



White Paper

2025 Blockchain Mining Machine Industry

2025.10

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Chapter 1 — Overview of Global Blockchain and Cryptocurrency Industry



Chap 1.1

Introduction of Blockchain

Introduction of Blockchain

Brief Explanation of Blockchain

Blockchain is a decentralized data management and value transfer system built upon Distributed Ledger Technology (DLT). Its core mechanism lies in the use of cryptographic algorithms to encapsulate data into sequential “blocks,” which are then linked through hash functions to form a continuous and tamper-resistant “chain” of information. This structure ensures the integrity, security, and chronological order of data during its creation and transmission. Within a blockchain network, all nodes operate without reliance on a central authority, achieving consensus through algorithmic protocols that verify and synchronize transaction records across the distributed ledger. This enables a system characterized by decentralized storage, immutability, traceability, and transparent information sharing. Fundamentally, blockchain represents an institutional innovation that replaces traditional trust intermediaries with algorithmic trust. It establishes a reliable foundation for multi-party collaboration and provides the technological infrastructure for secure value exchange, digital identity verification, and smart contract execution in the digital economy.

Classification of Blockchain

Blockchain can be categorized into four types according to the participation rights of nodes and the controlling entities :			
Type	Definition	Managing Entity	Characteristics
Public Blockchain	Completely open; anyone can read, write, and verify data	No central control; maintained jointly by global nodes	Highest degree of decentralization, strong transparency, relatively lower efficiency
Private Blockchain	Accessible only to specific institutions; permission required for data access	Single institution	High control, fast and secure, low degree of decentralization
Consortium Blockchain	Managed collectively by multiple institutions; node permissions jointly decided	Consortium organization	Balances efficiency and security; suitable for cross-institutional collaboration
Hybrid Blockchain	Combines public and private blockchains; some data open, some private	Multiple entities	Flexible and controllable, supports cross-chain interaction



Chap 1.2

Analysis of Blockchain Industry

Analysis of Blockchain Industry

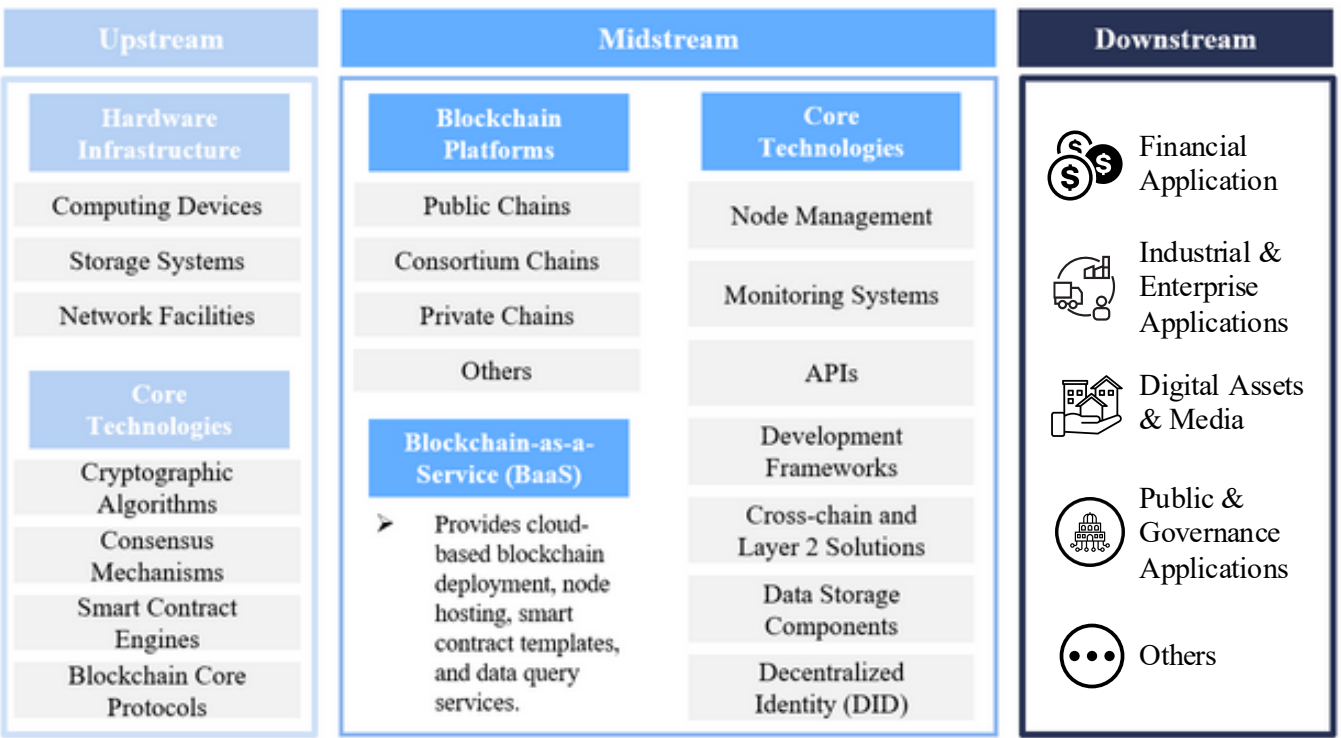
Value chain Analysis of Blockchain Industry

The upstream of the blockchain industry provides the technical foundation, including hardware, cryptographic algorithms, and consensus mechanisms. The midstream builds platforms and development environments, enabling blockchain networks and smart contract deployment. The downstream focuses on industry applications, driving the commercialization of blockchain technology in areas such as finance, supply chain, and digital assets.



The downstream of the blockchain industry encompasses diverse industry and scenario-based applications. It includes financial services such as crypto trading, payments, decentralized finance (DeFi), and cross-border settlements; industrial and supply chain applications like traceability, energy and carbon trading, and IoT-based asset verification; digital assets and media including NFTs, digital copyright protection, and Web3 content platforms; and public and governance applications covering government services, healthcare and education credentialing, voting, and secure data sharing. These applications translate blockchain technology into real-world business value and user-facing services.

Value Chain of Blockchain Industry





Chap 1.3

Introduction of Cryptocurrency

Introduction of Cryptocurrency

Brief Explanation of Cryptocurrency

Cryptocurrency is a form of digital asset built upon blockchain technology and cryptographic principles. Its fundamental characteristic lies in decentralized issuance and management, meaning it operates without reliance on central banks or traditional financial institutions. Instead, transactions are verified and recorded through a distributed ledger maintained collectively by network nodes under a consensus mechanism. Each transaction is secured by encryption algorithms, ensuring data integrity, anonymity, and immutability. Beyond functioning as a medium of exchange and store of value, cryptocurrencies also serve as incentive and governance instruments within applications such as smart contracts and decentralized finance (DeFi). Representative examples include Bitcoin and Ethereum, which together form the trustless value transfer infrastructure underpinning the broader digital economy.

Classification of Cryptocurrencies

Cryptocurrencies can be classified based on their primary function and application within the blockchain ecosystem, forming six major categories: Payment Tokens, Infrastructure Tokens, Governance Tokens, Financial Tokens, Media and Entertainment Cryptocurrencies, and Other Tokens.

Payment Tokens	• Pure Payment Coins • Transaction-Efficient Coins • Cross-Border Settlement Coins
Infrastructure Tokens	• Smart Contract Platform Tokens • Layer-2 / Scaling Tokens • Cross-Chain / Interoperability Tokens
Governance Tokens	• Protocol Governance • DAO Governance
Financial Tokens	• Stablecoins • Security / Asset-Backed Tokens • DeFi Governance / Utility Tokens
Media and Entertainment Tokens	• Content & Social Media Tokens • NFT / Collectible Tokens • Gaming Tokens • Metaverse Tokens
Other Tokens	• Privacy Coins • Algorithmic / Experimental Tokens • Governance-Independent Incentive Tokens • Multi-Function Tokens





Chap 1.4

Analysis of Cryptocurrency Industry

Analysis of Cryptocurrency Industry

Price of Bitcoin

Bitcoin is the world’s first decentralized digital currency, introduced in 2009. Its core innovation lies in the use of blockchain technology, which records transactions on a distributed ledger and removes reliance on centralized authorities, thereby enabling peer-to-peer value transfer. The total supply of Bitcoin is capped at 21 million, endowing it with the characteristics of “digital gold” and positioning it as both a store of value and a hedge against inflation. Since its inception, Bitcoin’s price has exhibited significant volatility, influenced by macroeconomic conditions, monetary policy shifts, regulatory developments, and evolving market perceptions of its long-term value and technological potential.

Price of Bitcoin, 2020-2025.06

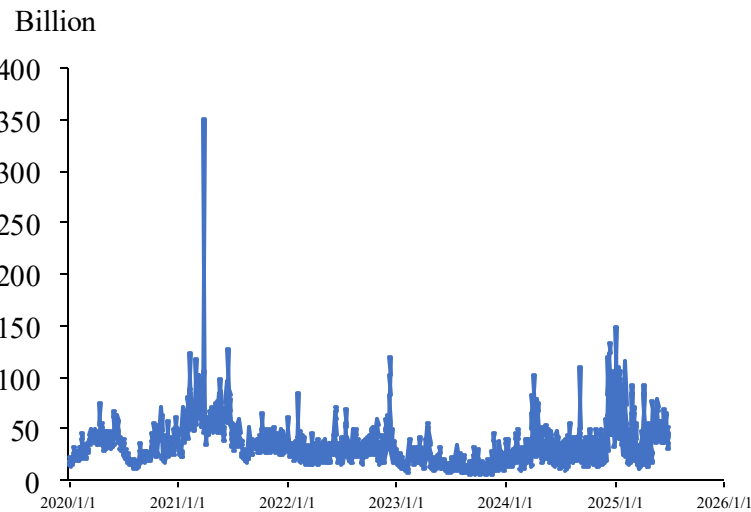


Bitcoin’s price started at a relatively low level in early 2020 and surged sharply throughout 2021, reaching its first major peak by the end of that year. It then underwent a significant correction during 2022, reflecting cooling market sentiment and tighter macroeconomic conditions. Starting in 2023, Bitcoin began to recover gradually, entering a strong upward phase in 2024 and surpassing previous highs. BTC rose to \$110K in May, 2025, marking a record level. This trajectory highlights Bitcoin’s cyclical nature and its responsiveness to global inflation pressures, institutional adoption, and renewed investor confidence.

Trade Volume

Bitcoin’s trading volume reflects market activity and investor participation and serves as an important indicator of liquidity. Since 2020, daily trading volumes have increased significantly with the entry of institutional investors and the growing popularity of mainstream exchanges. Trading volume typically rises sharply during periods of significant price fluctuations or major macroeconomic events, demonstrating the market’s sensitivity to risk and opportunity. At the same time, the rapid expansion of the derivatives market, including futures and options trading, has further increased overall transaction volumes and contributed to the continued maturation of the Bitcoin market.

Trade Volume of Bitcoin, 2020-2025.06





Chapter 2 — Overview of Global Blockchain Mining Machine Industry



Chap 2.1

Introduction of Blockchain Hardware Industry

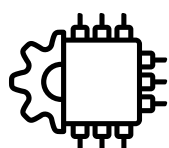
Introduction of Blockchain Hardware Industry

Definition of Blockchain Hardware Industry

The blockchain hardware industry refers to the complete industrial ecosystem that provides physical device support for blockchain technologies and applications. It encompasses hardware facilities used for blockchain network operation, data storage, computational processing, and security assurance. This industry spans from underlying computing and storage equipment, mining hardware, and dedicated cryptographic chips to auxiliary networking devices, supporting high performance, robust security, and scalability of blockchain systems.



Classification of Blockchain Hardware



Computing & Processing Hardware

Provides the necessary computing power and data processing capabilities, forming the foundation for blockchain network operation.

- General-Purpose Servers & Data Center Equipment
- Mining Machine
- Cryptographic Chips



Storage & Data Management Hardware

Supports blockchain data storage, backup, and fast access.

- High-Performance Storage Devices
- Distributed Storage Node Devices



Security & Authentication Hardware

Ensures the security of digital assets, nodes, and transactions.

- Hardware Wallets
- Security Modules (HSM / Secure Enclave)



Networking & Communication Hardware

Ensures high-speed, low-latency, and secure communication between blockchain nodes.

- Network Routing & Switching Devices
- Encrypted Communication & Security Modules



Auxiliary & Operational Hardware

Provides operational support for blockchain nodes, mining farms, and data centers.

- Power Supply & Cooling Equipment
- Monitoring & Management Devices

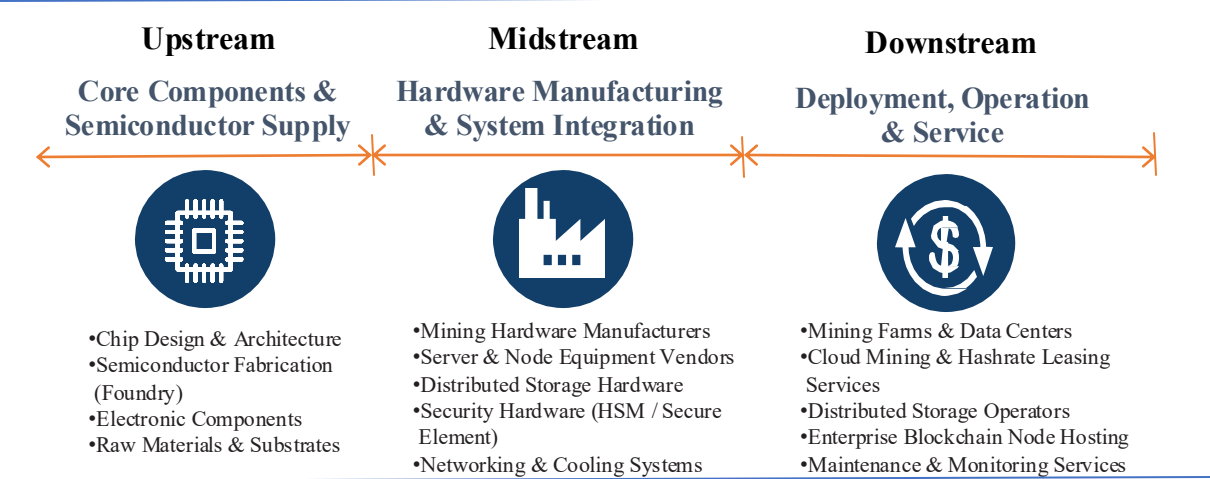


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Analysis of Blockchain Hardware Industry

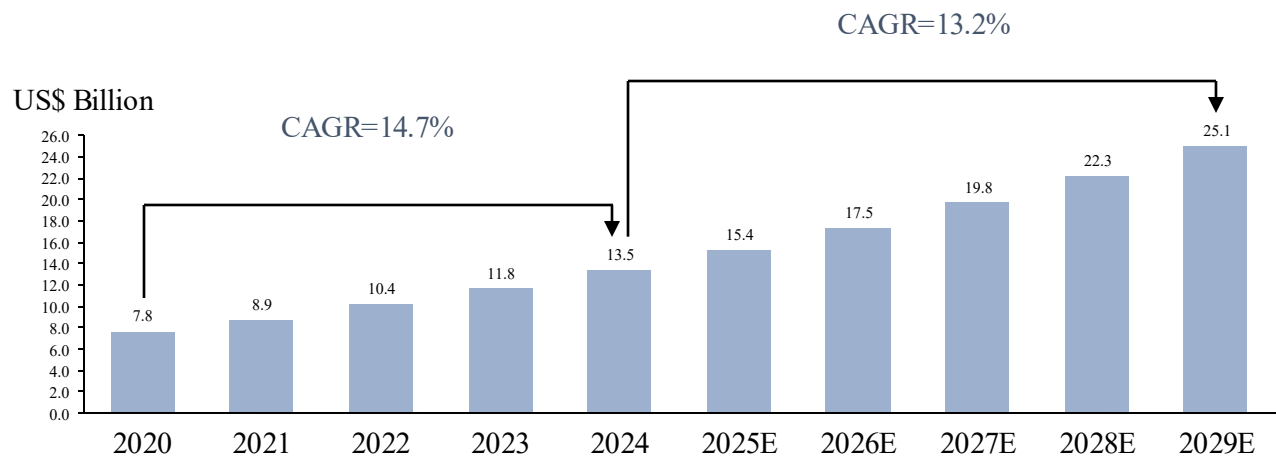
Analysis of Blockchain Hardware Industry

Value Chain of Blockchain Hardware Industry



The blockchain hardware value chain includes upstream core components and semiconductor supply, midstream hardware manufacturing and system integration, downstream deployment and operation, and peripheral support in security, energy, and compliance. Upstream provides computing foundations, midstream ensures performance and reliability, downstream realizes commercial value, and the peripheral layer secures system stability, forming a complete ecosystem.

Market Size of Blockchain Hardware Industry



The initial rapid growth was likely driven by the boom in the cryptocurrency market, the pilot implementation and application of blockchain technology in more business scenarios, and the rising demand for secure storage of digital assets (such as hardware wallets). The slight moderation in the growth rate in the later period, however, may reflect the market's gradual maturation, the increased difficulty of sustaining ultra-high growth after the expansion of its base scale, as well as a potential slowdown in overall demand growth due to regulatory changes or improvements in the efficiency of hardware technology itself.



Chap 2.3

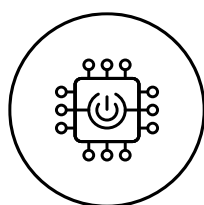
Introduction of Blockchain Mining Machine

Introduction of Blockchain Mining Machine

Definition and Classification of Blockchain Mining Machine

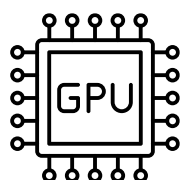
Mining Machine

A blockchain mining machine is a computer device specifically used for cryptocurrency mining. It maintains the security of the blockchain network by performing complex computational tasks, verifies the authenticity of transaction records, and obtains network rewards in return.



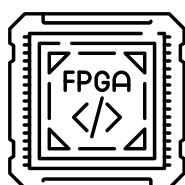
•ASIC Mining Machine

It is highly optimized for specific mining algorithms, such as the SHA-256 algorithm. It has a higher energy efficiency ratio than GPU and is also more expensive. It is the mainstream mining equipment in the Bitcoin network, and its computing power often reaches dozens or hundreds of TH/s.



•GPU Mining Machine

GPU is good at parallel computing and is efficient and flexible in mining some cryptocurrencies such as Ravencoin and Zcash. It is more suitable for cryptocurrencies that rely on video memory bandwidth for mining algorithms, such as those using the Ethash algorithm.



•FPGA Mining Machine

It is between GPU and ASIC and can customize circuits through programming. However, its cost-performance ratio is usually not as good as ASIC, so its market share is relatively small.

Customers of Mining Machine

2B Customers: The main customers of mining machines are still 2B-oriented, mainly including large-scale mining farms and institutional investors. These customers usually purchase a large number of mining machines for large-scale cryptocurrency mining to obtain greater benefits.

Emerging 2C Customers: There are also some 2C customers in the mining machine market, mainly individual miners. Some mining machines with low power consumption and quiet design have reduced the technical and financial thresholds for individuals to enter the mining field, making it possible for individuals and small-scale miners to engage in mining.



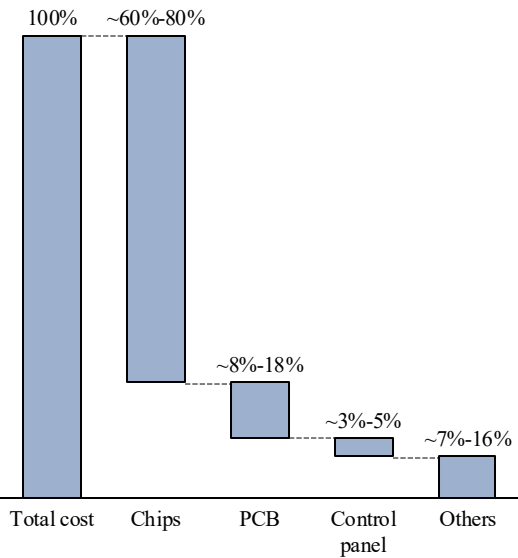


Chap 2.4

Analysis of Blockchain Mining Machine

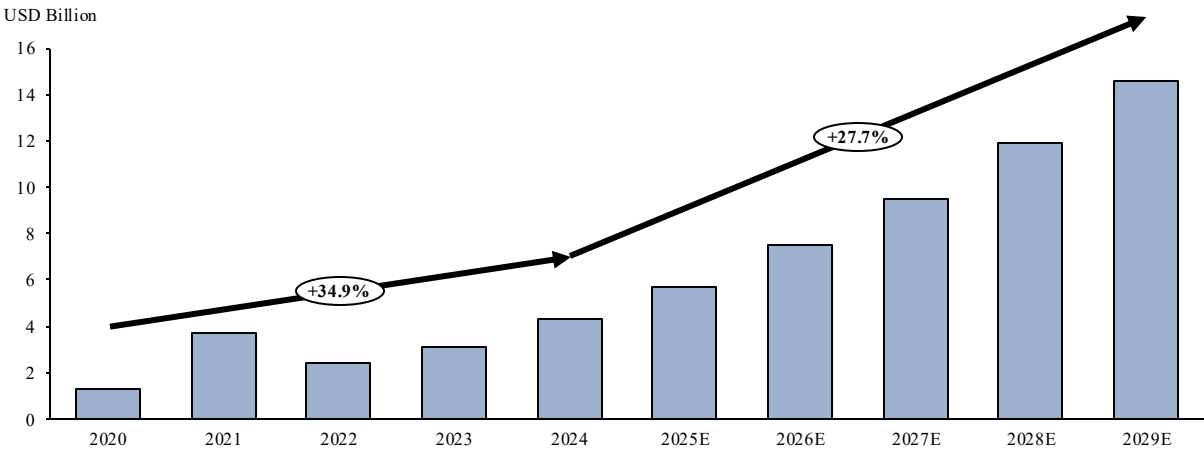
Analysis of ASIC-based Bitcoin Mining Machine

Cost Structure of Bitcoin Mining Machines



The single biggest cost and strategic lever in a Bitcoin miner is the ASIC chip, which ultimately dictates hash rate, joules-per-terahash, thermal headroom, and how fast a product line can iterate. Real competitiveness comes from choices around foundry node, wafer pricing and yields, binning, and package/test, all of which drive COGS volatility. Around the silicon, power delivery and thermal design determine whether rated efficiency holds up in real farms, while board stack-up, control firmware, and autotuning shape stability, uptime, and fleet manageability. Vendors compete as much on supply-chain reliability—wafer allocation, lead times, field failure rates, and warranty logistics—as on headline specs. In short, winners pair leading silicon with disciplined PCB/control/cooling engineering to deliver predictable efficiency at scale.

Market Size of ASIC-based Bitcoin Mining Machine Market, by Revenue, 2020-2029E



After an early ramp and a brief pullback, the ASIC-miner market is in a new expansion leg from 2024, powered by both new capacity and a large replacement cycle post-halving. Buyer focus has shifted from peak hash rate to energy efficiency and total cost of ownership, accelerating adoption of liquid and immersion cooling and tighter system-level optimization. Procurement is getting institutional: frame contracts, vendor financing, longer warranties and SLAs, and delivery schedules that smooth capex. Supply remains shaped by advanced-node wafer allocation, yields and binning, which create price and efficiency dispersion and tilt share toward tier-one vendors. Hosting growth is bounded by power and interconnection constraints, so demand is migrating to sites with low or stranded energy and clearer policy.



Chap 2.5

Analysis of Bitcoin Mining Profitability

Analysis of Bitcoin Mining Profitability

Profitability Formula of Bitcoin Mining

Net Daily Profit

= *Daily Revenue* – *Electricity Cost* – *Pool/Maintenance Fees*



- **Daily Revenue (USD)**

= (Miner's Hash Rate / Global Network Hash Rate) × Daily Total Reward (BTC) × Spot BTC Price (USD) + Transaction Fees

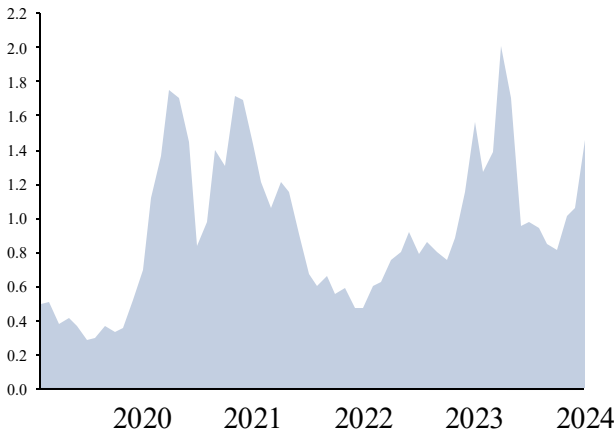
- **Daily Electricity Cost**

= Power (kW) × 24 h × Electricity Rate (\$/kWh)

Bitcoin Miner Revenue Trajectory (2020-2024)

Monthly fluctuations in block subsidies and transaction fees

Billion USD



The chart illustrates monthly Bitcoin miner revenue (block subsidy plus transaction fees) from 2020 to 2024. It peaked above \$1.5 billion in early 2021 during the post-halving bull market, then declined sharply through late 2022 as prices fell and difficulty rose. A modest rebound occurred in 2023, followed by a sharp rise to over \$2 billion in March 2024. Visibly, the curve exhibits high cyclical volatility, with revenue swinging by over \$1 billion within single quarters.

Key Factors Influencing Profitability

- **Bitcoin Price:** The most significant driver. Changes in Bitcoin's market value directly impact the monetary worth of mining rewards, with price movements having a proportional effect on overall revenue and profit margins.
- **Network Hash Rate:** As the global network's computing power grows (with more miners participating), an individual miner's share of total network capacity decreases. This reduces the proportion of blocks they can mine, thereby lowering their daily cryptocurrency earnings.
- **Electricity Price:** A critical factor in cost management. Since energy consumption constitutes a large portion of operational expenses, fluctuations in electricity rates directly affect total costs, with higher prices squeezing profit margins and vice versa.



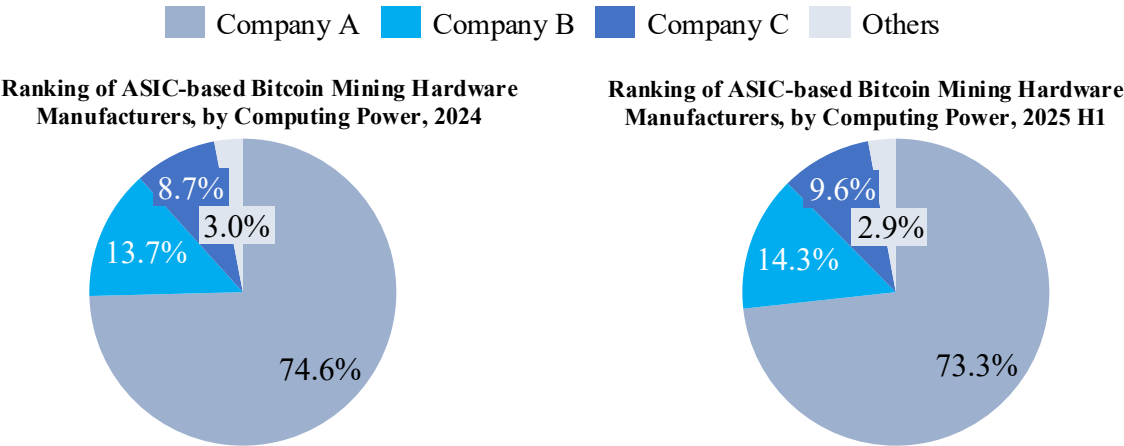
Chap 2.5

Competitive Landscape of ASIC-based Bitcoin Mining Machine Industry

Competitive Landscape

The ASIC-based Bitcoin mining hardware market is oligopolistic, and a small group of vendors controls most shipments through advanced-node ASIC design, secured wafer allocation, and scaled assembly and test capacity. Competition focuses on energy efficiency (J/TH), delivered \$/TH at scale, product reliability and field failure rates, and delivery lead time, with liquid or immersion cooling, power delivery, and firmware autotuning becoming key differentiators. On the B2B side, large miners still purchase through frame contracts, vendor financing and SLAs, which concentrates volume with tier-one suppliers. At the same time, the emerging consumer and small-site segment is creating demand for lighter, plug-and-play devices. Trade, tariff and compliance risks continue to push vendors toward dual sourcing, overseas assembly and localized after-sales, and market shares still shift mainly around new product cycles and access to wafers.

Ranking of ASIC-based Bitcoin Mining Hardware Manufacturers, by Computing Power Sold



These leading manufacturers maintain their technological edge through continuous R&D investment, driving rapid product iteration and higher mining efficiency. Their close collaboration with semiconductor foundries ensures stable production and delivery even during global chip shortages. The market’s competitiveness is centered on high energy efficiency and superior hash rate performance, yet only a few vendors possess the capability to achieve both at scale. This dual barrier of technology and capacity creates significant entry hurdles, further consolidating the dominance of existing market leaders.





Chapter 3 — Market Trends and Future Opportunities of Blockchain Mining Machine Industry



Chap 3.1

Market Trends

Expansion into Home and SMB Miniature Mining Solutions

Home vs. Professional Mining Rigs

Feature	Home Mining Rig	Professional Mining Rig
Hash Rate	Moderate (e.g., 90 TH/s)	Extremely High (e.g., 200 TH/s+)
Power Compatibility	Standard Home Outlet (110V-240V)	Requires Industrial Wiring (208V/240V)
Noise Level	Ultra-Quiet (~45 dB)	Very Loud (~75 dB+)
Core Value Proposition	Accessibility, Simplicity, Heat Utilization	Maximum Raw Hashrate & Efficiency at Scale
Primary User	Home Users, SMBs, Enthusiasts	Large Mining Farms & Industrial Operations
Efficiency	~38.0 J/TH	~17.5 J/TH

Heat Utilization & Energy Efficiency

innovative products utilize waste heat generated from mining for home heating, creating a dual-benefit model. This not only enhances the comprehensive utilization efficiency of energy but also significantly reduces the net energy cost of mining, making home mining more economically viable. By capturing this waste heat for space heating, the effective net energy cost of mining is drastically reduced. The cost of electricity for mining is partially or fully offset by the savings from not using a traditional heating system. This makes mining profitable at higher electricity price points than would otherwise be feasible.

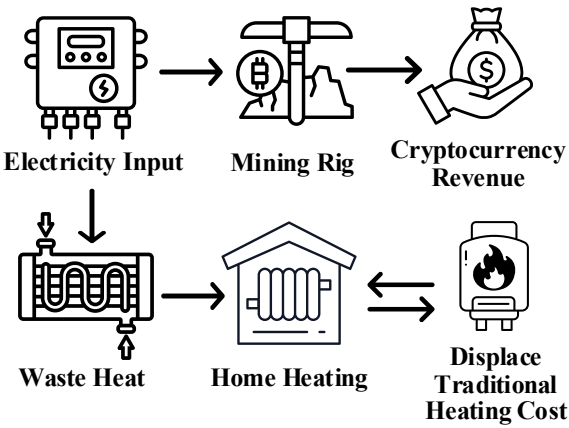
Conclusion

The rise of Home and SMB miniature mining solutions signifies a pivotal democratization and maturation of the blockchain mining industry. Technological advances have successfully miniaturized professional-grade hardware into accessible, quiet, and efficient consumer products. Additionally, the integration of heat utilization is a revolutionary step, transforming mining from a pure cost-center into a potential dual-revenue (crypto + energy savings) appliance for the household. In the future, this trend is expected to accelerate, further blurring the lines between consumer electronics and blockchain infrastructure, and opening up the ecosystem to a much broader global audience.

Penetration from Industrial to Personal

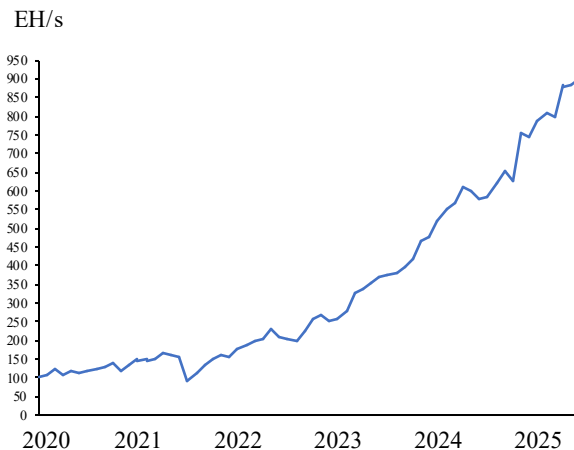
In recent years, a notable trend in blockchain mining equipment has been its penetration from large-scale mining farms into home and small-to-medium enterprise settings. This shift is driven by both technological advancements and diversifying market demands. For individual home users, the ideal mining rig prioritizes quiet operation, ease of use, and compatibility with home environments. By combining near-industrial hash rates with silent operation and simple plug-and-play installation using common home voltages, these miners make powerful cryptocurrency mining accessible for the first time in residential settings.

Energy and Economic Efficiency of Heating-Integrated Mining



Efficiency Escalation and Operational Cost Optimization

Network Hash Rate from 2020 to First Half of 2025



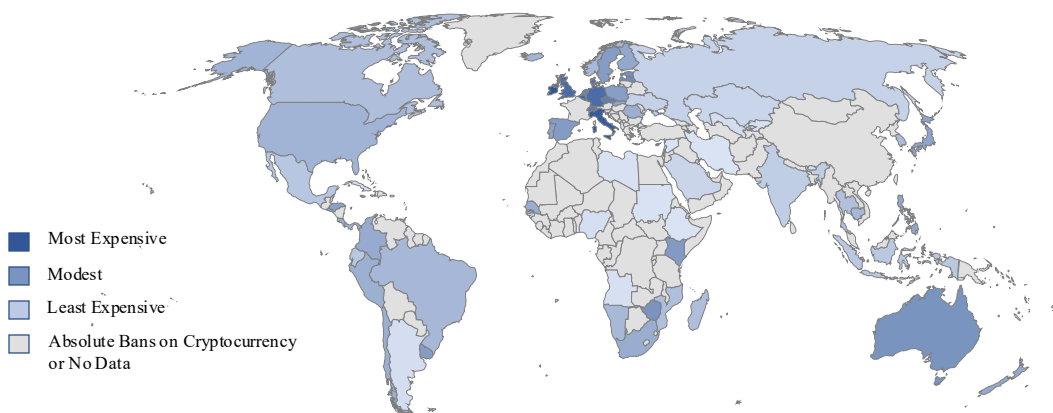
Hardware Efficiency Leap

Innovations in ASIC chips have propelled the industry into a new era characterized by low power consumption and high computational power. Combined with synergistic upgrades in cooling systems and supporting hardware, these advancements have collectively fueled a leapfrog growth in the network's total computing power. This innovation directly translates into exceptional energy efficiency, with the latest mining hardware achieving remarkable performance metrics. The outcome of this hardware upgrade has been the Bitcoin network's sustained explosive growth in total computing power, soaring from approximately 100 EH/s in 2020 to over 900 EH/s by mid-2025.

Operational Cost Optimization

Electricity costs typically make up 60% to 80% of total Bitcoin mining expenses, so optimizing energy strategies has become a core market driver for the mining machine industry, directly boosting miners' profitability. Relocating facilities to low-cost electricity regions is a mainstream tactic. Large-scale use of renewable energy also plays a key role, with hydropower, wind, and solar now powering over half of global mining. These strategies along with waste heat recovery and AI tools to optimize real-time energy use not only lower operational costs but also shape mining machine innovation, favoring rigs with low energy use and flexibility for diverse energy setups.

Electricity Consumption of 1 Bitcoin Mining in 2024



Conclusion

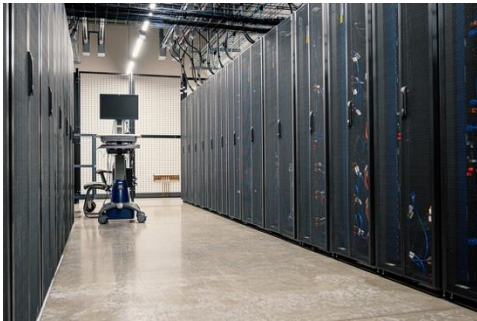
The dual forces of efficiency escalation and operational cost optimization are fundamentally reshaping the Bitcoin mining industry. The continuous advancement in technology has improved hardware efficiency and promoted the continuous upgrading of Bitcoin mining machines. Simultaneously, the industry's strategic pivot toward low-cost energy regions and renewable sources not only sustains individual mining profitability but also propels the entire industry toward greater scalability and sustainability, ensuring its continued evolution in the face of rising network difficulty and evolving market conditions.

Rise of Mining Hosting and Cloud Mining Services

The Bitcoin mining industry is becoming increasingly specialized. The rise of mining rig hosting and cloud mining services has significantly lowered the barrier to entry, emerging as a key market driver propelling the growth of the mining hardware industry.



- **Mining hosting** is a service model in which the customer retains ownership of the miners while the operator furnishes the facility, low-cost electricity, and round-the-clock maintenance to keep the hardware hashing.
- **Cloud mining** is a lease-based model where customers rent a defined quantity of hash power, bypassing the purchase, transport, and upkeep of physical rigs and receiving daily BTC proceeds directly to their wallets.



Core Characteristics of Mining Hosting and Cloud Mining Services

Feature	Mining Hosting	Cloud Mining
Business Model	Users own the physical hardware ; service providers offer infrastructure (power, space, maintenance) for a fee.	Users rent computational power , service providers manage all hardware and operations.
Target Customer	Capital-rich individuals, SMBs, and institutional investors.	Retail investors, individuals with no technical expertise, and those seeking low-entry barriers.
Advantage vs. Traditional Mining	Solves operational challenges: Access to low-cost energy and professional maintenance without managing a private facility.	Solves all hardware & operational barriers: Zero capital expenditure on hardware and no technical knowledge required.
Driving Force for Bitcoin Mining Hardware Market	Creates sustained demand for latest-generation, high-efficiency ASICs from a professional buyer segment.	Expands the total addressable market by democratizing access , indirectly driving demand for hardware purchased by service providers.

Conclusion

The rise of mining hosting and cloud mining services directly stimulate demand for mining rigs by dramatically lowering participation barriers. Hosting services create a reliable customer base for hardware manufacturers by enabling individuals and institutions to own equipment without operational complexities, particularly driving demand for the latest high-efficiency ASICs. Simultaneously, cloud mining platforms function as large-scale institutional buyers, purchasing hardware en masse to support their hashrate offerings, thus providing stable bulk orders for manufacturers. Together, these models establish a powerful symbiotic ecosystem: they democratize access to mining while ensuring continuous hardware upgrades, directly fueling both the technological advancement and commercial expansion of the Bitcoin mining hardware market.



Chap 3.2

Future Opportunities

Diversification into AI Computing Infrastructure

In recent years, the blockchain mining machine industry has experienced a structural shift. Cryptocurrency price volatility and regulatory tightening in major markets have significantly reduced the profitability of Bitcoin and other PoW (Proof-of-Work) mining operations. As a result, the industry is seeking new demand sources for high-performance chips and data center capacity, which directly aligns with the explosive rise of AI computing needs.

Strategic Convergence Comparison: Mining Machine Manufacturers vs New AI Entrants

Comparison Dimension	Mining Machine Manufacturers	New AI Entrants	Advantage Explanation
Hardware Architecture	Mature high-parallel computing architectures (GPU/ASIC/FPGA), firmware adaptable	Need to design or procure GPUs/ASICs	Mining firms can quickly adapt existing hardware for AI training/inference
Packaging & Cooling	Advanced packaging, liquid cooling, power management expertise	Must develop in-house or outsource	Technology can be directly transferred, saving R&D costs
Data Center Infrastructure	High-density power supply, advanced cooling, distributed deployment	Need to build from scratch	Mining facilities can be quickly converted into AI data centers, lowering capex
Supply Chain & Manufacturing	Long-term partnerships with foundries, secured chip capacity	Must compete for limited capacity	Mining firms can quickly capture the AI compute gap window

Leveraging their technical and resource advantages, mining machine companies can pursue new business models such as repurposing rigs for compute-as-a-service (CaaS) to provide on-demand AI compute for startups, research institutions, or cloud providers, generating high-margin recurring revenue. They can also operate hybrid data centers that handle both blockchain and AI workloads, improving utilization and energy efficiency. Additionally, companies can develop AI-specific ASICs or partner with AI cloud providers for GPU farm co-location or managed services, securing stable clients and strategic alliances.

Conclusion

Given the rapid growth in global AI compute demand and the long-term supply constraints, mining machine companies are well-positioned to leverage their existing technology, hardware, and facilities to enter the AI compute market quickly. This strategic move allows revenue diversification and elevates their role in the global compute infrastructure ecosystem, potentially establishing them as a critical backbone of AI infrastructure worldwide. To achieve this transformation, companies should prioritize evaluating farm retrofitting costs, hardware adaptability, and potential partner networks while developing a three- to five-year actionable roadmap for the transition.

Renewable Energy-Integrated Mining Initiatives

The global energy system is undergoing a profound transformation, with decarbonization, digitalization, and intelligentization emerging as the core directions of energy transition. Against this backdrop, the blockchain mining industry is facing a historic opportunity to redefine its energy structure. Over the past decade, the mining sector has relied heavily on fossil fuels, resulting in high energy consumption, significant carbon emissions, and increased policy risks. Today, however, the sharp decline in renewable energy costs and the maturation of energy management technologies have provided a solid economic and technological foundation for green mining.

Total installed cost and LCOE trends by technology, 2010 and 2023

	Total installed costs			Levelised cost of electricity		
	USD/kW			USD/kWh		
	2010	2023	Percent Change	2010	2023	Percent Change
Bioenergy	3010	2730	-9%	0.084	0.072	-14%
Solar PV	5310	758	-86%	0.460	0.044	-90%
Hydropower	1459	2806	92%	0.043	0.057	33%
CSP	10453	6589	-37%	0.393	0.117	-70%

The global energy landscape is undergoing a profound transformation toward decarbonization and digitalization, and the rapid decline in renewable energy costs is redefining the energy foundation of the blockchain mining machine industry. According to data between 2010 and 2023, the installed cost of solar photovoltaic (PV) power dropped from USD 5,310 per kilowatt to USD 758 per kilowatt, representing an 86 percent decrease, while its levelized cost of electricity (LCOE) fell from USD 0.460 per kilowatt-hour to USD 0.044 per kilowatt-hour, a 90 percent reduction.

Stranded Assets and Carbon Mitigation

Although the stranded-asset effect contributes only a modest amount of additional carbon emissions each year, its cumulative impact can substantially erode the power sector’s remaining carbon budget. Studies suggest that in the U.S., this effect alone could consume roughly 16% of that budget within ten years. Repurposing stranded energy for renewable generation can help avert such carbon lock-in. The deployment of solar PV over the past six years now avoids around 1.4 Gt of CO₂ emissions annually, while wind power avoids about 900 Mt per year, collectively helping reduce the emissions associated with stranded assets.

Conclusion

For mining companies, electricity expenses typically account for the majority of operational costs, and the increasing affordability of renewable power enables a new model of sustainable profitability built on low-cost and low-carbon energy. By co-locating mining operations with solar, wind, or hydro facilities, enterprises can achieve energy self-sufficiency, stabilize power costs, and reduce dependence on volatile fossil fuel markets. At the same time, the intermittent nature of renewable power drives innovation in mining hardware design, encouraging manufacturers to develop next-generation machines equipped with intelligent power modulation, energy storage coordination, and adaptive computational load management to optimize energy utilization. Furthermore, integrating mining operations with renewables mitigates carbon lock-in risks while enhancing cost stability and long-term sustainability.



Chapter 4 — Best Practice for Consumer-grade ASIC- based Bitcoin Mining Machine

Best Practice for Consumer-grade ASIC-based Bitcoin Mining Machine



Canaan Inc. (NASDAQ: CAN) is one of the earliest pioneers of ASIC-based Bitcoin mining hardware. Since launching the Avalon line in 2013, it has built end-to-end capabilities spanning in-house ASIC design, system engineering, and mass manufacturing. Its portfolio covers industrial-grade Avalon Miner systems (air-, liquid- and immersion-cooled), the consumer-oriented Avalon Home series, and modular infrastructure such as Avalon Box, alongside joint-mining and hosting services. Canaan’s edge centers on energy efficiency (J/TH), reliable scale delivery, and lifecycle support (firmware autotuning, warranty/RMA). Its latest generation, the Avalon A16 series released in October, 2025, pushes the line further toward higher efficiency and high-density deployments, with the air-cooled A16XP delivering up to 300 TH/s at 12.8 J/TH.

To broaden its reach beyond industrial deployments and address emerging household-level computing demand, the Company introduced a new generation of the Avalon Home series in 2025. The product line focuses on improvements in energy efficiency, acoustic and thermal performance, and plug-and-play usability. This launch extends the capabilities historically associated with industrial-grade mining systems to home and small-office environments, offering a more accessible entry point for a wider user base.

Canaan—Avalon Home Series

We note that Canaan Inc. (NASDAQ: CAN), one of the mainstream ASIC Bitcoin mining machine vendors, was the first major player to launch a consumer-facing Avalon Home series in 2025. This signals a shift from a miner business that was traditionally B2B- and farm-focused toward household and small-footprint deployments. The line prioritizes low power, low noise and plug-and-play setup, reaching individual users through direct and e-commerce channels, and creating an accessible entry point for light hashrate, heating-plus-mining, and education/maker use cases.

Avalon Nano 3S



28V 5A
140 watts
-5 ~ 30 °C
6 TH/s
30 ~ 40 dB

Avalon Nano 3S is an entry-level home Bitcoin miner, about 6 TH/s at 140 W, quiet enough for desktop use. It is plug-and-play with a bundled GaN adapter and app control, ideal for first-time or casual miners.

Avalon Mini 3



110-240V AC
50/60Hz
-5 ~ 40 °C
37.5 TH/s
35 ~ 55 dB

Avalon Mini 3 targets home and small-farm users, delivering around 37.5 TH/s at about 800 W. It supports quieter operating modes, enabling “mining + heating” use so it can run for long periods indoors.

Avalon Q



110-240V AC
50/60Hz
-5 ~ 35 °C
90 TH/s
45 ~ 65 dB

Avalon Q is the premium home model, about 90 TH/s at 1.67 kW, bringing near-pro performance to a single unit. It suits users or small teams who want high hashrate without building a full mining site.

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In recent years, the Bitcoin mining industry has expanded beyond a pure B2B model toward a growing 2C segment, as advances in efficiency and acoustics have enabled low-power, low-noise, plug-and-play devices suitable for homes and small offices. Recognizing this shift, Canaan introduced the Avalon Home series. The lineup currently centers on the Avalon Mini 3 and Avalon Q models, which retain professional-grade mining capability while enhancing consumer usability. Key attributes include improved energy efficiency and thermal management, quiet operation, app-based setup and remote management, simplified pool onboarding, and flexible pricing structures such as per-unit bundles and optional hashrate-as-a-service. These products address diverse emerging use cases including household heat recycling, education and hobby applications, and small community nodes.

Avalon Mini 3

Cashback Rate
107%

Power Cost
\$ 0.08/kWh

Cost of Running
\$ 46.08

Monthly Rewards
\$ 49.16



➤ **High-Value Hashrate for Home Use**

Avalon Mini 3 delivers roughly 37.5 TH/s at about 800 W, which is a practical power band for homes, small offices, and studios. It gives a real jump in mining capability over 6 TH/s entry devices, yet it does not push the user into 1.5–3 kW industrial territory that needs dedicated circuits, racks, or special cooling. The benefit is straightforward: one box, meaningful hashrate, predictable monthly power bill. Since it is sold as a standardized unit with clear specs, users can model payback, pools can recommend it, and resellers can list it easily in consumer channels.

➤ **Indoor-Friendly, Long-Run Operation**

Avalon Mini 3 is tuned for long-term indoor operation, not just peak hashrate. Quieter or night-running profiles, moderated airflow, and an 800 W thermal load make it feasible to keep the unit in a study, utility room, small warehouse corner, or even a garage without turning the space into a server room. In colder months it can double as a small heat-recycling (heating + mining) device, so the user captures more value from the same kWh. The user benefit is comfort and predictability: no 75 dB fan roar, no constant tweaking of exhaust, and fewer placement constraints. With app-based monitoring of hashrate, power, and temperature, the device behaves like an appliance, and intervention is only needed on alerts, which lowers the day-to-day operational burden for non-professional miners.

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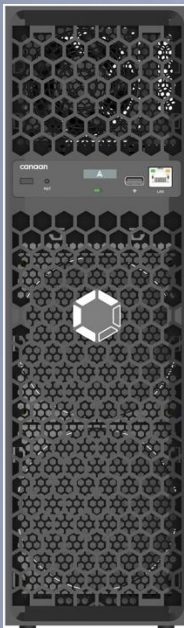
Avalon Q

Cashback Rate
122%

Power Cost
\$ 0.08/kWh

Cost of Running
\$ 96.42

Monthly Rewards
\$ 123.01



➤ Near-Pro Hashrate in a Home Form Factor

The main value of Avalon Q is that it delivers around 90 TH/s at about 1.67 kW in a single ready-to-ship unit, which is close to what small professional rigs offer. This lets individual users, small teams, or studios get near-pro performance without committing to full racks or immersion systems. Within the same home lineup, it clearly sits above the 6 TH/s and 37.5 TH/s tiers, so it is the one you choose when you actually care about output, not just “trying mining.” Because the hashrate is high and the specs are transparent, ROI and payback modeling by tariff is easier and more convincing.

➤ Easy to Deploy, Power-Compatible Across Regions

Avalon Q is built as a true ready-to-run unit. It ships with a matched PSU and supports 110–240 V, 50/60 Hz, so it can be powered in US 110 V environments as well as EU/PRC 220 V grids, with only a dedicated circuit recommended for 110 V to handle the ~1.6 kW load. Cooling is air-based and tuned for this power level, which means users can place it in garages, utility rooms, storage corners or small office spaces without adding a separate liquid or immersion system. Network and pool setup are done via app or web, typically by scanning a code or entering pool/wallet/worker info, so it can start hashing within minutes. The benefits are clear: low deployment friction (no extra PSU or rack needed), easy relocation across regions with different mains standards, and lightweight maintenance since users mainly need to keep airflow clean and watch alerts. In practice, it behaves much closer to a high-power appliance than to a data-center miner.

Methodology

Comprehensive Market Research Approach

Frost & Sullivan's Research Institute focuses on the Chinese market, conducting in-depth studies across 10 major industries and 54 vertical sectors, with nearly 500,000 industry research samples accumulated and over 10,000 independent research consulting projects completed.

Life Cycle Analysis of Industry Dynamics

Leveraging China's dynamic economic environment, the Research Institute explores fields such as social security, artificial intelligence, and big data, covering the entire life cycle of industries. This includes the establishment, growth, and expansion of companies, as well as their journey to IPO and maturity. Industry researchers evaluate and assess the evolving industrial models, business strategies, and operational models of companies, offering a professional perspective on the industry's development.

Integration of Traditional and Innovative Research Methods

The institute integrates traditional and new research methodologies, using proprietary algorithms and combining cross-sector big data analysis. By employing diversified research approaches, the team uncovers the logic behind quantitative data and explores the insights underlying qualitative content. This enables objective and authentic explanations of the industry's current state, along with forward-looking predictions of future trends. Each report produced by the Research Institute presents a comprehensive picture of the past, present, and future of the industry.

Adaptive and Continuous Data Refinement

The Research Institute closely monitors the latest developments in industry trends. The content and data in its reports are continuously updated and refined based on industry growth, technological advancements, changes in competitive landscapes, regulatory policies, and deeper market insights.

Strategic and Executional Perspective in Research

With a commitment to meticulous research and forward momentum, the Research Institute analyzes industries from a strategic viewpoint and interprets them from an execution perspective, offering valuable reports to readers seeking thorough and insightful industry analysis.

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