0.35	0.48	0.41	1					
IREN	0.51	0.01	0.80	0.02	-0.06	-0.03	-0.07	1				
MARA	0.46	0.02	0.51	0.61	0.40	0.71	0.44	0.42	1			
RIOT	-0.04	0.88	-0.05	0.02	-0.03	-0.01	-0.02	0.01	0.03	1		
WULF	0.49	-0.04	0.60	0.54	0.62	0.59	0.51	0.55	0.60	0.69	1	
Bitcoin	0.06	-0.01	0.07	0.08	0.03	0.06	0.02	0.06	0.07	0.07	0.04	1

Across the miner universe, correlations reflected a growing influence of non-Bitcoin revenue narratives. In 2024, most miners exhibited moderate to high intra-sector correlations (generally 0.6–0.75), while correlations to bitcoin itself were near zero, underscoring that miner equities were trading more on idiosyncratic factors such as balance sheet, cost structure, and execution risk than on BTC beta.

In 2025, dispersion increased. Several names — particularly IREN, CIFR, BITF, and HUT — showed declining correlation with legacy pure-play miners, consistent with their AI/HPC pivots reframing investor perception toward infrastructure and compute optionality rather than pure hashrate growth. Bitcoin correlations remained low, but the miner cohort bifurcated further into digital infrastructure platforms and mining-first operators.

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Capital Markets in Bitcoin & Mining

Capital Markets Landscape

Capital markets play a critical role in the Bitcoin and mining ecosystem, enabling growth and scalability by providing access to funding, liquidity, and risk management tools. In 2025, these markets evolved significantly, responding to the increasing institutional adoption of Bitcoin. Bitcoin mining companies now have access to a sophisticated suite of tools for raising capital and managing risk, having moved past pure reliance on traditional debt and equity issuance. In 2025, hashrate derivatives went mainstream and grew exponentially, paving the way to Bitcoin-native financing for miners, and BTC-denominated yield opportunities for investors.

Meanwhile, the advent of Bitcoin treasury companies provided a crash course in corporate finance — with Strategy standing out as a case study — and the ongoing AI/HPC pivot offered a new avenue for credible candidates to diversify compute revenues and attract capital.

Hashrate Derivatives

Bitcoin mining companies use hashrate forward contracts to hedge against hashprice volatility, and to finance fleet expansions. These over-the-counter (OTC) contracts allow miners (sellers) to lock in a future hashprice, mitigating the risk of fluctuations in bitcoin price, network difficulty, and transaction fees. For investors (buyers), hashrate forwards a unique opportunity to gain exposure to SHA-256 hashrate without the complexity of operating hardware and infrastructure. There are two types of hashrate forward contracts, Non-deliverable Forwards (NDFs), and Deliverable Forwards (DFs), which differ in terms of settlement.

NDFs entail cash settlement: hashrate underlying the contract is not actually delivered. Daily positions are settled in USD or BTC based on the difference between the contract's fixed forward hashprice, and the daily spot settlement hashprice, as measured by Luxor's Bitcoin Hashprice Index. On the other hand, DFs entail actual physical delivery: the buyer agrees to purchase a certain amount of daily hashrate which is continuously delivered for a fixed duration at a fixed forward hashprice. In return, the seller receives USD or BTC payment daily or upfront. In bitcoin mining terms, NDFs can be summarized as Fixed Pool Payouts, whereas DFs can be summarized as Upfront Pool Payouts. All settlements for both types occur through Luxor Pool.

OTC hashrate forward contracts provide custom terms tailored to the needs of both miners and investors, offering flexibility. However, they entail counterparty risk. Since the DF involves upfront payment, it tends to trade at a discount to the NDF, compensating the buyer for the inherent credit risk involved in actual physical hashrate delivery for the duration of the contract. This discount differential between DFs relative to NDFs can be interpreted as the interest rate in hashrate-based lending markets. In 2025, that yield (cost of capital) was 6–13% annualized.

Bitcoin miners (sellers) can use Luxor's DFs to achieve their financing goals, leveraging assets they already own to get a low cost of capital in BTC or USD. On the other side of these contracts, Bitcoin investors (buyers) can earn BTC yield from miners and have the option of a fixed or variable return. Buyers and sellers of the DF can pair a DF trade with the NDF to lock-in a fixed yield (cost of capital).

Equity Markets

Bitcoin mining companies utilize equity markets to raise capital by issuing shares through public offerings (IPOs or secondary offerings) or private equity placements, enabling them to finance operations, expand infrastructure, and purchase mining hardware.

Debt Markets

Bitcoin mining companies use debt markets to raise capital by issuing instruments such as traditional loans, bonds, or convertible notes. Debt financing allows for access to immediate liquidity without diluting equity ownership, making it a strategic choice for public miners.

Buyers use vanilla debt markets for fixed income returns, which appeal to investor profiles seeking steady cash flow. Convertible notes are hybrid securities: they provide interest payments with the option to convert into equity, providing additional upside exposure.

Capital Markets Activity in 2025

In 2025, capital markets activity focused on balance sheets, asset consolidation, and adjacent infrastructure rather than greenfield mining expansion. Riot's Rockdale facility acquisition from Rhodium set the stage at the site level, while CleanSpark, Cipher Mining, Hut 8, and Bitdeer repeatedly accessed convertibles, secured debt, and ATM equity to extend runway or fund access to power and AI/HPC optionality. Capital raise activity outweighed M&A as miners adapted to compressed margins and rising difficulty.

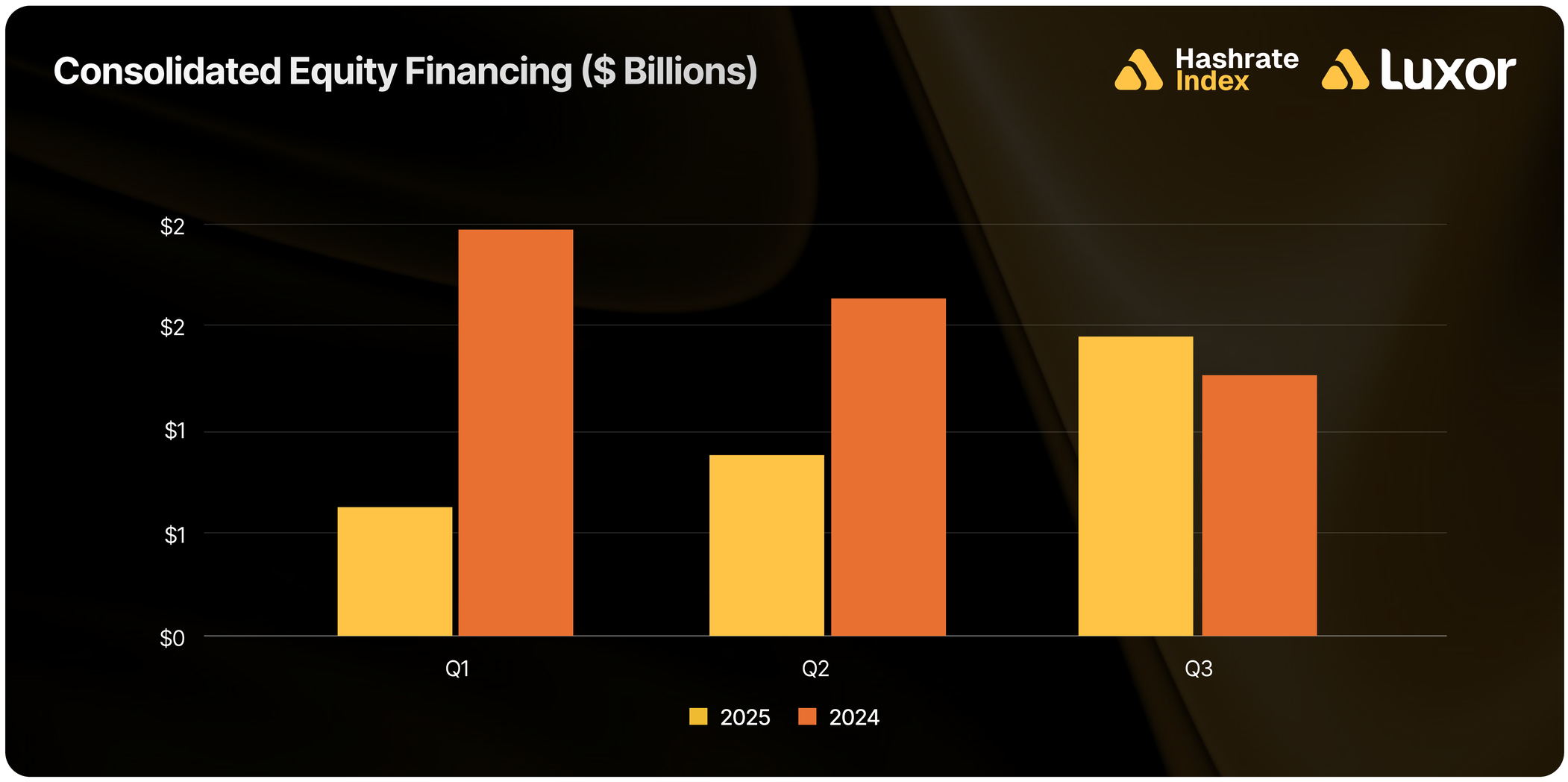
Capital raises included Antalpha's $49.3M IPO, and WhiteFiber's $183.3M IPO, whereas mergers & acquisitions included HIVE's $85M Yguazú acquisition. A summary of 2025's bitcoin mining deals from the most active investment banks in the industry are shown below:

	Capital Raise		Mergers and Acquistions	
Advisor Name	Value ($m)	# Deals	Value ($m)	# Deals
KBW (Stifel)	$10,658	15	N/D	3
H.C Wainwright & Co.	$10,647	15	-	-
B. Riley	$9,032	19	N/D	1
Canaccord Genuity	$3,250	4	-	-
BTIG	$1,150	1	-	-
Cohen & Co.	$150	1	$111	1

ND indicates deal value not disclosed by the firm. All deals shown are best estimates based on publicly available information and should not be considered a comprehensive record of all industry transactions for the year.

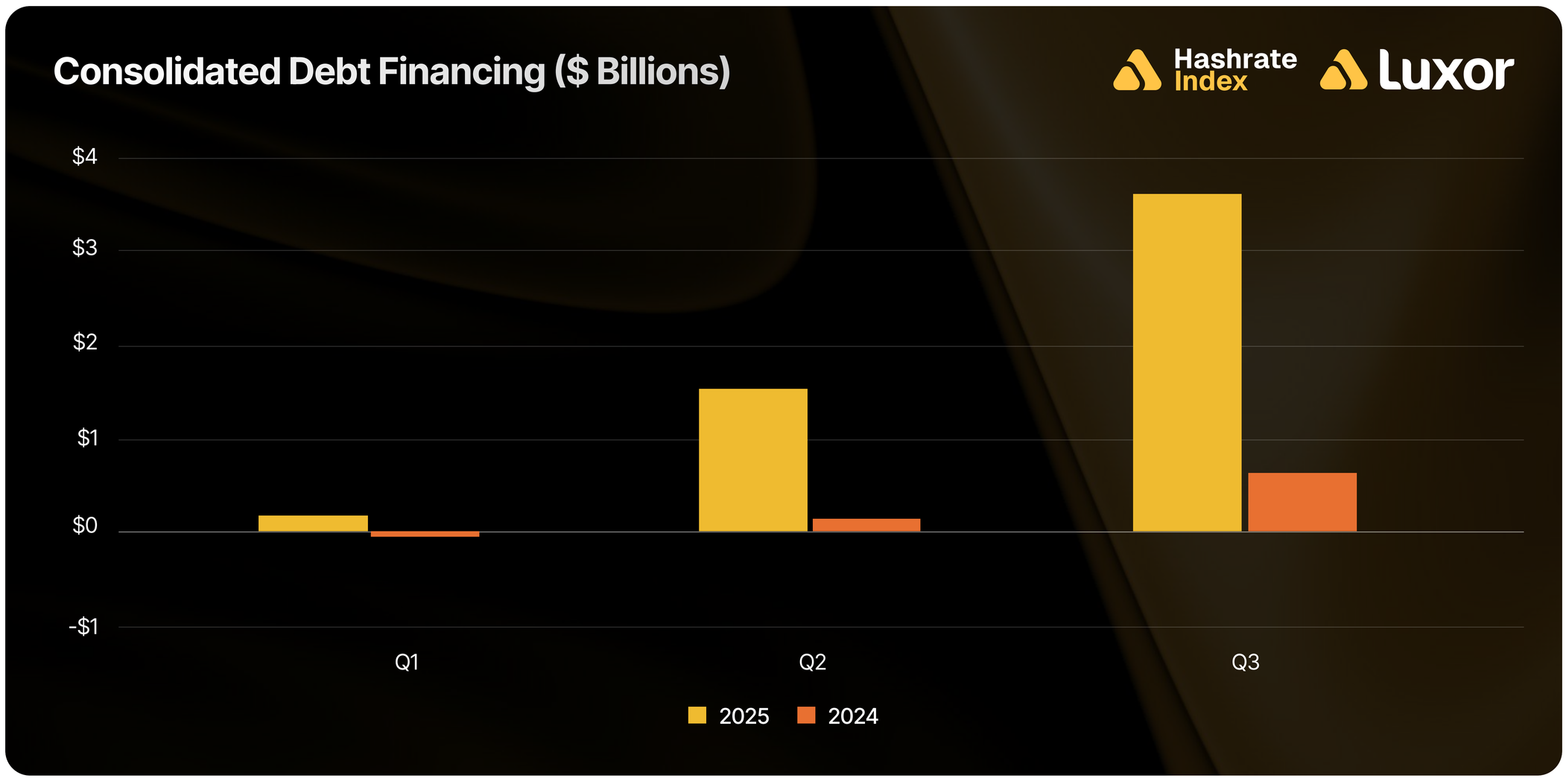
Estimated Capital Raises

In the first nine months of 2025, public miners increasingly utilized At-the-Market (ATM) equity issuances, raising an estimated $3 billion through equity markets. Although the rate of issuance ramped up throughout the period, equity raises came in at a lower absolute level compared to the prior period in 2024, when miners raised over $5 billion, since there was heightened investor interest driven by the fourth halving and the approval of spot Bitcoin ETFs.



Source: TheMinerMag

Public miners consistently utilized debt instrument issuances as well, raising over $5 billion over the same period. In contrast, miners spent Q1-2024 paying down debt, followed by strategically borrowing $700 million after the 2024 halving to continue raising capital for expansion, primarily through the issuance of convertible notes.



Mergers & Acquisitions

M&A activity in 2025 were few and far in between, reflecting a decisive shift toward purchasing power-secured, infrastructure-heavy assets. Riot's Rockdale facility continued to anchor its strategy, underscoring how early, large-scale power positioning compounds in value as grid access tightens and alternative compute demand rises. Bitfarms' closure of the Stronghold merger reinforced this theme, prioritizing vertically integrated power and scale over incremental hashrate growth. HIVE's $85 million acquisition of the Yguazú site extended its consolidation wave in South America, locking in long-duration hydro power.

Treasury Companies Stole the Spotlight

The rise of Bitcoin treasury companies in 2025 was a trending topic in capital markets. What began as balance-sheet experimentation evolved into a new playbook for capital formation, leverage, and duration matching, with Strategy emerging as a clear case study. By evolving through a range of security issuance rounds spanning traditional convertible debt to novel innovations in perpetual preferred equities, these firms demonstrated how public markets can be used to accumulate bitcoin at scale. The result was a reframing of corporate valuation from cash flows to credibility, forcing investors to reassess shareholder dilution and leverage through a Bitcoin lens. In doing so, treasury companies pulled attention away from bitcoin mining narratives, and deal flow followed the money.

Below is a list of select recent financings transactions by public miners and treasury companies throughout 2025:

Closed Date	Issuer	Gross Proceeds ($M)	% of Market Cap	Financing Type	Investor(s)	Maturity	Interest / Div.	Convert Price / Prem.	Warrants	Warrant Strike $	Exp. Dilution %	Δ% in Stock Since Ann.
12/8/2025	Twenty One Capital	$959	959%	$472M Common Equity & $487M Convertible Notes	SoftBank, Tether, Bitfinex	12/1/2030	1.00%	$13.00, 30.0%	-	-	-	(6.00%)
12/8/2025	IREN	$1,632	12%	Registered Direct Offering at $41.12 / sh.	Syndicated	-	-	-	-	-	14%	(15.71%)
12/8/2025	IREN	$2,300	15%	Convertible Senior Notes	Syndicated	6/1/2032; 6/1/2023	0.25%, 1.00%	$51.40, 25.0%	-	-	7%	(15.71%)
12/5/2025	ProCap Financial	$767	307%	$532M Common Equity & $235M Convertible Notes	Syndicated	12/5/2028	0.00%	$13.00, 30.0%	-	-	-	(69.80%)
11/24/2025	Cipher Mining	$333	6%	Senior Secured Notes	Syndicated	11/15/2030	7.125%	-	-	-	-	+3.90%
11/13/2025	Applied Digital	$2,350	27%	Senior Secured Notes	Syndicated	6/1/2030	9.25%	-	-	-	-	(22.37%)
11/13/2025	CleanSpark	$1,150	26%	Convertible Senior Notes	Syndicated	2/15/2032	0.00%	$19.16, 27.5%	-	-	21%	(29.95%)
11/13/2025	Bitdeer Technologies Group	$400	14%	Convertible Senior Notes	Syndicated	11/15/2031	4.00%	$17.77, 27.5%	-	-	12%	(28.50%)
11/13/2025	Bitdeer Technologies Group	$149	5%	Registered Direct Offering at $13.94 / sh.	Syndicated	-	-	-	-	-	6%	(28.50%)
11/13/2025	Cipher Mining	$1,400	16%	Senior Secured Notes	Syndicated	11/15/2030	7.125%	-	-	-	-	(33.26%)
11/13/2025	Strategy	$715	1%	STRE Perpetual Preferred Stock	Syndicated	-	10.00%	-	-	-	-	(41.07%)
11/10/2025	Strive	$160	17%	Variable Rate Perpetual Preferred Stock	Syndicated	-	12.00%	-	-	-	-	(38.75%)
11/6/2025	Tharimmune	$545	2,428%	Common Equity PIPE at $3.08 / sh.	DRW, Liberty City, Canton Foundation[1]	-	-	-	-	-	2,329%	(12.20%)
11/5/2025	AVAX One (AgriFORCE)	$219	6,939%	Common Equity PIPE at $2.56 / sh.	Hivemind, ParaFi, Galaxy, Kraken	-	-	-	-	-	7,096%	(43.15%)

2025 Bitcoin Mining Transactions | Source: Cohen & Company

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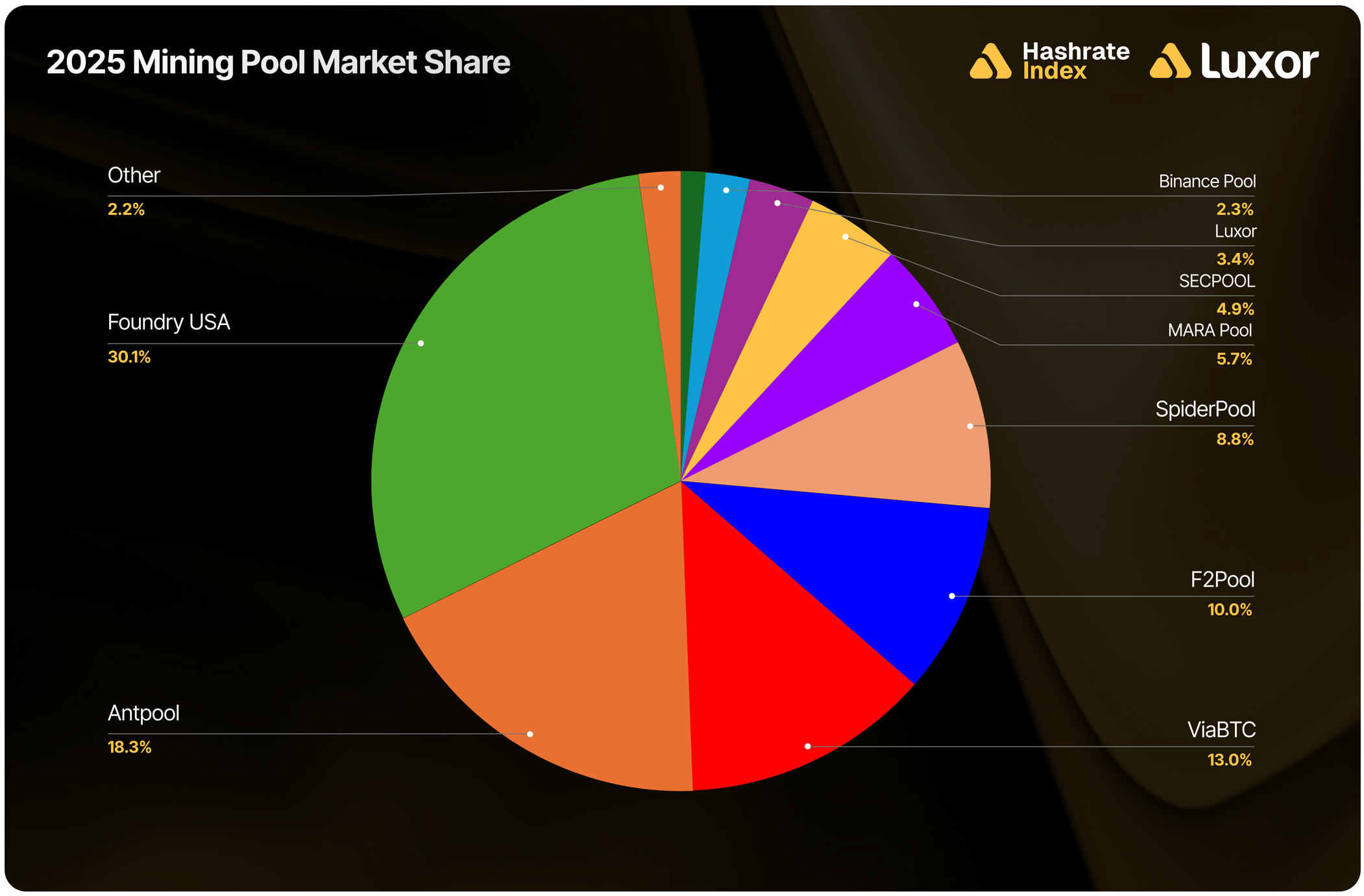
Mining Pools and Firmware

Mining Pools

Pooled mining emerged in 2011 as a structural response to exponential hashrate growth. As difficulty rose, solo mining became unviable, pushing miners to aggregate hashes for more frequent rewards and lower variance. Pools became a necessary tool for transforming probabilistic block discovery into predictable revenue streams.

Since then, bitcoin mining pools have evolved well beyond basic reward aggregation. Institutional demand forced higher standards, and leading pools achieved System and Organization Controls (SOC) compliance certifications for enterprise-grade reliability. Innovation in payout methods accelerated this shift.

In 2025, the competitive frontier moved further up the mining stack. The best pools now integrate firmware, fleet management, energy, and finance. SHA-256 hashes are increasingly being treated as a risk-managed compute commodity, and the best miners are continuously optimizing operations based on real-time markets in bitcoin mining and electricity. The pools that matter today are much more than just endpoints for hashrate.



Rank	Dec-18	Dec-19	Dec-20	Dec-21	Dec-22	Dec-23	Dec-24	Dec-25
1	BTC.com	BTC.com	f2pool	f2pool	foundry	foundry	foundry	foundry
2	ANTPOOL	f2pool	Poolin	ANTPOOL	ANTPOOL	ANTPOOL	ANTPOOL	ANTPOOL
3	SLUSH POOL	Poolin	BTC.com	Poolin	f2pool	f2pool	ViaBTC	ViaBTC
4	ViaBTC	ANTPOOL	ANTPOOL	ViaBTC	BINANCE POOL	ViaBTC	f2pool	f2pool
5	BTC.TOP MINING POOL	SLUSH POOL	Huobi	BINANCE POOL	ViaBTC	BINANCE POOL	MARATHON DIGITAL HOLDINGS	SpiderPool
6	f2pool	ViaBTC	ViaBTC	BTC.com	Poolin	MARATHON DIGITAL HOLDINGS	BINANCE POOL	MARATHON DIGITAL HOLDINGS
7	Unknown	BTC.TOP MINING POOL	58COIN&1THash	foundry	BTC.com	Luxor	SpiderPool	SECPOOL
8	Poolin	Unknown	OKEX	SLUSH POOL	SLUSH POOL	BTC.com	Luxor	Luxor
9	DPOOL	Huobi	BINANCE POOL	Huobi	Luxor	BRAIINS POOL	SECPOOL	BINANCE POOL
10	BITCLUB NETWORK	BITFURY	SLUSH POOL	Luxor	SBI Crypto	Poolin	BRAIINS POOL	SBI Crypto

Payout Methods

Pool payouts have evolved over time, from luck-based methods like solo mining and Pay-Per-Last-N-Shares (PPLNS) to more predictable models like Pay-Per-Share (PPS) and Full-Pay-Per-Share (FPPS). Different methods emerged to address preferences around payout frequency and variance. Pools experimented with a variety of alternatives, and as the industry matured, a handful of popular and commercially relevant payouts eventually emerged.

The Pay-Per-Last-N-Shares (PPLNS) model was one of the earliest methods used to distribute mining rewards, first introduced circa 2011. In this structure, miners are only paid when the pool successfully discovers a block, and the reward is distributed among the most recent contributors (the “last N” shares). While PPLNS fairly compensates miners proportional to their actual work, it exposes them to significant variance risk: if the pool is unlucky and doesn't find a block, miners receive nothing during that time.

Around 2012, pools began introducing the Pay-Per-Share (PPS) model to reduce variance and offer more predictable earnings. PPS pays miners a fixed amount for every valid share submitted, based on the block subsidy, regardless of whether the pool finds a block. This smooths out earnings for miners and eliminates luck risk, transferring that variance to the pool operator instead. PPS was the first step toward making mining rewards more predictable and commercially viable, especially for small-to-mid-sized operators who were unable to absorb long dry spells.

PPS+ is a variant of the traditional Pay Per Share (PPS), which provides payouts based on the number of valid shares miners contribute, irrespective of whether their pool successfully mines a block. Miners are paid for their shares based on a fixed rate (calculated using network difficulty and expected block rewards) in addition to a share of transaction fees collected from mined blocks. By factoring in transaction fees, PPS+ enables miners to benefit from exposure to the transaction fee market. In 2025, PPS+ stood out as a loser in market share as transaction fees became an immaterial portion of overall block rewards.

Payout Method	Dec-17	Dec-18	Dec-19	Dec-20	Dec-21	Dec-22	Dec-23	Dec-24	Dec-25
PPLNS	59%	49%	22%	6%	5%	5%	3%	4%	2%
PPS	19%	0%	0%	0%	0%	0%	0%	0%	0%
PPS+	22%	23%	24%	27%	30%	29%	10%	25%	14%
FPPS	0%	28%	54%	67%	66%	67%	87%	69%	68%

However, looking at the bigger picture, transaction fees have indeed become a more meaningful portion of block rewards over time, which incentivized popular pools to evolve from PPS into Full-Pay-Per-Share (FPPS). FPPS retains the predictable per-share payout model of PPS but includes a pro-rata share of transaction fees in addition to the block subsidy, reflecting total block rewards earned by miners.

All in all, the industry standard for full pay-per-share (FPPS) payouts still stands today. Miners continue to show a preference for stable, consistent payout structures and an aversion to mining luck exposure.

Pool Innovations

Luck-independent pool payout methods, like PPS and FPPS, were an improvement for miners. However, a fundamental risk remained: spot hashprice volatility. Even with regular payouts, miners were still exposed to fluctuations driven by bitcoin price, network difficulty, and transaction fees — causing challenges for revenue forecasting and limiting access to financing.

Luxor Pool's fixed and upfront payouts change that. These innovative payout methods remove spot hashprice risk and/or provide miner-native financing. The table below demonstrates the difference:

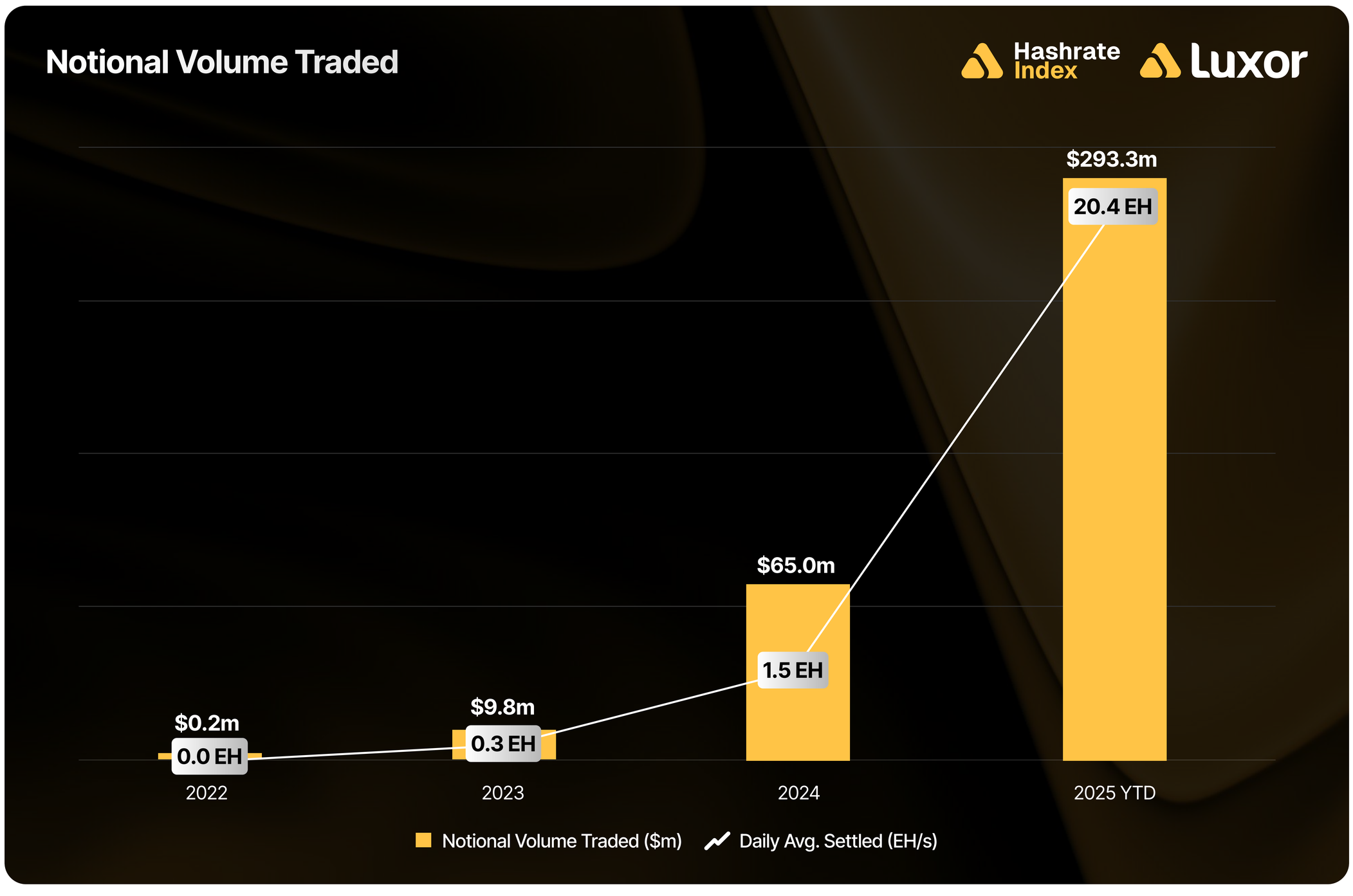
Mining Reward Options	Removes Mining Luck?	Removes Spot Hashprice Volatility?	Provides Miner Financing?
Solo & PPLNS	No	No	No
PPS & Luxor FPPS	Yes	No	No
Luxor Fixed	Yes	Yes	No
Luxor Upfront	Yes	Yes	Yes

Since 2023, Luxor's fixed payouts have allowed miners to lock in a future BTC-denominated hashprice, regardless of spot hashrate market conditions. This eliminates the uncertainty introduced by hashprice volatility and enables future cash flow modeling with certainty.

Upfront payouts took this one step further in 2024 by providing miners with immediate, non-dilutive BTC capital in exchange for a fixed commitment to deliver hashrate over time.

Both payout structures extend out to twelve months, allowing miners to hedge by selling future hashrate now, at a guaranteed price. Settlement occurs daily on Luxor Pool.

With over $290 million dollars of notional volume traded in 2025, the trend is clear: fixed and upfront pool payouts are the next evolutionary step for modern mining operations.

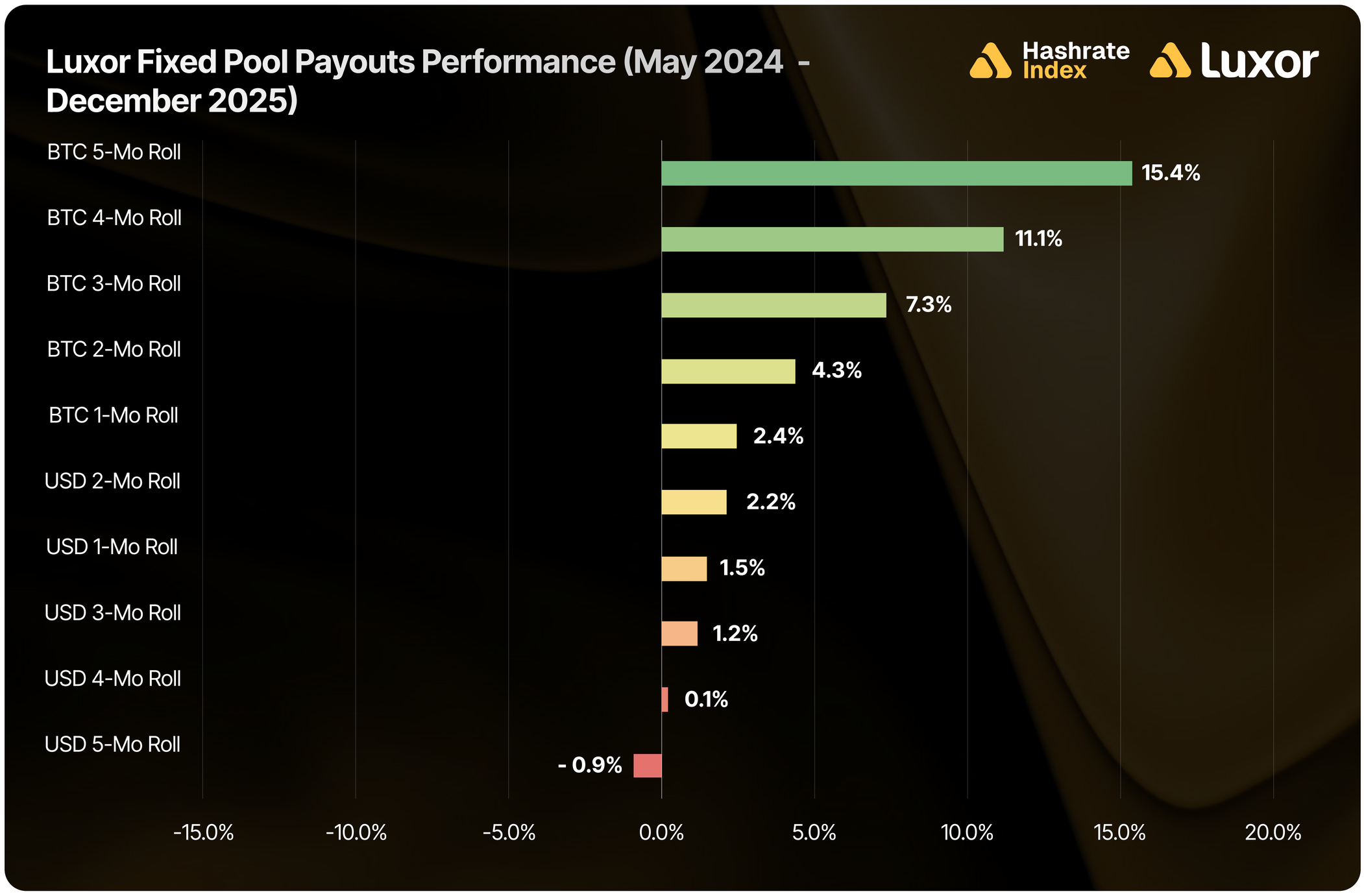


Case Study: Fixed Pool Payouts Performance Since 2024 Halving

The 2024 halving set off a period of sustained margin compression for miners. BTC price action was overwhelmed by growth in network difficulty and weak transaction fees. Hashprice declined in this environment, constraining miner financing, fleet expansion, and treasury management.

However, not all miners were impacted equally. Those who hedged their hashes won. Miners who utilized fixed pool payouts consistently locked in revenue above spot (FPPS) rates for that duration. Post-2024-halving, these "rolling" strategies delivered significant outperformance.

The chart below shows results for a range of fixed pool payout strategies relative to spot mining (FPPS), segmented by contract denomination and hedge horizon, from May 2024–December 2025:



This comparison reveals that rolling BTC-denominated fixed pool payout strategies outperformed post halving, with the strongest results coming from 5-months (+15.4%) and 4-months (+11.1%). These longer-duration hedges generally benefited from locking in a higher hashprice ahead of rising network difficulty and low fee environments.

In contrast, USD-denominated fixed pool payouts outperformed spot mining by a small margin, 0.8% on average, because of an overall rise in bitcoin price since May 2024.

Note: these figures are strictly for demonstration purposes and exclude fees and bid/ask spreads associated with entering into hashrate forward contracts.

A second caveat: although selling forward proved to be favorable during timeframes shown above, it is critical to recognize that hedging is typically a cost of business rather than a revenue generation method. Hedgers willingly pay a price to buy certainty and obtain more predictable cash flows, which increases valuation, reduces cost of capital, and ultimately attracts investments.

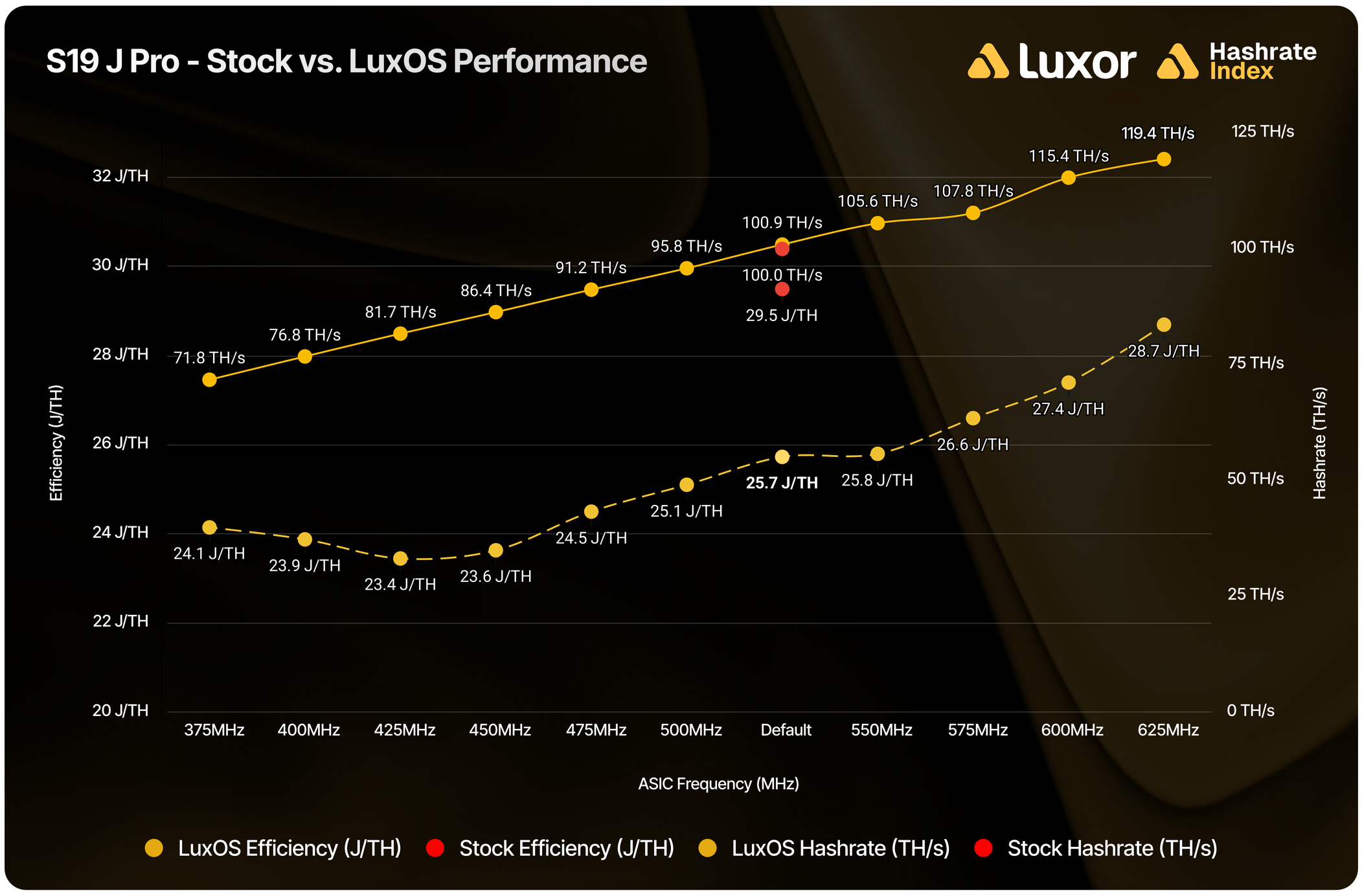
Firmware Market

Firmware is specialized software installed directly on each individual machine's control board. Serving as an Operating System (OS), it enables control and customization over performance parameters for various conditions. As an intermediary between hardware and software, firmware unlocks the full range of hashrate, power consumption, and efficiency for a mining machine, providing an opportunity for a mining operation to maximize its margins.

Over time, bitcoin mining firmware has expanded from manufacturer-provided, standardized “stock” systems into third-party versions offering flexible features like overclocking and advanced thermal management. This shift toward flexible firmware has empowered operations to adapt to changing market conditions and remain competitive.

Manufacturer-installed stock firmware provides basic operational modes with limited options. They typically offer binary “On/Off” functionality with predetermined performance profiles, strictly engineered for fixed and stable hashrate output under static conditions.

Third-party firmware solutions unlock granular control. They enable operators to adjust a machine’s frequency settings, voltage levels, and thermal profile to optimize for a range of goals — whether it's maximizing hashrate, minimizing power consumption, or finding efficiency sweet spots in between. Taking this simple step transforms a mining fleet’s operational profile from “On/Off” to “0–100”, as demonstrated by the S19j Pro’s hashrate and efficiency curves below



At stock settings, Bitmain's Antminer S19j Pro (100TH) produces ~100 TH/s at ~29.5 J/TH, consuming 2,950 W of power. Running Luxor's Antminer firmware — LuxOS — unlocks the ability to operate this model in frequency ranges anywhere between 375MHz to 625MHz, producing hashrate outputs ranging from ~72 TH/s to ~120 TH/s, while consuming proportionally varying amounts of power.

Now, consider the machine's fully unlocked operational range under LuxOS. At 450 MHz, the machine produces 86.4 TH/s at an efficiency of 23.6 J/TH, consuming 2,041 W of power. This performance profile is roughly 72% of the machine's maximum hashrate at only 60% of its maximum power consumption. This illustrates the non-linear relationship between power and hashrate: power draw rises steeply at higher frequencies, but hashrate scales linearly. As a result, efficiency "sweet spots" emerge at the lower end of the spectrum (around 400–450 MHz), where miners capture the majority of hashrate output at significantly lower power cost.

This efficiency gain becomes economically significant when electricity represents 60–80% of total operating (OpEx) costs. Firmware preserves profitability by sacrificing some hashrate production for an outsized improvement in efficiency.

Advanced firmware also provides several other critical capabilities, such as custom profile configurations, automated thermal management (based on environmental conditions), and rapid response capabilities for participating in ancillary grid services — key ingredients for Intelligent Mining.

Since hardware efficiency gains are slowing and power costs remain to be the dominant determinant of competitive outcomes, firmware now sits front and center for making the most of every hash and watt. Leading providers offer much further than just clock speed changes, focusing on real-time optimization as conditions change and markets move.

Landscape

The third-party firmware landscape continues to evolve. Well-established incumbents have been developing custom firmware since 2018, whereas recent years have seen new entrants into the space, namely Luxor and ePIC Blockchain in 2023, and Marathon Digital's MaraOS in 2024.

	Domiciled	Released	Firmware Type	Model
ePIC UMC	Canada	2023	Proprietary	Purchase
Luxor Firmware	USA	2023	Proprietary	Subscription
Braiins OS	Canada	2018	Proprietary	Subscription
Vnish.com	Russia	2018	Proprietary	Subscription

LuxOS has been available since Q2 2023, and has introduced several enhancements in 2025 to improve mining performance and user experience:

- Power-first control and predictability: LuxOS introduced Power Targeting across major S19 and S21 variants, allowing miners to set precise wattage targets with an autotuner that dynamically adjusts for temperature and environmental conditions. This materially improves power predictability, fleet-level planning, and grid-constrained operations.
- Material gains in tuning, stability, and efficiency: Major upgrades to autotuning, ramping logic, and Advanced Thermal Management (ATM) delivered faster, smarter tuning, reduced stuck ramps, better voltage selection, and more resilient behavior under thermal stress — directly improving realized hashrate efficiency and uptime.
- Expanded hardware and control board support: Throughout 2025, LuxOS added broad support for new Bitmain air-cooled, hydro, and immersion models, multiple PSU variants, and Beaglebone, Xilinx, and CVI control boards — simplifying mixed-fleet management and reducing firmware fragmentation.
- Improved observability and operator UX: Enhanced UI performance, richer logging, new health and metrics APIs, real-time events, system audit tooling, and better filtering and navigation significantly improved monitoring, troubleshooting, and day-to-day operator experience at scale.

These updates reflected Luxor's commitment to providing miners with feedback-driven features.

2025 has seen significant developments in the firmware space, underscoring third-party providers' commitment to delivering advanced solutions for the mining community. We believe that custom firmware adoption will continue to become a major competitive advantage and unlock the next wave of competitive advantage in the mining landscape throughout this epoch.

Firmware Case Study: Hedged Hashprice & Spot Power

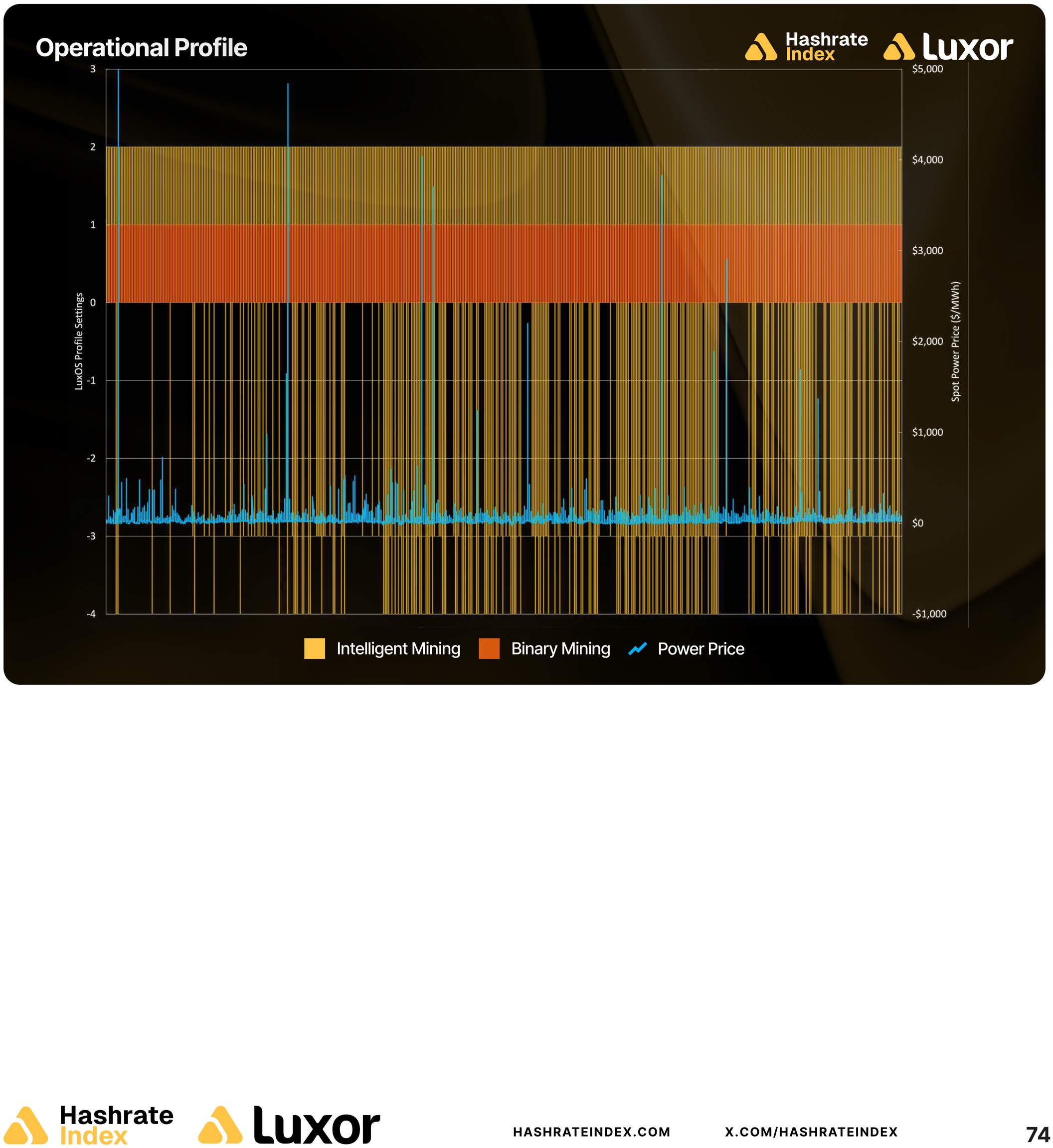
In order to showcase the power of flexible firmware, we performed a simulation backtest using operational data captured through Luxor's R&D mining fleet.

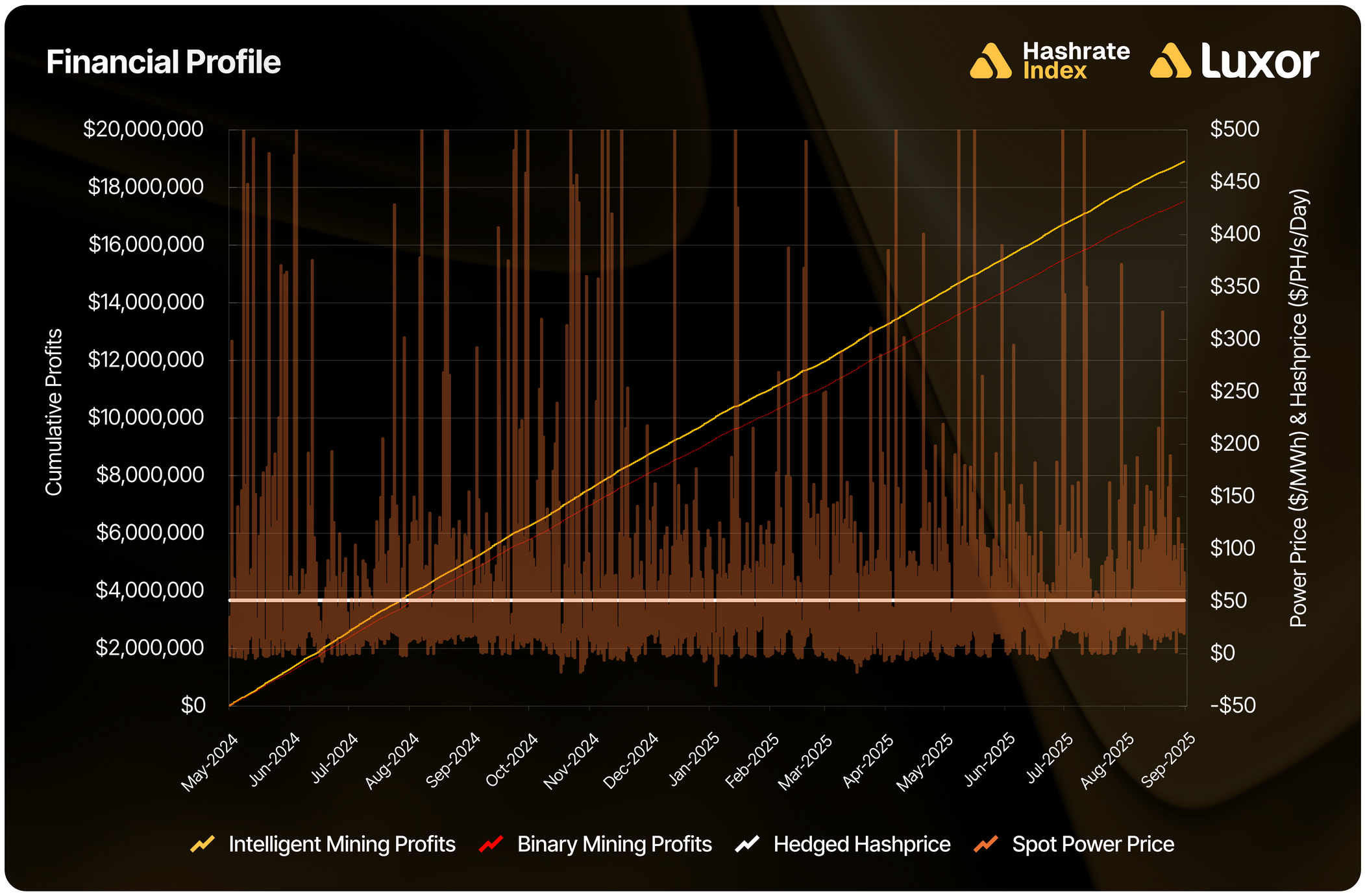
Profile

1 EH/s miner operating in ERCOT West Texas Load Zone, hedging hashprice via rolling 6-month contracts (USD-denominated) while remaining exposed to spot power prices. The fleet consists of 5,000 Antminer S21 units (200 TH/s) deployed from May 2024 – August 2025.

Results:

Metric	Intelligent Mining (LuxOS)	Binary Mining (Stock)
Total Revenue ($)	$26,363,596 (+8.6%)	$24,273,875
Total Cost ($)	$7,438,663 (+10.5%)	$6,732,224
Gross Mining Profit ($)	$18,924,933 (+7.9%)	$17,773,365
Gross Profit Margin (%)	71.8% (-0.5 pps)	72.3%
Average Hashprice ($/PH/s/Day)	$51.00	
Average Power Price ($/MWh)	$39.68	
Average Hashrate (EH/s)	1.059 EH/s (+8.6%)	0.975 EH/s
Total Power Consumed (MWh)	225,358 MWh (+12.7%)	199,903 MWh
Uptime (%)	97.97% (+0.45 pps)	97.52%
Curtailment Intervals	948 (-18.1%)	1,162





Insights

1. Cost control through curtailment: LuxOS encountered ~18% fewer curtailment intervals (948 vs. 1,162) by underclocking and improving efficiency instead of total shutdown, avoiding unnecessary downtime as a result while still responding to unprofitable power prices.

2. Capitalizing on cheap: There were 2,769 intervals when prices fell to zero or below. LuxOS exploited these windows by overclocking, squeezing out extra hashrate, and generating $2.1 million (+8.6%) in additional revenue.

Conclusion

LuxOS delivered higher uptime, more hashrate, and nearly 8% more profit than stock operations. Real-time fleet optimization turned power price volatility into an opportunity.

Future-proofing the Network with Firmware

Throughout 2025, miners were heavily incentivized to improve their operational efficiency amid a new hashprice regime. We believe that the age of mining with static stock firmware systems is coming to a close. The industry is at a point where those who continuously optimize fleets against moves in hashprice and power markets will be the only ones to not only survive, but thrive.

Several trends reinforce this outcome:

- Margins will continue to compress: Bitcoin mining is a near-perfectly competitive industry. As more efficient fleets enter the network and difficulty climbs higher, profit margins will inevitably tighten up, and running on a simple on/off basis will no longer be viable.

- Industry consolidation will accelerate: Profitable and well-capitalized miners are already attracting new investment, acquiring distressed assets, and scaling operations. In the coming years, consolidation will be led by those who demonstrate operational excellence and consistently maintain profitability across cycles.

- Hashprice volatility will intensify: With every halving, the fixed block subsidy shrinks, and transaction fees represent a larger share of miner revenue. This dynamic will only make hashprice more volatile. Navigating such an environment requires the ability to dynamically respond to swings in both blockspace demand and power prices, which stock firmware operations are structurally incapable of doing.

We expect custom firmware adoption to increase significantly in 2026, which may improve both the efficiency and the industry-wide breakeven hashprice for the global network. This trend could enable network security to continue growing, even under tight(er) mining economics.

8

Significant Regulatory and Legislative Action in 2025

In 2025, Bitcoin experienced the most consequential year of regulatory and legislative action in its history. Prior years were defined by regulatory ambiguity, enforcement actions, and incremental accommodation, but 2025 marked a decisive shift toward formal recognition, statutory clarity, and sovereign integration. Regulatory posture moved from containment to enablement, with coordinated action across the U.S. executive branch, Congress, and financial regulators reshaping the legal foundation of Bitcoin, mining, and digital assets more broadly.

The change in administration in January triggered an immediate reset. Long-standing barriers to institutional participation (ranging from punitive accounting rules and debanking practices to regulatory hostility toward mining and custody) were systematically dismantled. Bitcoin was explicitly reframed by policymakers as a commodity, strategic asset, and legitimate component of the U.S. financial system, culminating in the creation of a Strategic Bitcoin Reserve and the passage of landmark stablecoin legislation.

Below is an overview of the most significant regulatory and legislative actions in 2025:

January:
FASB's new accounting standard for certain digital assets went into effect, requiring companies to measure bitcoin at fair value, with unrealized gains and losses recognized in net income — eliminating the asymmetric impairment-only treatment that had previously discouraged corporate adoption. Donald Trump was inaugurated as President of the United States, initiating a broad pro-Bitcoin policy shift. The White House issued an Executive Order directing federal agencies to review digital asset regulation and support private-sector innovation. The Securities and Exchange Commission (SEC) repealed SAB 121, removing the requirement that banks custodying digital assets record client assets on balance sheets — one of the largest structural barriers to bank participation. Senator Cynthia Lummis was appointed Chair of the Senate Banking Subcommittee on Digital Assets, formalizing a legislative venue for Bitcoin policy. Congressional hearings exposed Operation Chokepoint 2.0, confirming regulatory-driven debanking of crypto-native firms under the prior administration.

February:
The SEC scaled back its enforcement-first approach to digital assets, reassigning enforcement staff and requiring Commission-level approval for formal investigations. Exchanges filed rule changes to allow in-kind creation and redemption for spot Bitcoin ETFs and to expand ETF options position limits, signaling regulatory openness to commodity-style Bitcoin market structure. Scott Bessent was confirmed as U.S. Treasury Secretary, aligning Treasury policy with broader pro-Bitcoin regulatory objectives.

March:
President Trump signed an Executive Order establishing a Strategic Bitcoin Reserve and a U.S. Digital Asset Stockpile, formally elevating Bitcoin to a sovereign strategic asset held by the federal government.

The Office of the Comptroller of the Currency (OCC) and Federal Deposit Insurance Corporation (FDIC) issued guidance restoring and clarifying banks' authority to custody digital assets, engage in stablecoin activities, and interact with blockchain networks — effectively ending the debanking era for crypto-native and mining companies.

April:
The Federal Reserve withdrew restrictive supervisory guidance related to bank crypto-native activities, completing the normalization of Bitcoin and digital assets engagement across U.S. banking regulators and removing residual regulatory friction.

July:
The SEC formally approved in-kind creation and redemption for spot Bitcoin ETFs and authorized a 10x increase in ETF options position limits, completing Bitcoin's transition into a commodity-grade ETF regime. A Presidential Executive Order opened access to Bitcoin and digital assets exposure within 401(k) retirement plans, expanding regulated investor access.

September:
The GENIUS Act was signed into law, codifying stablecoin regulation at the federal level. The SEC introduced generic listing standards for commodity-based ETFs, paving the way for additional spot ETFs beyond Bitcoin.

December:
The CFTC approved spot trading on regulated exchanges, extending regulatory oversight beyond derivatives markets. DTCC received no-action relief enabling the tokenization of real-world assets, signaling regulatory readiness for on-chain settlement infrastructure.

Internationally, 2025 marked a clear divergence in how governments approached Bitcoin mining.

In December, the Bitcoin network experienced a sharp hashrate decline of more than 80 EH/s, coinciding with a rolling central government inspection campaign in Xinjiang, China. First-hand accounts from miners, hosting operators, and local contacts indicate that operations were powered off as part of coordinated inspections. Authorities framed the action as an ongoing inspection process rather than a one-time crackdown, implying prolonged operational downtime and limited near-term prospects for restarting activity in the region.

In Ethiopia, after briefly emerging as a hydro-powered mining hub in early 2025, rising domestic power demand and grid sustainability concerns prompted authorities to suspend new permits and raise tariffs, signaling a retreat from energy-intensive exports toward electrification priorities.

Pakistan emerged as a new regulatory frontier, establishing the Pakistan Crypto Council and advancing proposals to allocate surplus power to Bitcoin mining and AI data centers under structured tariff regimes.

Paraguay implemented electricity tariff hikes for Bitcoin miners and other high-intensity users, tightening pricing to better reflect grid costs while preserving a regulated framework that continues to monetize surplus hydroelectric capacity rather than abandoning mining outright.

9

Conclusions and Predictions

In our 2024 Bitcoin Mining Year in Review, we expressed our belief in 2025 being a transformative year for Bitcoin mining. We also made the following predictions:

- Global hashrate market shares would change: the East would grow, the West would slow, and Europe and the Middle East would decline.
- Hashprice would hit a yearly low of $30 per PH/s/Day.
- Tariffs on hardware produced in China would increase significantly.
- At least one public Bitcoin miner would be acquired by a Hyperscaler.
- Bitcoin ETFs would be integrated into major TradFi platforms.
- Bitcoin and mining tax treatment would become more favorable.
- A Bitcoin miner would offer a bitcoin dividend yield.

Some of these predictions came close, particularly around changes in global hashrate distribution, hashprice trajectory, hardware tariffs, and Hyperscaler M&A.

2025 was a productive year for Bitcoin, with both institutional adoption and regulatory clarity continuing to improve, but a significant challenge for the mining industry.

Looking ahead into 2026, we (loosely) predict the following:

- Global hashrate continues to move: Venezuela will gain, and the U.S. will decline.
- New hardware launches boast ASIC efficiencies at around ~7 J/TH.
- Competition in hardware heats up, and hydro-cooled model deployments increase.
- The relentless demand for watts slows down annual hashrate growth, and the network closes the year at ~1,350 EH/s.
- Hashrate hedging becomes a popular financing tool for Bitcoin miners.
- Bitcoin treasury companies consolidate.

Here’s to another year in the beautiful game.

— Happy Hashing!