

Greengage

The Case for ASIC-Backed Lending

"Falsehood will fly, as it were, on the wings of the wind, and carry its tales to every corner of the earth; whilst truth lags behind; her steps, though sure, are slow and solemn."

English clergyman Thomas Francklin, 1787.

WHITE PAPER



Contents

Introduction	3
Definitions	4
What do digital miners do?	5
Digital mining opportunity – a high growth sector	6
The growing demand for cryptographic data centres	7
Early entrants	8
The advantages: identifying drivers for the business case of lending to miners	9
Miner profitability	12
The challenges	14
In conclusion: how Greengage can assist	15
Important Research Content Disclosures	16



Introduction

In making the case for lending to data centres operating in the digital assets sector, it is worth noting that terms such as blockchain, cryptocurrency and distributed ledger technology (DLT) have gradually entered our daily lexicon. Since we are at such early stages of this new class, it is not surprising that agreed upon definitions of these terms are not yet commonplace among industry representatives, regulators and investors. In this paper we will consider key terms from a perspective of investing into the digital asset mining industry. We discuss the evolution of lending to the growing sub-sector known as digital asset mining, the advantages and challenges of entering this segment, and how Greengage is already assisting in a digital asset landscape populated by participants many of which we might euphemistically call buccaneering in spirit.

Greengage's aim is to build a digital financial firm that will be crypto friendly and uniquely placed to capitalise on the multitude of opportunities that crypto companies are presenting e.g. by offering mining clients not just much needed financial services and treasury management, but also capitalising on the high volatility level of cryptocurrencies such as Bitcoin by deploying hedging strategies with partners for price and yield. It cannot be emphasized enough how lacking the digital mining

community is of even the most straight forward 'plain vanilla' financial services, a problem rooted in historical reasons.

However, there is already evidence of burgeoning lending from institutions to miners in the past 18 months, and we will look at how this high growth area is rapidly evolving as finance professionals move into the space bringing prior expertise in financial problem solving to what is still a very new industry.



Definitions

<p>Digital Miner / ASIC</p>	<p>A digital asset miner (or ASIC - Application Specific Integrated Circuits) is context specific - it can mean a single machine or a company that runs thousands of machines. They are essentially computers that have been designed for a specific application (thus increasing efficiency) and use large fans for extra cooling power so that machines can run 24/7/365 YoY until they are no longer profitable.</p>
<p>Distributed Ledger Technology (DLT)</p>	<p>Distributed Ledger Technology (DLT) is a key framework for digital assets miners. It is a relatively new digital database system that is predicated on records of transactions being verified and reported in multiple places at the same time with no central data store or administration functionality. In some cases, the ledger or record of transactions, is practically impossible to corrupt and is thus said to be immutable. It is miners that are the authority ensuring the ledger is true and immutable. This is achieved by running 'Proof of Work' (PoW) consensus algorithms whose authority is directly derived from the power of mathematics¹ and not beholden to any single mining machine or ASIC, with the assumption that at least 51% of the mining power of the entire network is not controlled by a single bad actor.</p>

¹Let us imagine that the probability that miners are rational, or honest, is at least 51% of the global mining pool. They are rational because they do not want to destroy their own value or ecosystem. We define:

p = probability that an honest miner verifies the next block in the blockchain,

q = probability that a dishonest miner or 'attacker' tries to alter the next block in the blockchain, and we assume $p > q$ (because we stipulate that *at least* 51% of miners are rational). Then using:

q_z = probability the attacker will catch up falsifying the public records from z blocks behind the latest block, and characterising the race between an honest blockchain and dishonest one as a Binomial Random Walk, we can write:

$$q^z = \begin{cases} 1, & \text{if } p \leq q \\ \left(\frac{q}{p}\right)^z, & \text{if } p > q \end{cases}$$

If our assumption that $p > q$ is correct, we see that a dishonest miner has *less and less chance* of disrupting the chain the further back down they go because the product of multiplying a number less than 1 by itself reduces with each iteration. In other words, the authority from whence some Blockchains can claim their certainty resides in Mathematics and not a centralised authority such as a central bank, exchange, lawyer, etc. This explains why the Bitcoin system of electronic transactions is said to be *trustless*.



What do digital miners do?

Digital miners are essentially computers designed to complete a specific task, and are dedicated to maintaining particular blockchains e.g. Bitcoin miners maintain the bitcoin network.

A miner produces lots of mathematical calculations which produce an output known as a hash. Each hash represents a guess at a solution to a cryptological puzzle that once solved is rewarded with for example some bitcoin, hence the term mining. Because the nature of the maths involved is such that it is effectively impossible to directly calculate the solution, a 'brute force' or iterative process of hashes is needed. This results in the network producing trillions of hashes each and every second², requiring huge amounts of electrical power. As the number of miners that come online has grown, so has the difficulty level of the network³, which has resulted in the miners having to make even more *hashes* to mine each subsequent block. This continued increase in competition increases the security of the network but carries the downside of requiring more electricity, unless more efficient 'next generation' miners are deployed.

Once new miners are installed, they operate a continuous and steady demand for power, something that power generators appreciate because it helps them to plan for their base load scenarios (miners operate 24/7/365 with near zero fluctuation in power demand). This becomes a positive factor for miners in negotiations for Power Purchase Agreements (PPAs).

When the correct 'guess' is identified, a validation process results which *i*) becomes the basis for recording a transaction in a block and *ii*) makes the transaction publicly available to be viewed, with a confirmation of the validated work being 'forwarded' or included into the next block, hence the 'chain' part to blockchain. This link between blocks is maintained by the successful hash of the previous block being contained in the new block and effectively renders the chain trustworthy and immutable whilst simultaneously being accessible to actors anywhere. This is the inherent value proposition in blockchains; after all, any network that can *permanently* maintain an accurate and always changing database *has value*, especially one which updates every 10 minutes, can be viewed globally and whose correctness, redundancy and availability is not reliant on any single individual, authority, corporation or government. It is never a 'copy' of a firewalled original (as are almost all data we receive e.g. email, bank accounts, etc.) In short, the activity of miners serves to enforce the central tenets of digital asset networks, namely decentralization and immutability, with intrinsic value derived from the capital intensity or energy usage of the process and outcomes hitherto not possible or practical with centralised systems.

² Currently, there are 15.5 quintillion or 1.5×10^{19} guesses or hashes per second being produced on the Bitcoin network. This is known as the global hash rate and includes all the output from bitcoin miners all over the planet.
Source: <https://www.blockchain.com/charts/hash-rate>

³ Difficulty is reset by the network itself, an inherent feature of the code that governs the length of time to mine a data block, aiming for 10 minutes each time. As computing power increases, the difficulty increases also, otherwise block times would be mined faster and more unpredictably. The Difficulty is a 'body clock' to Bitcoin and guarantees predictability and stability of production.



Digital mining opportunity – a high growth sector

The institutional lending market collateralised with digital mining equipment, whilst admittedly nascent, has seen exponential growth since its beginnings in 2020. Although there are few sectors where collateralised lending against fixed assets can yield at least 12%, the rate was much higher until institutional lenders entered the market.

We expect loan growth to multiply significantly over the next few years, with loans originated primarily in North America and Asia. By way of a comparison as to what the future may hold, we have seen crypto lending books (lending against crypto currencies used as collateral) growing up to 8 to 10 per year since inception. For example, Figure 1 below shows the crypto loan book growth for Genesis, the largest crypto collateralised lender, with a sharp increase in cumulative lending in Q3 2020 adding \$5.2bn in loans. Although in its earliest stages, we are already beginning to see similar growth rates in ASIC-backed mining lending.

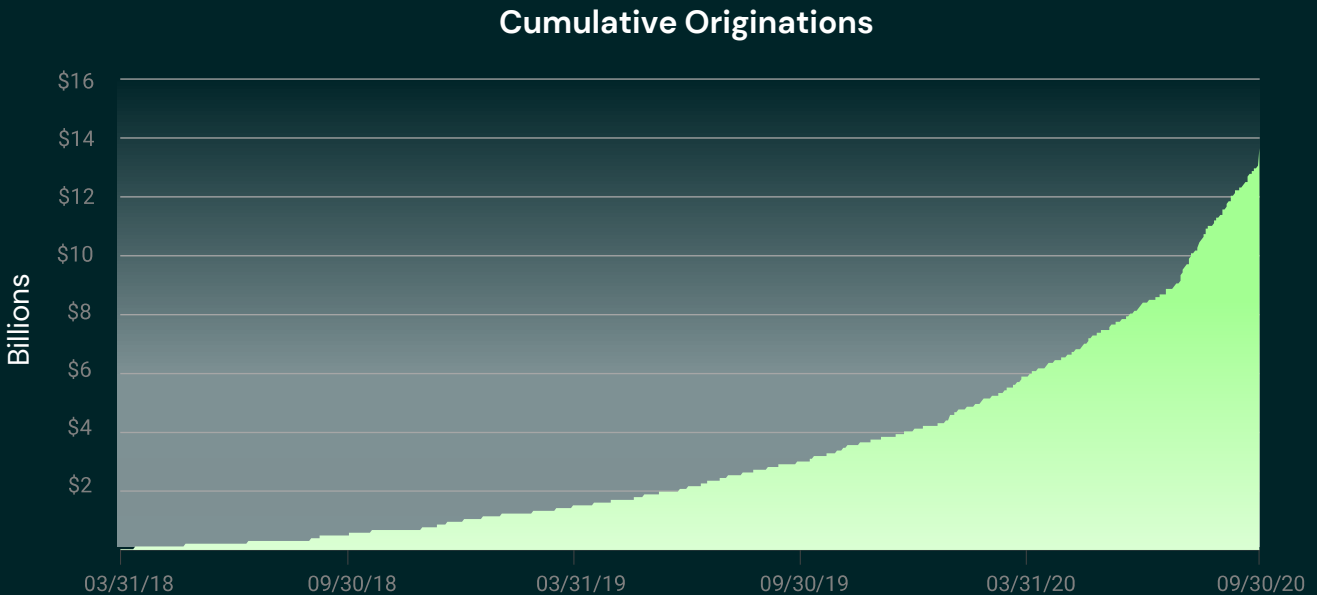


Figure 1: Graph showing crypto loan book growth for Genesis (source: Genesis quarterly report Q3 2020)



The growing demand for cryptographic data centres

The inherent feature of Distributed Ledger Technology (DLT), namely that transactions on the ledger are effectively immutable and easily shared, combined with a scarcity value⁴ in the case of Bitcoin, meant that Bitcoin has grown significantly as a store of value since the first coin was minted on January 3rd 2009 and is the crypto currency with the highest market capitalisation.

But what is the future of crypto or DLT in general? In fact, this technology is already impacting business models in a range of industries. Imagine a supply chain for a large housing development in which all suppliers are integrated into a chain that connects from the timber suppliers all the way up to services providers for finished homes. Every hypothetical conditional on this chain can be programmed onto a 'smart contract' e.g. as the lorry delivering timber to the housebuilder crosses the gate, an RFID chip alerts a blockchain based code, which in turn executes a whole new set of operations (e.g. payment to supplier, ordering finishing materials, confirmation to logistics of schedule timing etc). Later in this supply chain, we would see new homes built using 'smart grids'⁵ in which homes would be able to trade stored power between themselves or even with the national grid, hugely increasing efficiency, all made possible by DLT.

Many projects using DLT are already underway. For example, Fidelity are offering Bitcoin as an investment but has also been mining for some years now in a bid to better understand this new technology. As one of the traditional finance world's blue chip custodians, they are anticipating leveraging DLT to offer a better service whilst simultaneously slashing costs (the aim of all tech plays) and future-proofing themselves to boot. Much of trading will be on a blockchain and Greengage expect that the next phase of the revolution will see real world assets 'tokenised' for this to happen. Indeed, this is already happening with USD⁶ (and DeFi derivatives protocols like Synthetix), with the advantage that once a currency is used to collateralise a token, that token can then be sent anywhere in the world very quickly and cheaply. Central banks are taking note also; there has been much speculation as to which will offer the first national digital currency, an effort made worthwhile when we consider that the tokenisation of USD has real world economic benefits for GDP in its incredible impact on 'velocity of money'; the average USD changes hands four⁷ times a year on average, whereas a tokenised USD changes hands 1250⁸ times on average, thus directly leading to potential GDP increases without the need to increase leverage in the banking system. This explosion in demand for crypto currencies is leading to exponential demand increases in mining power.

⁴ It is hard coded and publicly viewable that there will only ever be 21 million Bitcoins: at the time of publication on 1st October 2020 ~88% of them have already been mined.

⁵ A smart grid is an augmented efficiency network enabling a two-way flow of electricity and data with digital communications technology enabling the ability to detect, react and pro-actively respond to changes in usage and multiple issues. Smart grids have self-healing capabilities and enable electricity customers to become active participants in the trading of power.

⁶ These are known as stablecoins and are cryptocurrencies designed to minimize the volatility of the price of the stablecoin, relative to some "stable" asset or basket of assets. A stablecoin can be pegged to a cryptocurrency, fiat money, or to exchange-traded commodities (such as precious metals or industrial metals).

⁷ https://alfred.stlouisfed.org/series?seid=MIV&utm_source=series_page&utm_medium=related_content&utm_term=related_resources&utm_campaign=alfred

⁸ If we define VoM as daily traded notional divided by market cap, the leading USD stable coin has VoM of 1250.



Early entrants

In early 2020, specialist lenders began to establish themselves with the first deal being for \$1m⁹, with notional deals quickly increasing to \$4m¹⁰ and even higher in less than a year. These new lenders typically deploy capital from networks of HNWI's and were a step on from "friend and family" raises. More recently, there has been the first large institutional size commitment to the mining sector in the form of Digital Currency Group (or DCG). This is a leading multi-billion dollar conglomerate in the digital asset sector with wide ranging interests, announcing in September 2020 that they were making \$100m¹¹ available for investment into miner financing and even mining operations in which they are already invested to the tune of 'tens of millions of dollars'. In their announcement of a joint venture (JV) with Foundry, they claimed to already be one of the largest Bitcoin miners in North America and would also make financing available for equipment makers, bringing 'institutional expertise, capital, and market intelligence' to the community. Barry Silbert, founder and CEO of DCG, said:

"Foundry is bringing critical resources and guidance to an essential corner of the industry."

This shows how quickly the mining sector is financialising and able to scale. Foundry also aims to partner with major entities across mining and staking¹² and pledged to "work closely" with energy providers and governments to help these firms carry out their mining strategies. This level of investment is driving efficiencies up and down the chain. For instance, MicroBT, a miner manufacturer, has taken the decision to contract with a manufacturer outside of China to build its new miners and produce and deliver MicroBT's 'WhatsMiner' equipment to U.S. mining, who would otherwise pay an additional 25% tax if they received shipments directly from China due to U.S. tariffs. These savings in equipment purchases directly impact on the profitability of mining. Greengage expects to see further global supply chain optimisation as participants make larger commitments and hopes to provide financial services to some of these high growth companies.

⁹ <https://www.coindesk.com/arctos-inks-1m-sale-and-leaseback-deal-with-bitcoin-miner-blockware>

¹⁰ <https://www.coindesk.com/bitfarms-leases-bitcoin-miners-blockfills>

¹¹ <https://www.coindesk.com/dcg-to-invest-100m-in-bitcoin-mining-venture>

¹² An alternative validation process to PoW. Staking is actively participating in transaction validation (similar to mining) on a proof-of-stake (PoS) blockchain. On these blockchains, anyone with a minimum-required balance of a specific cryptocurrency can validate transactions and earn staking rewards.



The advantages: identifying drivers for the business case of lending to miners

- 1. Miners get paid:** Bitcoin miners are rewarded with freshly minted Bitcoins in exchange for their work – processing transactions and securing the network using specialized hardware. They are the source of new coins and the analogy to traditional mining is quite accurate in that they run yield¹³ and price¹⁴ risk, make sizeable investments in time and capital and need to be extremely focused to become profitable. Bitcoin miners can also be paid 'transaction fees' as it is possible to attach bitcoin payments to transactions. Interestingly, of the 21m coins that will ever be mined (as determined and 'paid' by the Bitcoin code), over 18.5m have been mined already, and we are seeing transaction fees as a growing part of the reward for mining.
- 2. Financial instruments are mitigating risks for miners:** In a short space of time, the industry has seen a growth in financial products that can help miners mitigate yield and price risks. The ability to hedge price moves has existed for some time but only recently has liquidity in futures on regulated exchanges started to provide keener pricing. This particular risk is now filtering through structured products books which are better able to engage with the exchanges and satisfy demand from institutional investors. Greengage (as DAG) were also a pioneer in assisting miners with hedging their yield risk¹⁵, as reported on by Reuters.
- 3. Negligible counterparty and credit risk:** As mentioned earlier, DLT is a decentralised technology with no central co-ordinating authority and near zero counterparty or credit risk. Written into the publicly viewable code of the Bitcoin network is a reward for miners to get paid for their work as transaction processors. Therefore, if a hash is successful and a miner is to be credited, a reward in the form of newly minted coins are released by the code always.
- 4. Central bank policies are favourable for 'inflation hedge' assets:** Within the Bitcoin code it is defined that there will only ever be a limited supply of Bitcoin. The supply rate of Bitcoin is furthermore governed in the block subsidy schedule with halvings every 210,000 blocks. This rate determines how much miners are paid and is derived from the initial supply cap of 21 million bitcoins. This limited supply causes investors to regularly compare Gold to Bitcoin in that they are finite, require large amounts of power to produce and so make an ideal hedge against inflation, reasons that initially powered Bitcoin's first valuation model¹⁶.

¹³ <https://www.reuters.com/article/us-crypto-currencies-derivatives-idUSKBNIYEOKA>

¹⁴ <https://www.coindesk.com/cme-bitcoin-futures-open-interest-record-high>

¹⁵ <https://www.reuters.com/article/us-crypto-currencies-derivatives/with-hashes-and-hedges-power-hungry-crypto-miners-court-investors-idUSKBNIYEOKA>

¹⁶ <https://medium.com/@100trillionUSD/modeling-bitcoins-value-with-scarcity-91fa0fc03e25>



Many believe Bitcoin to be a safe haven¹⁷ asset and academic studies have shown it to be uncorrelated from macro factors¹⁸, something that is further driving demand for the new asset class. The requirement to keep constant¹⁹ the intervals between network updates of the ledger, set at roughly 10 minutes, is maintained through a periodic algorithmic adjustment of the difficulty in which new *valid hashes* (or 'nonces'- number only used once) are found by the miners. This is an elegant solution to ensure growth of the network does not accelerate the emission of new coins, causing instability and unpredictability.

5. **Miners are committed:** Miners are integral to the Bitcoin ecosystem and are motivated by a mechanism that rewards them. Miners are also amongst the most committed protagonists in the crypto arena, evidenced by the lengths and efforts they go to in becoming owners of this new asset class. They are willing to travel to far flung parts of the globe in the quest for cheap electricity to power their data centres and commit millions entering into long term power contracts and infrastructure builds. They then need to develop their sites with substations and cabling, with their eventual reward being that they hopefully obtain their bitcoin below spot price, something not guaranteed when dealing with a highly volatile price action.
6. **Geography:** Jurisdiction is important in that since loans are collateralised against ASICs then a legally robust framework and method of recovery needs to be in place in the event of forfeiture. Furthermore, it may seem counter-intuitive in considering the impact of geography on digital 'goods', but the location of mining rigs are subject to business cost vagaries, as shown in Figure 2.

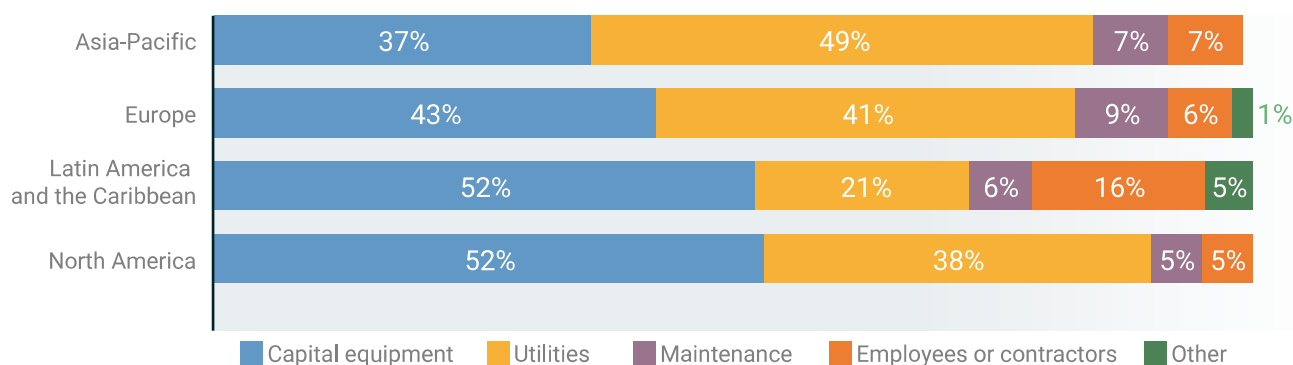


Figure 2: Cost Breakdown of Hashers per Region
 (source: University of Cambridge, 3rd Global Cryptoasset benchmarking study 2020)

¹⁷ <https://www.forbes.com/sites/cbovaireid/2020/03/09/is-bitcoin-really-a-safe-haven-asset/?sh=f9c9bfe2f0c5>

¹⁸ <https://news.bitcoin.com/report-bitcoin-untied-from-the-economic-cycle-largely-uncorrelated-to-other-asset-classes/>

¹⁹ Ten minutes is a trade-off between a miner finding the right solution (or mining a block) and other miners still seeking it. After a block is mined, it takes time for other miners to find out about it, and until then they are wasting electricity. For example, if it takes miners 1 minute on average to learn about new blocks, and new blocks come every 10 minutes, then the overall network is wasting about 10% of its work. Lengthening the time between blocks reduces this waste.



- 7. A nascent industry brimming with opportunities:** Mining is financially the most underserved sector in the digital asset ecosystem, with funding for the first multiple server sites having been initially all from “friends and family”. In late 2020, participants were estimating that more than \$1 billion of new ASICs would be purchased and located in North America in the next 2 years, with the recent Cipher²⁰ deal worth \$595 million confirming this growth rate. Whilst much of traditional finance has avoided the digital asset sector in general because banks were too stuck in a ‘death by committee’ attitude towards new ventures or risks and a tick box KYC and AML culture with respect to digital assets, they refused even to engage with what was possibly the most recognisable part of the digital asset universe, namely data centres and their funding. Therefore, miners and in fact most digital asset sector companies, are simply unable to access bank funding rates.

This lack of fiat supply then would seem to have created a genuine arbitrage opportunity for lenders to digital asset data centres. We know that traditional data centres are profitable and operate at scale as an industry (e.g. AWS, Equinix, INAP, OVH etc.) and there is no reason why this will not be replicated in the digital asset mining sector, with first movers already enjoying extraordinary profits.

²⁰ <https://www.businesswire.com/news/home/20210305005234/en/Cipher-Mining-Inc.-a-Newly-Formed-US-based-Bitcoin-Mining-Company-to-Become-a-Publicly-Traded-Company-via-a-Merger-with-Good-Works-Acquisition-Corp>



Miner profitability

To determine what drives miner profitability, the establishment and running of a mining site needs to be considered. Initial capital expenditure (CAPEX) is needed to cover acquiring a site, ASIC mining hardware purchases, preparing the site for the modules that house the ASIC miners, building or situating the module, the acquisition of a Power Purchase Agreement (a 5-year minimum commitment usually and often more), installing a power line to the source of power,²¹ buying and installing substations and then the 'kiting' that connects the modules to the substations. The two main factors underpinning profitability are electricity and the hardware.

1) Electricity

Once the mining site is up and running, the main OPEX costs for miners is electricity, followed by salaries and maintenance costs. For instance, miners focusing on cryptocurrencies that employ the SHA-256 mining algorithm, as used by the Bitcoin network, electricity costs range from 60% to 79% of their operational expenditures, with differences in power prices and regional locations affecting this percentage. The following chart in Figure 3 shows the distribution of differing electricity prices that miners pay for their power depending on their location.

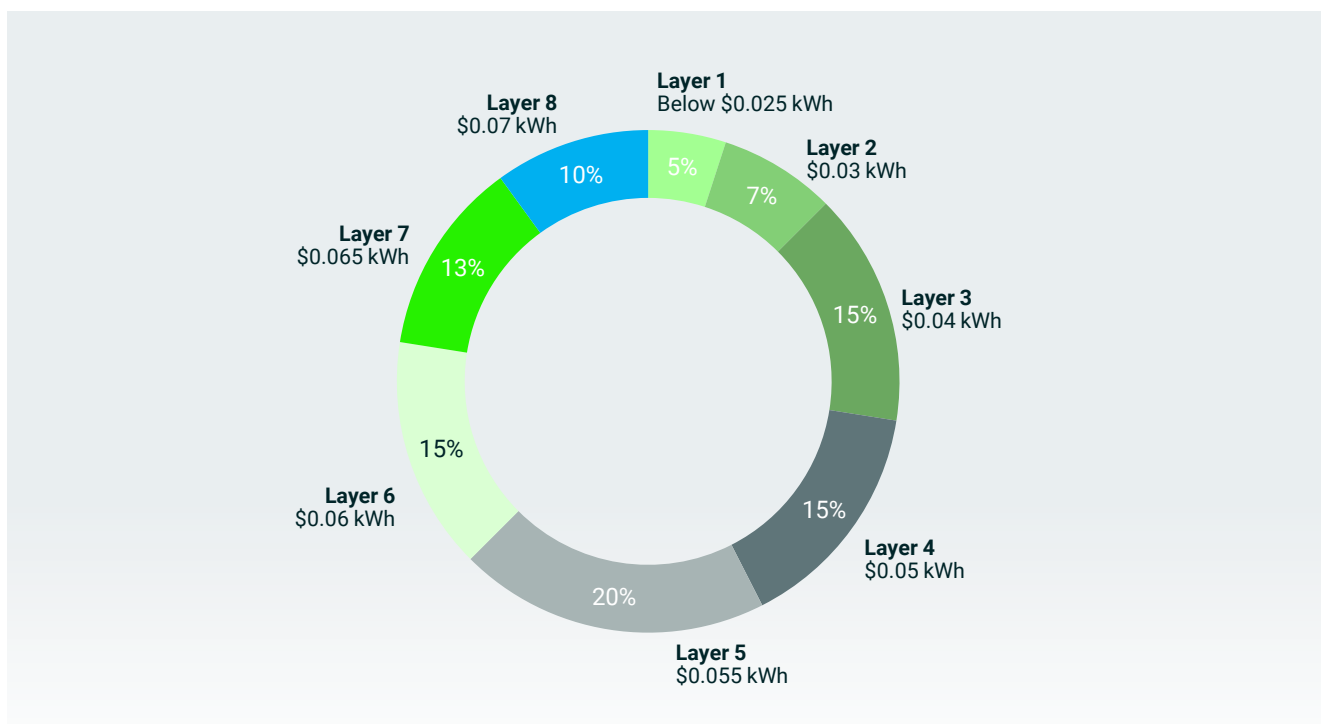


Figure 3: Miner Electricity Rate Distribution \$/kWh
 (source: Coindesk, Understanding Bitcoin Market Participants 2020)

²¹ Estimated to be 39% to 73% hydroelectric and therefore a very green industry. Also, quite often sites are in areas where older smaller hydro sites are no longer viable for retail demands (and there are fluctuations), so some of the power used by mining is power that would otherwise not be used.

<https://bitcoinke.io/wp-content/uploads/2020/09/2020-3rd-Global-Cryptoasset-Benchmarking-Study-1.pdf>
<https://coinshares.com/assets/resources/Research/bitcoin-mining-network-december-2019.pdf> (p. 11 cites 39%)
<https://coinshares.com/assets/resources/Research/bitcoin-mining-network-december-2019.pdf> (p.6 cites 73%)



2) The hardware

When digital mining first started in 2009, people were using their home computers and even mobile phones! People quickly switched to using graphics cards for their increased processing power, until eventually the SHA-256 ASIC was born, a chip designed specifically for Bitcoin mining. These chips were initially approximately 100 nanometres thick and although a huge jump in performance over graphics cards because of their singularity in design purpose, the thickness of the chip still led to resistance creating heat and constraining computing power. As competition drove the performance on chips, successive marginal improvements decreased as microchip thickness approached 1 nanometer, a limiting factor. Nonetheless, with each generation of hardware and despite declining marginal utility, computing power has massively increased whilst simultaneously the power requirement has dropped.

Typically, lenders to miners will always ask what the loan is specifically for. If the full sum of the loan is used to invest in upgrading ASICs to the latest generation equipment, lenders feel more comfortable as this both increases profitability directly for the borrower and the collateral is more valuable for longer. In fact, as the limit of 1 nanometre on chips is nearly reached, lenders benefit from the fact that equipment life spans are consequently growing²² since the next generation machine provides less of a leap in computing power. This leads to a sweet spot of 12 to 18 months tenor for miner loans, based on their ability to repay interest or amortise being well within acceptable parameters for miner treasury management.

The ability to easily reclaim and then re-sell equipment has been a major factor in the development of lending to miners and makes their physical location important. There exists a thriving secondary market for these ASIC machines where prices can be as volatile as the digital asset they are intended to generate. Western based lenders are extending credit into either US or Canadian jurisdictions, supported by a used equipment market and dedicated teams that already pick up and relocate miners on demand, whereas Chinese lenders tend to deal with miners only when the ASICs are hosted at certain sites located in China, with ownership remaining with the lender i.e. the miner must locate their machines at pre-approved 'hosting' sites where infrastructure and power costs are purchased at a fixed price from the host and the miner just delivers and then runs their own machines. This difference in risk appetite reflects the perceived differences in the robustness of legal jurisdictions.

²² For example, the S9 miner from Bitmain has been profitable for those paying the lowest power costs for over 4 years, and it is anticipated that this latest generation of equipment will be profitable for at least as long.



The challenges

Avoiding headwinds: In April of 2020, Cryptologic, a miner using 30 Mega Watts (MW) of power, was sold for its equipment value to Hive and in May 2020, Hyperblock went into administration (20MW), but these numbers are insignificant when compared to the total number of MW used globally in supporting various blockchains, estimated at approximately 14000 MW²³. Furthermore, these ‘failures’ were not indicative of a poor business case, as evidenced by the fact that their equipment was quickly acquire by other market participants; rather they were the result of poor management failing to plan for a major publicly known (and therefore mitigatable) adjustment within the Bitcoin code known as ‘the halving’²⁴. Also, timing entry for use of funds in buying miners is a major risk as automatic stabilisers like changes in difficulty level are directly linked to profitability.

Risks: Mining is by no means a risk-free industry and while critically important to the digital asset space, it also carries its own risks especially in terms of cash flow.

The two primary risks for any producer are yield and price fluctuations and the volatile price of crypto assets is well documented. The impact of the volume of competition from other miners seeking to mine the next block first and so reap the associated reward is not straightforward, suffice to say that this adds to yield risk²⁵, but perhaps counter-intuitively, in no way does this competition from other miners add to the supply, rather it increases the difficulty and thus safety of the network. The *rate* of Bitcoin supply is kept constant for periods of about 4 years²⁶ at a time, at which point supply halves for the next 4-year period and this process is repeated until the last Bitcoin is mined, estimated to be in 2140²⁷.

²³ <https://cbeci.org/>.The Cambridge Bitcoin Electricity Consumption Index (CBECI) provides a real-time estimate of the total electricity load and consumption of the Bitcoin network.

²⁴ A bitcoin halving is when the reward for mining new blocks of data is halved, meaning miners receive 50% fewer BTC for verifying transactions. Bitcoin halvings will occur once every 210,000 blocks – roughly every four years – until the maximum supply of 21 million bitcoins has been released. Bitcoin halvings are important as they reduce the number of new bitcoins being generated by the network. This limits the supply of new coins thus making Bitcoin an inflation hedge, so prices could rise if demand remains strong. While this has happened in the months before and after previous halvings – causing bitcoin’s price to appreciate rapidly – the circumstances surrounding each halving are different and demand for bitcoin can fluctuate wildly.

²⁵ Yield risk is dictated by changes in difficulty in finding the correct solution, the aim being to keep block times being mined at 10 minutes. If more power comes onto the network, difficulty increases, and vice versa. Mining difficulty has increased 17,000 times in the last 10 years to compensate for exponential increases in computing power, however this increased supply has only served to make the network safer and more robust, since increased mining production does not increase supply of bitcoin at all since supply rate is governed by code.

²⁶ In a fully decentralized monetary system, there is no central authority that regulates the monetary base. Instead, currency is created by the nodes of a peer-to-peer network and passed onto miners. The Bitcoin algorithm defines, in advance, how currency will be created and at what rate. Bitcoins are created each time a user discovers a new **block**. The rate of block creation is adjusted every 2016 blocks so that as total mining power increases or decreases, the rate at which blocks are mined remains at 10 minutes. The number of bitcoins generated per block decreases geometrically, with a 50% reduction every 210,000 blocks, or approximately four years.

²⁷ To date, approximately 18,500,000 bitcoins have been mined so the bulk of Bitcoin that will ever be formed is already in existence, with concerns regarding viability of network maintenance because of lower mined block rewards mitigated by the fact that transactions can have fees attached to them, ensuring incentives for miners.



In conclusion: how Greengage can assist?

From Greengage's discussions with multiple miners, it is clear that the more profitable operators have a good understanding of balance sheets and optimising treasury operations. Greengage aims to be able to assist with these services in the future, as part of fulfilling its role as a digital financial firm.

Furthermore, it is Greengage's belief that the industry would significantly benefit from vertical integration by instituting quality controls and adding services along the value chain, as has been the case in other resource businesses. We believe that we will be able to assist not just with payment services and treasury management, but also by capitalising on the high volatility level of Bitcoin by deploying hedging strategies with partners based on recognised 'yield enhancement' plays that are regularly used in commodity production. Indeed, Greengage supported the use of derivatives in helping miners mitigate their production risk²⁸.

As a digital finance firm, Greengage will be uniquely placed to 'experience' the cash flows of its corporate customers in real time via open banking APIs and therefore build a good understanding of its clients' businesses and best assess the customers for payment products and services. Greengage's experienced team includes bankers, entrepreneurs, risk managers and derivatives experts, bringing a rare edge to a new asset class that is without doubt one of the great growth stories and will continue to be so for the coming year.

We are an ambitious scale-up of digital natives, aspiring to pioneer a new era in digital finance. Working at the intersection of traditional financial services and new digital innovations, we combine broad expertise to provide a highly client-focused experience for today's ever-changing market.

Combining the high-end care and bespoke personal service found in traditional British financial institutions with leading-edge technology, our evolving platform aims to support entrepreneurs, SMEs, family offices and digital asset firms with a wealth of innovative products and services which facilitate cost-effective transactions within and across traditional currency as well as digital assets. Our purpose is to liberate digital finance in the future.

To find out more about this topic please do not hesitate to contact us at info@greengage.co

²⁸ <https://www.reuters.com/article/us-crypto-currencies-derivatives/with-hashes-and-hedges-power-hungry-crypto-miners-court-investors-idUSKBNIYEOKA>



Important Research Content Disclosures (1/2)

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