Bitcoin Miner Financing

A PRIMER — JULY 2026

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Why This Primer Exists

The miners best positioned for long-term success are not necessarily the ones with the cheapest power or the newest rigs — they are the ones who take a disciplined approach to capital structure. Many mining operations are sitting on financeable assets that remain under-leveraged: BTC treasury holdings, hashrate production capacity, ASIC fleets, energy infrastructure, and future revenue streams. Each of these can be converted into growth capital — without diluting equity and without selling Bitcoin.

The challenge is that most operators approach these assets in isolation, or not at all, funding growth through operational cash flow and selling BTC when capital is needed rather than treating capital structure as a discipline in its own right. The instruments now exist to do better. Financing support and lender access span every layer of the mining asset base, from BTC-backed lending and hash rate-forward contracts to ASIC equipment finance, energy infrastructure project finance, and bespoke hybrid structures that combine multiple layers for capital efficiency.

The scale of the need is wide-ranging. Requirements run from a few million dollars in working capital to two hundred million or more for a new facility. In each case the task is the same: identifying the right structure and matching it to the right counterparties.

The Bitcoin mining industry has been transformed. What started as a garage-scale hobby is now a multi-billion-dollar capital-intensive sector[1] — and significant financing gaps remain across the sector. The April 2024 halving proved what the market already suspected: miners who rely solely on operational cash flow to fund growth face a structural disadvantage compared with those who approach capital structure as a core strategic discipline.

The opportunity is enormous. Institutional-grade financing is now available across the full range of mining assets — BTC treasuries, hashrate production, ASIC hardware, energy infrastructure, and revenue streams — but most operators are using only a fraction of what's available. Hashrate-forward contracts allow you to monetise future production without selling BTC. Equipment finance and sale-leasebacks unlock capital from existing fleets. Energy infrastructure lending attracts the lowest headline rates in the mining finance universe. And structured hybrid capital stacks — layering multiple instruments across your asset base — can reduce your blended, risk-adjusted cost of capital relative to single-source financing.[2]

This primer is your comprehensive guide to every major financing instrument available to Bitcoin mining operations today. It is designed for CFOs, treasury managers, and founders who want to understand not just what exists, but how to select, structure, layer, and risk-manage these instruments to build an operation that thrives through every halving cycle.

Key takeaways from this primer include: an understanding of how each financing instrument interacts with the Bitcoin halving cycle, network difficulty adjustments, hardware depreciation curves, and

1. Estimated at $30–40 billion in aggregate enterprise value of publicly listed and major private mining operators as of Q1 2026 — this is separate from the annual financing TAM and capex estimates cited later in this primer; see the note in Section 1.4.
2. Illustrative range discussed in prior Greengage deal reviews is approximately 300–500 bps versus single-instrument financing; actual savings depend on borrower credit profile, asset mix, and prevailing market conditions, and are not a guaranteed outcome. See Section 5.1 for the risk-adjusted cost-of-capital rationale behind this.

energy cost structures; a strategic framework for selecting the right instrument based on your operational philosophy (accumulator vs. producer vs. hybrid); a risk management architecture for avoiding correlated liquidation events; and a practical decision matrix for evaluating any financing proposal.

1. Market Context: The State of Bitcoin Mining in 2025–2026

1.1 Industry Scale & Growth

The Bitcoin mining industry has reached an unprecedented scale. The total network hashrate surpassed 800 EH/s in early 2025 and has continued to climb, driven by the deployment of next-generation ASIC miners and the expansion of large-scale facilities across North America, the Middle East, and parts of Africa and Latin America. According to data from the Cambridge Centre for Alternative Finance (CCAF), the annualised electricity consumption of the Bitcoin network exceeds 150 TWh, comparable to the national energy consumption of medium-sized countries.

The post-halving environment has accelerated industry consolidation. Public miners such as MARA Holdings (formerly Marathon Digital), CleanSpark (CLSK), and Riot Platforms (RIOT) have pursued aggressive acquisition strategies, absorbing smaller operators who lacked the capital reserves to survive the margin compression. This trend mirrors the historical pattern observed after the 2020 halving, where publicly traded miners' share of total network hashrate grew from approximately 15% to over 30% within eighteen months.

Core Scientific (CORZ) followed a different path. After emerging from Chapter 11 bankruptcy in early 2024, it did not pursue an aggressive acquisition strategy; instead, it became a takeover target. In July 2025, CoreWeave agreed to acquire Core Scientific in an all-stock transaction (implied equity value of roughly $9 billion at signing), under which Core Scientific stockholders would have held less than 10% of the combined company. The deal required Core Scientific shareholder approval and did not obtain it: on 30 October 2025 stockholders voted against the merger and the agreement was terminated the same day, leaving Core Scientific an independent, publicly traded company with CoreWeave continuing as a commercial partner. The episode illustrates a broader pattern in this cycle: mining operators with valuable infrastructure — particularly the power and interconnection assets now prized by AI/HPC buyers — have become sought-after acquisition targets, even where shareholders judge standalone value to exceed the offer on the table.

1.2 Post-Halving Economics

The April 2024 halving reduced daily BTC issuance from approximately 900 BTC to 450 BTC. At a Bitcoin price of approximately $100,000, this represents approximately $45 million in daily block subsidy revenue shared across all miners globally. Transaction fees, which have historically contributed 2–5% of miner revenue, have become increasingly significant, periodically spiking to 15–20%+ of total block reward during periods of high on-chain activity driven by Ordinals inscriptions, BRC-20 tokens, and general network congestion.

The critical metric for mining profitability is the hashprice — the expected daily revenue per unit of hashrate deployed, typically measured per petahash (PH/s). As of early 2026, the hashprice sits in the range of $50–60/PH/day, having recovered substantially from the post-halving trough of approximately

$40/PH/day seen in mid-2024. This recovery has been driven primarily by Bitcoin's price appreciation rather than by meaningful increases in fee revenue or reductions in network difficulty.

1.3 The Capital Expenditure Imperative

Modern mining operations face a relentless capital expenditure cycle. Next-generation ASIC miners — such as the Bitmain Antminer S21 series, MicroBT's WhatsMiner M60 series, and emerging models from Canaan and Auradine — offer hash rates of 200–400+ TH/s at power efficiencies of 15–20 J/TH. A competitive 100 MW facility deploying current-generation equipment may require $150–250 million in total capital deployment, inclusive of hardware, electrical infrastructure, cooling systems, land, and interconnection costs.

This capital intensity creates a structural financing need. Unlike many technology businesses where growth can be funded through operating cash flow and modest credit facilities, mining operations require large, discrete capital outlays that must be timed to equipment availability cycles, energy procurement windows, and — crucially — the Bitcoin halving calendar. The mismatch between the lumpy nature of capital expenditure and the variable, cycle-dependent nature of mining revenue is the central challenge that the financing instruments described in this primer aim to solve.

Metric	Pre-Halving (Jan 2024)	At Halving (20 Apr 2024)	Post-Halving Low (Q3 2024)	Current (Q1 2026)
Network Hashrate	~550 EH/s	~590 EH/s	~620 EH/s	~850+ EH/s
BTC Price	~$42,000–45,000	~$63,000–64,000	~$58,000	~$95,000–105,000
Hashprice ($/PH/day)	~$85	~$60	~$40	~$50–60
Daily Block Subsidy	~900 BTC	450 BTC (post-halving)	~450 BTC	~450 BTC
Avg. Transaction Fees (% of reward)	~3–5%	~5–8%	~8–15%	~5–10%
Leading ASIC Efficiency	~21 J/TH	~19 J/TH	~17 J/TH	~15–16 J/TH
Estimated Global Mining CapEx	~$8–10B/yr	n/a	~$5–7B/yr	~$10–14B/yr

Source: Cambridge Centre for Alternative Finance (CCAF); Hashrate Index; CoinGecko historical BTC price data; Greengage analysis.

1.4 The Financing Landscape

The Bitcoin mining financing ecosystem has matured dramatically since the 2021–2022 cycle. The collapse of several major crypto lenders — including BlockFi, Celsius, Voyager, and Genesis — in 2022 temporarily froze credit availability for miners. However, the subsequent recovery has been

characterised by the emergence of more sophisticated, better-capitalised lenders and a diversification of available financing structures.

Key developments in the mining finance landscape include the entry of traditional equipment finance companies (e.g., Trinity Capital, Partners for Growth), the growth of hashrate-forward markets facilitated by firms such as Luxor Technologies and Blockware Solutions, the emergence of structured credit products from digital-asset-native firms like Galaxy Digital, and the increased willingness of traditional banks — following regulatory clarity in certain jurisdictions — to provide energy infrastructure financing to mining-adjacent entities.

The total addressable market for Bitcoin mining finance is estimated at $15–25 billion annually, encompassing equipment purchases, facility construction, working capital, and treasury management.[3] This represents a significant and growing opportunity for both lenders and mining operators who can navigate the complexities of structuring, pricing, and risk-managing these instruments.

3. This is an annual financing-flow estimate (new facilities originated per year across all instrument types), distinct from the ~$30–40B aggregate sector enterprise-value figure in the Executive Summary and the ~$10–14B/yr global mining capex estimate above, which covers hardware and infrastructure spend only. The three figures measure different things and are not directly additive.

2. The Mining Economics Primer: Understanding Your Asset Base

Before evaluating any financing instrument, a mining operator must have a rigorous understanding of the assets and revenue streams that underpin their business. Each financing structure ultimately monetises one or more of the following five core asset classes, and misunderstanding the risk profile of any single class can lead to catastrophic capital structure failures.

2.1 Asset Class 1: Bitcoin Treasury Holdings

Bitcoin held on the balance sheet represents the most liquid and volatile asset a miner possesses. BTC treasury management is both a strategic decision and a financing variable. Miners who adopt a "HODL" strategy (retaining all or most mined BTC) build a valuable but highly price-sensitive asset base. This treasury can be used as collateral for borrowing, but the volatility of Bitcoin creates significant margin call risk.

Key metrics: BTC treasury value, loan-to-value (LTV) ratios offered by lenders (typically 40–65% for BTC-backed loans), margin call trigger levels, and liquidation thresholds. Historical BTC drawdowns of 50–80% from all-time highs must be stress-tested against any BTC-backed financing structure.

Source: Glassnode; CoinGecko; lender term sheets reviewed by Greengage.

2.2 Asset Class 2: Hashrate Production Capacity

Hashrate represents the productive output capacity of a mining operation. It is a function of the number and efficiency of deployed ASIC miners, uptime, and overclocking or underclocking decisions. Hashrate can be "forward sold" through derivatives and structured products, creating a revenue stream analogous to commodity pre-sales in traditional extractive industries.

Key metrics: Deployed hashrate (EH/s), efficiency (J/TH), uptime percentage, hashprice ($/PH/day), and forward hashrate curve pricing. The hashrate market is still maturing and liquidity can be thin, particularly for longer tenors (>6 months).

Source: Luxor Hashrate Index; Blockware; NiceHash.

2.3 Asset Class 3: ASIC Mining Hardware

ASIC miners are depreciating physical assets with a useful economic life typically ranging from 2–4 years, depending on the pace of technological advancement and energy cost dynamics. The secondary market for ASIC miners is active but volatile, with resale values heavily influenced by Bitcoin price, network difficulty, and the availability of next-generation hardware. Equipment can serve as collateral for asset-backed lending, leasing, or sale-leaseback arrangements.

Key metrics: Fleet composition (model, vintage, efficiency), current replacement cost, secondary market value, depreciation schedule, and efficiency gap versus latest-generation models. A common

risk is "obsolescence cliff" — the rapid decline in secondary market value when a new generation of hardware is released.

Source: Bitmain pricing data; Luxor ASIC Index; Kaboom Racks secondary market data.

2.4 Asset Class 4: Energy Infrastructure & Contracts

Energy is the single largest operating expense for most miners, typically representing 60–80% of all-in production costs. Energy infrastructure encompasses power purchase agreements (PPAs), behind-the-meter generation assets (solar, wind, natural gas, nuclear), electrical substations, transformers, switchgear, and grid interconnection rights. These assets often have long useful lives (15–30+ years) and can attract infrastructure-grade financing with lower interest rates than crypto-specific lending.

Key metrics: All-in power cost ($/kWh), PPA tenor and structure (fixed, indexed, curtailable), renewable energy certificates (RECs), demand response revenue, behind-the-meter generation capacity, and grid interconnection queue position.

Source: EIA; ERCOT; PJM; industry PPA benchmarks; Greengage analysis.

2.5 Asset Class 5: Future Revenue Streams

Mining revenue — comprising block subsidies and transaction fees — represents a continuous but variable cash flow stream. This revenue can be factored, pledged, or pre-sold through various structures. The key challenge is the multi-variable nature of mining revenue, which depends on BTC price, network difficulty, transaction fee levels, hardware efficiency, energy costs, and uptime simultaneously.

Key metrics: Gross mining revenue, operating margin, revenue volatility (historical and modelled), correlation between revenue drivers, and the ratio of fixed costs to variable revenue.

Source: CoinMetrics; miner financial disclosures; Greengage modelling.

3. Strategic Framework: Defining Your Financing Philosophy

The single most important decision a mining operator makes before engaging with any financing provider is defining their core operational philosophy. This decision cascades through every subsequent choice — from the type of collateral offered, to the tenor of facilities sought, to the risk tolerances embedded in the capital structure. Three dominant philosophies can be identified among institutional mining operations.

3.1 Philosophy A: The BTC Accumulator

The Accumulator model prioritises the retention and growth of the Bitcoin treasury above all else. These operators view mining as a means of acquiring BTC at a cost basis below market price, and they are willing to accept higher financing costs or more complex structures to avoid selling their mined Bitcoin.

Financing implications: Accumulators should favour non-BTC collateral structures wherever possible — equipment-backed lending, energy infrastructure finance, and revenue-based facilities that do not require BTC to be pledged or sold. Where BTC-backed borrowing is used, extremely conservative LTV ratios (below 40%) and large margin buffers are essential.

Exemplar operators: MARA Holdings (formerly Marathon Digital Holdings) and Hut 8 Corp (formerly Hut 8 Mining) — both of which have publicly stated BTC treasury-first strategies and hold significant unencumbered BTC reserves.

3.2 Philosophy B: The Industrial Producer

The Industrial Producer model treats mining as a manufacturing business. These operators focus relentlessly on minimising unit production costs (cost per BTC mined), maximising operational margins, and selling BTC regularly to fund operations and growth.

Financing implications: Producers can use the full range of financing instruments, including BTC-backed lending (since they are less attached to treasury holdings), hashrate forwards, and equipment finance. The key risk for Producers is over-optimising for current-cycle economics and failing to retain sufficient BTC exposure for future upside.

Exemplar operators: Iris Energy and other operators who have historically sold the majority of mined BTC and focus on operational efficiency metrics.

3.3 Philosophy C: The Hybrid Opportunist

The Hybrid model combines elements of both Accumulator and Producer philosophies, dynamically adjusting the BTC retention rate based on market conditions, financing availability, and capital needs.

Financing implications: Hybrids require the most flexible capital structures — revolving facilities, adjustable LTV structures, and the ability to swap between BTC-backed and non-BTC-backed financing as market conditions evolve. This flexibility is best supported by experienced corporate treasury management capable of dynamically optimising across the full spectrum of available instruments.

3.4 Matching Assets to Financing Instruments

The following matrix maps each of the five mining asset classes against their optimal and sub-optimal financing use cases.

Asset Class	Best Financing Use Case	Avoid If…
BTC Treasury	Short-term liquidity; bridge financing for expansion	High volatility regime; low LTV headroom; BTC accumulator without margin buffer
Hashrate Production	Growth capital without selling BTC; monetising forward production	Difficulty trajectory uncertain; hardware fleet near obsolescence
ASIC Equipment	Hardware upgrade cycles; sale-leaseback for working capital	Equipment near end-of-life; next-gen models imminent; poor secondary market
Energy Infrastructure	Long-term infrastructure buildout; low-cost capital	Regulatory environment unstable; PPA counterparty credit risk high
Revenue Streams	Working capital; operational bridge during downturns	Bull market expansion (cost of capital too high); highly variable fee revenue

Source: Greengage Strategic Framework.

4. Financing Instruments: A Comprehensive Taxonomy

This section provides a detailed analysis of each major financing instrument available to Bitcoin mining operations. For each instrument, we examine the structure, typical terms, key providers, advantages, disadvantages, and critical risk considerations. Where data is available, we provide indicative pricing benchmarks as of Q1 2026.

4.1 BTC-Backed Lending

BTC-backed lending is the most widely available and well-understood form of Bitcoin mining finance. The structure is conceptually simple: a miner pledges Bitcoin held in treasury as collateral and receives a loan denominated in fiat currency (typically USD) or stablecoins (typically USDC or USDT).

Structure & Mechanics

BTC is transferred to the lender's custody (or a third-party custodian such as Coinbase Prime, BitGo, Fireblocks, or Copper) and held as collateral for the duration of the loan. The lender extends credit based on a loan-to-value (LTV) ratio — typically 40–65% at origination — meaning a miner pledging $10 million in BTC would receive a loan of $4–6.5 million. The collateral is marked-to-market continuously, and if the LTV rises above a predetermined threshold due to BTC price decline, the borrower faces a margin call requiring additional collateral or partial repayment.

Parameter	Typical Range (Q1 2026)	Notes
Origination LTV	40–65%	Lower LTV = lower rate; some lenders offer tiered LTV structures
Margin Call Trigger	70–80% LTV	Borrower must post additional collateral within 24–72 hours
Liquidation Threshold	80–90% LTV	Automatic liquidation of collateral; some lenders offer cure periods
Interest Rate (annualised)	6–14%	Depends on LTV, tenor, borrower credit, and lender cost of capital
Tenor	3–12 months (typical)	Some lenders offer up to 24 months; shorter tenor = lower rate
Custody	Third-party segregated	Best practice: qualified custodian with SOC 2 audit and insurance
Minimum Loan Size	$250K–$1M	Institutional lenders typically $1M+; some DeFi protocols lower

Source: Lender survey; Ledn; Unchained; Galaxy Digital; Coinbase Prime term sheets.

Key Providers

Institutional CeFi lenders: Galaxy Digital, Coinbase Prime (via institutional lending desk), Ledn, Unchained Capital, Maple Finance, XBTO. These firms typically offer the most competitive rates and most robust custody arrangements, but require extensive KYC/AML and minimum loan sizes of $1M+.

DeFi protocols: Aave (wBTC collateral on Ethereum), MakerDAO (wBTC vaults generating DAI), Compound, and emerging Bitcoin-native lending protocols on the Lightning Network and Stacks ecosystem.

Advantages

BTC-backed lending is highly liquid, widely available, and allows miners to access fiat capital without selling BTC — preserving upside exposure. It is the fastest form of financing to arrange (often within 1–2 weeks for established borrowers).

Disadvantages & Risks

The dominant risk is margin call and liquidation during BTC price drawdowns. A miner who borrows at 50% LTV when BTC is at $100,000 will face a margin call if BTC falls approximately 30–40%. In a severe drawdown (50%+ from ATH, which has occurred in every major cycle), the miner risks forced liquidation of their treasury at the worst possible time — a procyclical outcome that compounds losses.

> **Risk Alert: The Procyclical Liquidation Trap**
>
> The most dangerous scenario in BTC-backed lending is correlated liquidation. When BTC price drops sharply, multiple miners face margin calls simultaneously, forcing BTC sales that further depress the price, triggering additional margin calls in a cascading spiral. This dynamic was a significant contributor to the depth of the 2022 bear market.
>
> **Mitigation:** Maintain origination LTV below 40%. Keep unencumbered BTC reserves equal to at least 2x potential margin call requirements. Diversify across multiple lenders. Negotiate extended cure periods.

4.2 Hashrate-Forward Contracts & Synthetic Instruments

Hashrate-forward contracts represent one of the most innovative and rapidly evolving financing instruments in the Bitcoin mining ecosystem. These structures allow miners to monetise their future production capacity — selling the right to receive the output of a specified quantity of hashrate over a defined period — in exchange for upfront or periodic cash payments.

Structure & Mechanics

In a typical hashrate-forward contract, the miner agrees to deliver the mining output (BTC) produced by a specified quantity of hashrate (e.g., 1 EH/s) over a defined period (e.g., 6 months). The buyer pays

an upfront premium or a periodic fee, effectively purchasing BTC production at a discount to expected spot mining revenue.

Parameter	Typical Range	Notes
Tenor	1–12 months	Liquidity concentrated in 1–3 month tenors; >6 months requires bilateral negotiation
Pricing Basis	Discount to spot hashprice	Typically 10–30% discount depending on tenor and counterparty credit
Settlement	Physical (BTC delivery) or cash	Physical delivery dominant; cash settlement emerging
Difficulty Adjustment	Fixed or floating	Fixed: miner bears difficulty risk. Floating: buyer bears difficulty risk
Collateral Requirement	Varies	May require hardware or BTC collateral to ensure delivery
Contract Size	0.1–10 EH/s	Minimum viable size depends on counterparty; institutional desks: 1+ EH/s

Source: Luxor Technologies; Blockware Solutions; Greengage analysis.

Key Providers

Hashrate desks & brokers: Luxor Technologies, Blockware Solutions, PINTO (hashrate marketplace), and NiceHash. **Emerging platforms:** Several DeFi protocols are building on-chain hashrate derivatives, including Alkimiya.

Advantages

Hashrate forwards allow miners to secure future revenue at known prices, providing cash flow certainty for capex planning and debt service. They do not require the miner to pledge BTC or hardware as collateral, making them complementary to BTC-backed lending.

Disadvantages & Risks

The primary risk for miners is difficulty risk in fixed-difficulty contracts. If network difficulty increases significantly during the contract period, the miner must deploy additional hashrate at their own cost to meet the delivery obligation, or face shortfall penalties.

4.3 ASIC Equipment Financing

Equipment financing is the most established and widely used form of mining-specific debt. It encompasses a range of structures including traditional equipment loans, capital leases, operating leases, sale-leaseback arrangements, and vendor (OEM) financing programmes.

Structure & Mechanics

- **Equipment loans:** The miner purchases ASICs using loan proceeds, with the hardware serving as collateral. The loan amortises over the useful life of the equipment (typically 18–36 months), with interest rates ranging from 10–18%.
- **Capital leases:** The lessor purchases the ASICs and leases them to the miner, who has the option (or obligation) to purchase the equipment at the end of the lease term for a nominal residual value.
- **Operating leases:** The lessor retains ownership and bears the residual value risk, keeping debt off the miner's balance sheet but typically at a higher all-in cost.
- **Sale-leaseback:** The miner sells existing equipment to a financing party and simultaneously leases it back, freeing up capital while retaining use of the machines.
- **OEM / Vendor financing:** Bitmain, MicroBT, and other manufacturers offer direct financing programmes, typically requiring 20–40% down payment with the balance paid over 6–12 months.

Structure	Typical Rate	Tenor	LTV	Key Consideration
Equipment Loan	10–18%	18–36 months	60–80%	Amortisation must align with hardware useful life
Capital Lease	12–18%	18–36 months	65–85%	Tax treatment may differ from loan; check jurisdiction
Operating Lease	14–22%	12–24 months	N/A	Higher cost but off-balance-sheet; transfers residual risk
Sale-Leaseback	12–20%	12–24 months	50–70%	Unlocks liquidity from existing fleet; valuation is key
OEM Financing	0–10% (headline)	6–12 months	60–80%	Headline rate is often subsidised; effective cost is materially higher once the 20–40% down payment (an opportunity-cost drag) and any firmware- or pool-lock-in terms are factored in — model as a full package, not a rate.

Source: Trinity Capital filings; Bitmain financing terms; industry lender surveys; Greengage analysis.

Key Providers

Key providers include Trinity Capital (TRIN), Partners for Growth, BlockFills, Blockware Solutions, and the OEM financing arms of Bitmain and MicroBT.

> ### Critical Risk: The Obsolescence Cliff
>
> The defining risk of ASIC equipment financing is the obsolescence cliff. When a new generation of substantially more efficient hardware is released, the secondary market value of older-generation

> machines can drop 40–60% within weeks. If a miner has financed their fleet at high LTV ratios, this can trigger covenant breaches or create negative equity positions.

4.4 Energy & Infrastructure Financing

Energy and infrastructure financing represents the lowest-cost and longest-tenor financing available to mining operations, but also the most complex to structure.

Structure & Mechanics

- **Project finance:** A non-recourse or limited-recourse financing structure where the lender's repayment depends on the cash flows of the specific mining project. The gold standard for large-scale mining facility development ($50M+), attracting infrastructure-grade debt at rates of 6–12%.
- **PPA-backed financing:** Where a miner has secured a favourable long-term power purchase agreement, this contract itself can serve as collateral for borrowing.
- **Behind-the-meter (BTM) generation:** Miners who develop or acquire their own power generation assets can finance these separately from the mining operation.
- **Infrastructure-as-a-Service (IaaS):** A third party builds and owns the electrical and physical infrastructure, and the miner operates within it under a hosting agreement.

Structure	Typical Rate	Tenor	Ticket Size	Key Requirement
Project Finance	6–12%	5–15 years	$50M+	Non-recourse; requires robust contractual framework
PPA-Backed Lending	8–14%	3–10 years	$10M+	Long-term PPA with creditworthy utility counterparty
BTM Generation Finance	7–12%	5–20 years	$20M+	Independent generation asset valuation
Infrastructure-as-a-Service	N/A (opex)	2–5 years	Varies	Hosting agreement with clear SLAs and termination rights

Source: Infrastructure fund term sheets; US DOE data; Greengage analysis.

Energy infrastructure financing offers the most favourable terms in the mining finance universe because the underlying assets — generators, substations, transformers, grid interconnections — have intrinsic value independent of Bitcoin. A 50 MW substation does not become worthless if Bitcoin falls 50%; it retains its utility value and can be repurposed for data centres, industrial loads, or grid services.

Strategic Insight: The Energy Infrastructure Arbitrage

The most sophisticated mining operations are increasingly structured as energy companies that happen to mine Bitcoin. By separating the energy infrastructure from the mining operation, these operators can attract lower-cost infrastructure capital, maintain operational flexibility to pivot

compute capacity between Bitcoin mining and AI/HPC workloads, and create optionality value that pure-play miners lack.

Several formerly pure-play miners — including Hut 8 Corp, Applied Digital and Core Scientific — have allocated meaningful portions of their capacity to AI/HPC hosting, diversifying their revenue streams and improving their access to traditional infrastructure capital.

4.5 Revenue-Based Financing & Factoring

Revenue-based financing (RBF) provides capital in exchange for a percentage of future mining revenue. Unlike traditional debt, there is no fixed repayment schedule — the financing provider receives a share of the miner's revenue until a predetermined total return (typically 1.2–2.0x the advanced amount) has been reached.

Parameter	Typical Range	Notes
Advance Amount	$1M–$15M	Based on historical revenue and operational capacity
Revenue Share	5–25%	Higher share = faster repayment but more drag on operations
Total Return Multiple	1.2–2.0x	Provider receives 1.2–2.0x the advanced amount in total
Implied APR	15–35%	Depends on revenue velocity and return multiple
Maturity / Long-Stop	18–36 months	Any unpaid balance due at long-stop date
Revenue Verification	Pool API or on-chain	Automated revenue monitoring via mining pool integrations

Source: Pipe; Capchase (general RBF benchmarks); crypto-specific lender terms; Greengage analysis.

Revenue-based financing is particularly suited to miners with stable, predictable operations who need working capital without pledging specific assets. It is the most borrower-friendly structure during downturns, but it is also the most expensive form of financing on an all-in basis.

4.6 Equity, Convertible, & Token-Based Instruments

While the focus of this primer is on debt and debt-like financing structures, equity and equity-linked instruments remain a critical component of many miners' capital stacks.

Public Equity Markets

Publicly listed miners have raised tens of billions of dollars through common stock offerings, at-the-market (ATM) programmes, and follow-on offerings. MARA Holdings' ATM programme, for example, has been used extensively to fund both BTC purchases and operational expansion.

Convertible Notes & Bonds

Convertible debt instruments have become the preferred capital markets tool for larger public miners. MARA Holdings and Riot Platforms have each issued $500M+ in convertible notes, following the playbook established by Strategy (formerly MicroStrategy) in the broader Bitcoin treasury space.

Private Equity & Venture Capital

Private mining operations can raise equity from mining-focused funds and venture capital investors, including Galaxy Digital Ventures, Blockchain Capital, and Polychain Capital.

Token-Based Instruments

An emerging but still niche category involves the tokenisation of mining assets. Examples include Rigly's hashrate NFTs and various attempts at "mining-backed" tokens. These instruments face significant regulatory uncertainty and have not achieved meaningful institutional adoption.

4.7 Hybrid & Structured Capital Solutions

The most sophisticated mining finance structures combine multiple instruments into layered capital stacks that optimise the cost of capital while managing risk across multiple dimensions.

- **BTC-backed + Equipment Finance:** A miner pledges a portion of their BTC treasury for a revolving credit facility while simultaneously financing new hardware through an equipment lease.
- **Energy infrastructure + Hashrate forward:** A miner secures long-term project financing for a new facility, then uses hashrate forwards to pre-sell the expected production, de-risking the revenue side of the project finance model.
- **Convertible note + Revenue share:** A private miner issues a convertible note with a revenue-based repayment kicker, converting to equity once a target return is achieved.

> **Critical Warning: Cross-Default & Correlated Liquidation Risk**
>
> When layering multiple financing structures, the most dangerous risk is cross-default. If one facility enters default, cross-default clauses in other facilities can trigger simultaneous default across the entire capital stack.
>
> Equally dangerous is correlated collateral risk. If the same underlying event simultaneously reduces the value of BTC collateral, depresses ASIC secondary market values, and compresses mining revenue, all layers of the capital stack may come under stress at the same time. These multi-layer risks can be modelled and mitigated through stress testing, covenant optimisation, and counterparty diversification.

5. Capital Stack Architecture: Building a Multi-Layer Financing Structure

Building an optimal capital stack for a mining operation requires balancing five competing objectives: minimising the blended cost of capital, maximising operational flexibility, limiting liquidation and cross-default risk, aligning debt tenor with asset useful life, and preserving strategic optionality.

5.1 Principle 1: Layer by Risk-Adjusted Cost of Capital

The foundation of any capital stack should be the lowest-cost financing available on a risk-adjusted basis — which is not the same as the lowest headline rate. Energy infrastructure financing (6–12%) sits at the bottom of the stack because its rate is both low and stable: the underlying collateral retains value independent of Bitcoin's price. Equipment finance (10–18%) sits above it: a higher rate, but one that compensates lenders for obsolescence risk, not Bitcoin price risk.

BTC-backed lending's headline rate (6–14%) can look competitive with, or cheaper than, both of the instruments above — but that comparison is misleading taken at face value. The facility is directly exposed to Bitcoin price volatility and carries margin-call and forced-liquidation risk. On a risk-adjusted basis, BTC-backed lending should generally be treated as the more expensive, higher-risk layer of the stack, sized conservatively and used opportunistically rather than as a foundation. Revenue-based and equity instruments remain the most expensive layers on both a headline and risk-adjusted basis.

5.2 Principle 2: Match Tenor to Asset Life

A fundamental error in mining finance is tenor mismatch. Financing 3-year ASICs with 1-year debt creates refinancing risk; financing 1-year hashrate forwards with 5-year project finance creates capital inefficiency.

Asset / Instrument	Typical Asset Life	Optimal Debt Tenor	Mismatch Risk
Energy Infrastructure	15–30 years	5–15 years	Low — long-lived assets support long-tenor debt
ASIC Hardware (current gen)	2–4 years	18–30 months	Medium — obsolescence can shorten useful life
BTC Treasury	Indefinite	3–12 months (revolving)	High — volatility requires short-tenor, rolling structures
Hashrate Production	Continuous	1–6 months	Medium — difficulty changes can erode expected revenue
Revenue Streams	Continuous	12–24 months	Medium — halving cycle creates structural breaks

Source: Greengage Capital Structure Framework.

5.3 Principle 3: Avoid Correlated Risk Stacking

The most dangerous capital structure is one where multiple layers of debt are exposed to the same risk factor.

Scenario: Cascading Risk in a Poorly Structured Capital Stack

A miner has: (1) a BTC-backed loan at 50% LTV, (2) ASIC equipment finance at 75% LTV, and (3) a hashrate forward contract for 6-month delivery.

Bitcoin drops 40%. Simultaneously: the BTC-backed loan triggers a margin call; ASIC secondary market values drop 30%, putting the equipment loan into technical covenant breach; mining revenue drops 40%; and the hashrate forward's delivery obligation becomes unprofitable if difficulty has also risen.

This is not a theoretical scenario. Variants of this exact dynamic contributed to the failures of Compute North and several private miners in 2022, and to the balance-sheet pressure that ultimately led Core Scientific into Chapter 11 in December 2022 (from which it emerged, restructured, in early 2024).

5.4 Principle 4: Stress-Test Before Signing

Every proposed capital structure must be stress-tested against the following scenarios at minimum, run simultaneously, before a miner commits to any new financing facility:

Stress Scenario	Parameter Shock	What to Measure
BTC Severe Drawdown	BTC price -50% from current	Margin call triggers, collateral coverage, cash reserves
Difficulty Spike	Network difficulty +30%	Hashrate forward delivery costs, revenue impact, break-even shift
ASIC Market Collapse	Secondary market values -50%	Equipment loan LTV, covenant compliance, negative equity
Combined Stress	BTC -40%, Difficulty +20%, ASIC -30%	Simultaneous impact on all facilities; cross-default triggers
Revenue Drought	Hashprice drops to $30/PH/day	Cash flow coverage ratio across all debt service obligations
Counterparty Failure	One major lender becomes insolvent	Collateral recoverability; replacement financing availability

Source: Greengage Risk Framework.

6. Risk Management Framework

Effective risk management in Bitcoin mining finance requires understanding not just the individual risks of each financing instrument, but how those risks interact and compound across the capital structure.

6.1 Risk Taxonomy by Financing Type

Financing Type	Primary Risk Amplified	Secondary Risks	Mitigation Strategy
BTC-Backed Lending	Price volatility (BTC)	Custody, rehypothecation, counterparty	Conservative LTV (<40%); diversified custodians; no rehypothecation
Hashrate Forwards	Yield volatility (difficulty)	Delivery risk, basis risk, counterparty	Difficulty-adjusted contracts; partial hedging; counterparty credit assessment
Equipment Finance	Obsolescence risk (ASICs)	Residual value, technology cycle	Short amortisation; fleet diversification; manufacturer warranty
Revenue Finance	Upside cost (opportunity)	Revenue variability, covenant breach	Capped return multiples; revenue floor thresholds
Energy Infrastructure	Infrastructure lock-in	Regulatory, PPA counterparty, permitting	Multi-use facilities; diversified power sources; regulatory monitoring

Source: Greengage Risk Framework.

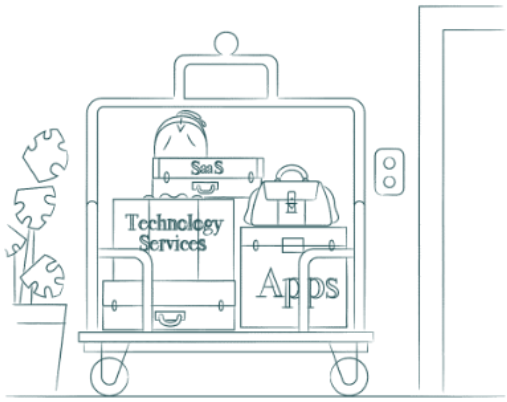
6.2 Hedging Instruments

- **BTC price risk:** Options, futures, and perpetual swaps on regulated exchanges (CME, Deribit) or bilateral OTC markets. 3-month ATM put options typically cost 8–15% of notional.
- **Difficulty risk:** Hashrate derivatives can partially hedge difficulty risk, though market liquidity remains limited. Miners commonly self-hedge by deploying 110–120% of the hashrate required to meet forward contract obligations.
- **Energy price risk:** Fixed-price PPAs, energy futures, and financial hedges against power price benchmarks. Miners in deregulated markets (e.g., ERCOT) can also monetise demand response programmes.

6.3 The Seven Questions Before Taking Any Facility

> 1. What is my post-halving margin at current BTC price and projected difficulty? Can I service this facility if margin compresses 50%?
> 2. Which asset class am I most determined to protect? Does this facility put that asset at risk?

3. Can I survive a 40% BTC drawdown, a 30% difficulty spike, and a 50% ASIC secondary market collapse — simultaneously?
4. Does this structure create margin call or forced liquidation risk? At what price levels?
5. Does this structure create production lock-in that limits operational flexibility?
6. What happens if multiple lenders exercise remedies simultaneously?
7. Have I modelled the interaction between this new facility and all existing facilities?



7. The Halving Cycle: Timing Your Capital Decisions

The Bitcoin halving — occurring approximately every four years — is the single most predictable and impactful event in the mining calendar. Understanding how to align capital decisions with the halving cycle is essential for long-term survival and growth.

7.1 Pre-Halving Strategy (12–18 Months Before)

Do: Lock in long-term energy contracts at favourable rates. Upgrade fleet efficiency. Build cash reserves and BTC margin buffers. Negotiate financing facilities with post-halving covenant relief built in.

Don't: Over-leverage BTC treasury at elevated prices. Take on new equipment finance with amortisation that extends deep into the post-halving period without modelling halved revenue.

7.2 Post-Halving Strategy (0–12 Months After)

Do: Focus on operational efficiency and cost reduction. Use revenue-based financing if working capital is needed. Acquire distressed assets from miners who failed to prepare.

Don't: Take on fixed-rate debt obligations misaligned with the new reward structure. Assume rapid BTC price recovery when stress-testing.

7.3 Expansion Phase (12–30 Months After Halving)

Historically, this is the optimal window for expansion. Margins have recovered, hardware prices are stabilising, and the market is preparing for the next cycle.

8. Decision Matrix & Operational Checklists

8.1 Master Decision Matrix

Philosophy	Cycle Phase	Primary Instrument	Secondary Instrument	Avoid
Accumulator	Pre-Halving	Energy infrastructure	Equipment finance	BTC-backed (high LTV)
Accumulator	Post-Halving	Revenue-based (bridge)	Equipment sale-leaseback	New fixed debt
Accumulator	Expansion	Energy + Equipment combo	Hashrate forward (partial)	Equity at cycle trough
Producer	Pre-Halving	Equipment finance	BTC-backed (moderate)	Long-tenor hashrate fwd
Producer	Post-Halving	Revenue-based	BTC-backed (low LTV)	New capex debt
Producer	Expansion	Equipment + Hashrate fwd	Project finance	Excessive equity dilution
Hybrid	Pre-Halving	Energy + Equipment blend	BTC-backed (conservative)	Unhedged hashrate fwd
Hybrid	Post-Halving	Revenue-based + BTC-backed	Hashrate fwd (short-term)	Multi-layer fixed debt
Hybrid	Expansion	Full capital stack build	Convertible note (growth)	Correlated collateral layering

Source: Greengage Strategic Framework.

8.2 Operational Readiness Checklist

Category	Required Information	Why It Matters
Operations	MW deployed; fleet model/age/efficiency; uptime history	Demonstrates operational capability and revenue predictability
Energy	All-in power cost; PPA structure & tenor; curtailment rights	Energy cost is the #1 driver of mining margin and loan serviceability
Treasury	BTC held; retention policy; current encumbrances	Determines BTC-backed borrowing capacity and strategic flexibility
Financials	12-month P&L; cash reserves; existing debt schedule	Standard credit analysis; essential for all institutional lenders
Models	Break-even BTC price; difficulty sensitivity; ASIC resale model	Shows sophisticated treasury management; builds lender confidence
Risk	Hedging positions; insurance coverage; counterparty exposure	Demonstrates risk awareness; may reduce pricing by 100–200 bps

Source: Borrower Preparation Guide.

8.3 Professionalising Treasury Management

Financial models: Break-even BTC price analysis at current and projected difficulty (+10%, +20%, +30%). ASIC fleet depreciation model with secondary market sensitivities. Monthly cash flow forecasting under bull, base, and bear scenarios.

Risk models: Margin call trigger analysis for all BTC-backed facilities. Cross-default risk mapping. Correlated liquidation stress test (the 'everything falls 40%' scenario).

Governance: Written treasury policy documenting BTC retention targets, hedging parameters, leverage limits, and decision-making authority.

9. Market Outlook & Emerging Trends

9.1 Mining Finance is Becoming Structured Commodity Finance

The most significant long-term trend in Bitcoin mining finance is its convergence with traditional structured commodity finance — reserve-based lending, production payment facilities, and commodity-linked bonds — tailored to the unique characteristics of proof-of-work mining.

9.2 The AI/HPC Convergence

The convergence of Bitcoin mining and AI/HPC infrastructure is reshaping the financing landscape. Several major miners have pivoted to allocate a portion of their capacity to AI/HPC hosting — Core Scientific's infrastructure was central to the strategic rationale for CoreWeave's 2025 bid for the company — an all-stock deal that Core Scientific shareholders rejected in October 2025.

We expect to see the emergence of 'convertible compute' facilities specifically designed to switch between mining and AI/HPC based on relative economics.

9.3 Regulatory Developments

Key developments to monitor include the ongoing evolution of US federal and state-level mining regulation, and the treatment of Bitcoin mining assets under Basel III banking capital requirements.

The EU's Markets in Crypto-Assets (MiCA) regulation is also relevant here, though indirectly: MiCA creates a comprehensive framework for crypto-asset service providers and stablecoin issuers operating in Europe, and mining itself is outside its direct scope. Its relevance is that MiCA shapes the compliance environment for the crypto-native lenders and custodians that miners rely on for BTC-backed facilities and treasury management.

9.4 Winners in the Next Cycle

The miners who will thrive through the next halving cycle (estimated 2028) and beyond will **optimise capital cost across multiple asset classes**, **avoid single-point collateral dependency**, **hedge intelligently rather than ideologically**, and **operate like disciplined energy producers** rather than speculative technology companies.

10. Conclusion

The Bitcoin mining industry is at an inflection point. The post-2024 halving landscape rewards operators who approach capital structure with the same rigour they apply to hashrate optimisation and energy procurement. You now operate in a world where:

- **You do not need to sell BTC to grow.** Equipment finance, energy infrastructure lending, and hashrate forwards can fund expansion without depleting your treasury.
- **You do not need to pledge ASICs to grow.** BTC-backed facilities, revenue-based financing, and equity instruments provide capital without hardware encumbrance.
- **You can monetise future production.** Hashrate forward contracts allow you to convert tomorrow's mining output into today's growth capital.
- **You can optimise energy infrastructure financing.** The lowest-cost capital available to miners is infrastructure debt.
- **You can build layered capital stacks.** Multiple financing layers, properly engineered, create compounding scale. Improperly layered, they create cascading risk.

The bottom line: leverage is no longer binary — it is structural. The quality of your capital structure is as important as the quality of your fleet or your power cost. The miners who master structured finance will be best positioned to thrive through the next decade of Bitcoin mining.

11. Appendix A: Glossary of Key Terms

ASIC: Application-Specific Integrated Circuit. Specialised hardware designed exclusively for Bitcoin mining.

ATM Programme: At-The-Market offering. A mechanism for public companies to sell shares incrementally at prevailing market prices.

Backwardation: A market condition where forward prices are lower than spot prices.

Block Subsidy: The BTC reward issued to the miner who successfully mines a block. Currently 3.125 BTC per block (post-April 2024 halving).

BTM (Behind-the-Meter): Power generation assets located at the mining site, allowing consumption without accessing the public grid.

Contango: A market condition where forward prices are higher than spot prices.

Cross-Default: A covenant triggering default if the borrower defaults on any other debt obligation.

DSCR: Debt Service Coverage Ratio. Lenders typically require >1.25x.

EH/s: Exahashes per second — 10^18 hash operations per second.

Halving: The pre-programmed 50% reduction in Bitcoin's block subsidy, occurring every 210,000 blocks (~four years).

Hashprice: The expected daily revenue per unit of hashrate deployed, typically expressed in $/PH/day or $/TH/day.

Hashrate: The total computational power applied to Bitcoin mining.

J/TH: Joules per Terahash — the standard measure of ASIC energy efficiency. Lower is better.

LTV: Loan-to-Value ratio.

Margin Call: A demand by a lender for additional collateral or partial repayment when LTV exceeds a threshold.

Network Difficulty: A measure of how difficult it is to mine a block. Adjusts every 2,016 blocks.

PPA: Power Purchase Agreement.

Rehypothecation: A lender using a borrower's pledged collateral for its own purposes.

Revenue-Based Financing: Repayment as a percentage of the borrower's revenue.

Sale-Leaseback: Selling an asset and immediately leasing it back from the buyer.

Tenor: The duration of a financing arrangement, from origination to maturity.

12. Appendix B: Selected Data Sources & References

Market Data & Analytics

Cambridge Centre for Alternative Finance (CCAF) — cbeci.org • Hashrate Index by Luxor Technologies — hashrateindex.com • CoinMetrics — coinmetrics.io • Glassnode — glassnode.com • CoinGecko / CoinMarketCap — coingecko.com • Blockchain.com — blockchain.com/explorer

Equipment & Hardware

Bitmain Technologies — bitmain.com • MicroBT — microbt.com • Luxor ASIC Index • Kaboom Racks

Energy & Infrastructure

U.S. Energy Information Administration (EIA) — eia.gov • ERCOT — ercot.com • PJM Interconnection — pjm.com • International Energy Agency (IEA) — iea.org

Financial & Regulatory

SEC EDGAR — sec.gov/edgar • Galaxy Digital Research • European Commission — MiCA Regulation texts • Basel Committee on Banking Supervision

Financing & Lending Market

Luxor Technologies • Blockware Solutions • Trinity Capital (TRIN) • Maple Finance • Greengage — proprietary lender survey and term sheet benchmarking (greengage.co)

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