


Bitcoin Numeraire

Business Plan: Bitcoin Mining Operations

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Chapter 1

Executive Summary

Numeraire is a Swiss-based software company with a mission to develop cutting-edge solutions for the Bitcoin industry. We leverage our expertise in software engineering, the Bitcoin protocol consensus algorithm (Proof of Work), and renewable energy to achieve this goal. Our company has three main divisions: Bitcoin mining, Bitcoin consultancy, and Bitcoin software development. This business plan focuses on our Bitcoin mining operations.

The Bitcoin mining industry has seen dramatic growth over the past years, with the number of miners and hashrate increasing substantially. Other Bitcoin technologies, such as the Lightning Network[1], have also seen significant expansion. These favorable market conditions present an opportunity for Numeraire to capitalize on this trend by launching a new Bitcoin mining operation that utilizes state-of-the-art hardware and software to maximize efficiency and profitability.

Our initial target market is Switzerland, where we will power our mining operations with renewable energy sources such as excess hydroelectric power from rivers and dams. In the long term, we plan to use other forms of excess energy internationally, such as geothermal and nuclear power, or wasted energy such as vented or flared methane. This approach not only helps to reduce greenhouse emissions but also stabilizes the energy grid and makes renewable energy producers more profitable.

To maintain a competitive advantage, we will use the most efficient mining hardware and software available, such as water-cooled Application-Specific Integrated Circuits (ASICs) and efficiency-improving autotuning mining firmware.

With a strong management team in place and a clear strategy for growth, Numeraire is well-positioned to succeed in the Bitcoin mining industry. As the usage and acceptance of Bitcoin continues to increase worldwide, we see this as an opportunity not only to secure our future but also to contribute to a more decentralized and equal financial system.

[1]The Lightning Network is a second-layer payment protocol built on top of the Bitcoin blockchain with the mission to enable fast, cheap, and secure micropayments by creating a network of bidirectional payment channels that allow users to transact directly with each other without the need for intermediaries

Chapter 2

Company Description

Numeraire is a software company based in Lugano, Switzerland, that specializes in developing solutions for the Bitcoin industry. The company was founded in 2023 by Dario Varela with assistance from Tomé Varela. Together, they bring a wealth of experience and expertise in the fields of software engineering, cryptography, the Bitcoin protocol, and economics. Numeraire is incorporated as a Limited Liability Company (LLC).

Numeraire's management team is composed of Dario Varela as CTO and Tomé Varela as CEO. Dario brings technical expertise in distributed systems (the Bitcoin and Lightning networks being distributed systems) and cryptography, while Tomé brings experience in business development and operations management. Together, they form a highly skilled team that is well-suited to lead Numeraire's growth and success in the Bitcoin industry.

The company operates in different fields, such as mining, consulting, and software development. The mining operation is focused on using excess energy from renewable sources such as hydroelectric and wasted energy such as vented/flared methane. The consulting division is focused on assisting other companies and individuals in the industry to improve their mining operations using renewable energy or any other Bitcoin related inquiry. The software development division focuses on the research and development of new software technologies for the mining industry, as well as other Bitcoin-related software products (mainly focused on the Lightning Network).

Numeraire's headquarters in Lugano, Switzerland, is strategically located to take advantage of the country's favorable regulatory environment for Bitcoin-related businesses following the launch of their Bitcoin Plan B[1] initiative, as well as its high-quality infrastructure. The company also plans to expand internationally in the future, targeting countries with favorable conditions for renewable energy production.

2.1 Company Name and Mission

`Numéraire` was coined by Marie-Esprit-Léon Walras, a French mathematical economist known for formulating the marginal theory of value. As Professor of Political Economy at the University of Lausanne (Switzerland), Walras is credited with founding the Lausanne school of economics, along with his successor Vilfredo Pareto.

In economics, the "*numéraire*" is a basic standard by which value is computed. It is a tradable economic entity in terms of whose price the relative prices of all other tradables are expressed. The term can be used interchangeably with "unit of account" or "money."

[1] https://planb.lugano.ch/

Historically, the numéraire has taken many different forms, such as cattle, salt, glass beads, precious metals like silver and gold, and fiat currencies. Today, the numéraire mainly refers to the United States dollar as the most used and desired international currency.

At Numeraire, we believe that Bitcoin possesses all the necessary properties of a commodity that could be used as a numéraire, and our goal is to increase awareness of it as such. Our company name and mission are thus merged as one.

As Bitcoin continues to gain acceptance and usage worldwide, it has the potential to transform the financial landscape in significant ways. One of the key benefits of Bitcoin is its ability to increase financial inclusion by providing access to financial services for individuals who may not have had access to traditional banking systems. By using Bitcoin, people can send and receive money securely and quickly without needing a bank account, which can be particularly valuable for those living in regions where traditional banking is not accessible.

Overall, Numeraire recognizes the potential of Bitcoin to promote financial inclusion and is committed to supporting this goal by developing cutting-edge solutions that make Bitcoin more accessible and efficient. Through our Bitcoin mining operations, we aim to contribute to a more decentralized and equal financial system by supporting the underlying infrastructure that powers Bitcoin transactions.

Chapter 3

Industry Analysis

This section provides an overview of the current state of the Bitcoin mining industry, including its various actors and key concepts, as well as a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. We consider this section to be essential for individuals seeking to gain a better understanding of the Bitcoin mining industry and dispel common misconceptions, particularly those related to its environmental impact (refer to section 3.6).

3.1 Industry Size and Growth

The Bitcoin mining industry has experienced explosive growth in recent years, driven by the increasing popularity and rising price of Bitcoin. As of March 2023, the total hashrate of the Bitcoin network exceeded 323 EH/s (as seen in Figure 3.1). This represents a significant increase from previous years, and it is expected that the industry will continue to grow in the future.

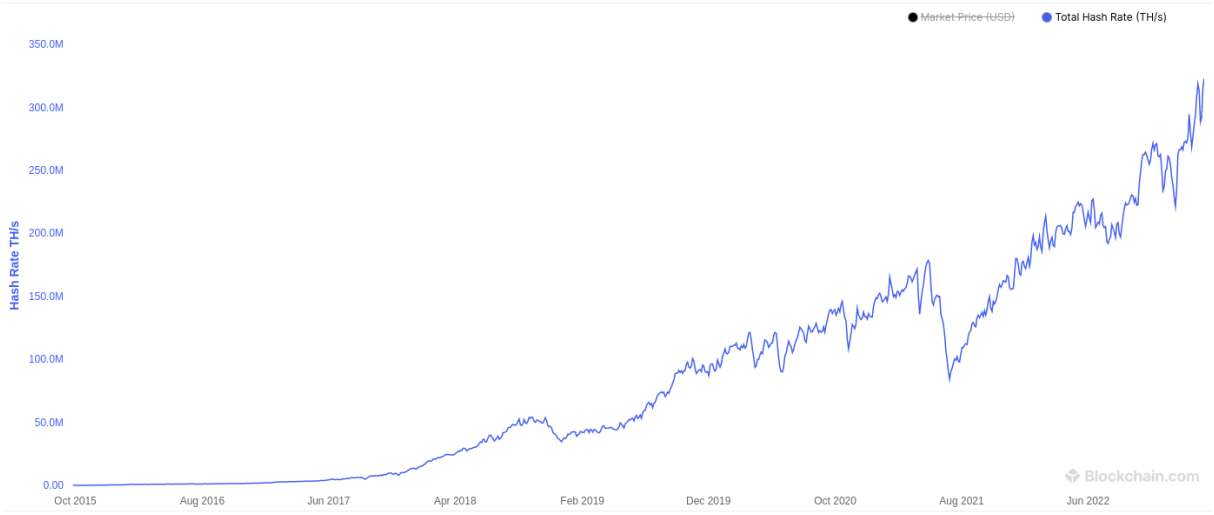

Figure 3.1: Bitcoin network hashrate

The Bitcoin mining industry is highly competitive, with a large number of players operating in the market, including both large mining companies and individual miners who use their own equipment.

As the network's difficulty increases over time, miners must constantly search for the cheapest electricity prices from energy producers and the most efficient hardware. As buyers of energy

at all times, especially during periods of low demand, Bitcoin miners tend to gravitate toward using excess or wasted electricity, as this represents the cheapest electricity available today.

3.2 Industry Structure

The Bitcoin mining industry is composed of a wide range of players, including large mining companies, as well as individual miners who use their own equipment. The industry can be divided into five main categories:

1. **Large Mining Companies**: These companies operate large-scale mining operations, using specialized mining equipment and facilities. They often have significant resources, including access to cheap electricity, and are able to achieve economies of scale that allow them to be more profitable than individual miners.
2. **Individual Miners**: These individuals or small groups operate their own mining equipment, typically using their own electricity and facilities. They may be hobbyists or small-scale operations that are not large enough to compete with the large mining farms.
3. **Cloud Mining Companies**: These hosting companies allow individuals to rent mining power. They provide the hardware and the electricity, and users only need to pay a monthly fee to access the mining power.
4. **ASIC Manufacturers**: These companies build Bitcoin mining hardware and must constantly innovate to outperform the competition and secure their share of the market.
5. **Bitcoin Exchanges**: These companies act as intermediaries between Bitcoin buyers and sellers. Partnerships with Bitcoin exchanges allow for lower fees for the sale of mined Bitcoin.

3.3 Bitcoin mining concepts

This section explains the most important Bitcoin mining concepts without which the operation cannot be understood.

3.3.1 Hashrate

The process of mining consists in executing a simple mathematical operation, called a hash, a very high number of times until a solution of the desired form is obtained. As an incentive for miners to participate in the process of verifying transactions (aka mining), they are rewarded with newly minted Bitcoin. This reward is called a "block reward" and it is currently set at 6.25 Bitcoin[1] per block. Miners also receive transaction fees from users who want their transactions to be processed more quickly, which adds to their overall reward.

The Bitcoin hashrate is a measure of the computational power of the Bitcoin network, expressed in hashes per second (h/s). The more efficient the hardware executing these operations is relative to the hardware of the competitors, the larger the chances to obtain the reward. By joining a mining pool, Bitcoin miners merge their hashrate to receive a percentage of the commonly generated rewards proportional to their hashrate contribution.

Because the mining process is as simple as executing a hash, mining operations can be extremely reactive and turn on an off their hardware in almost real time (in a matter of seconds) depending on external inputs, such as the electricity price. This flexibility of Bitcoin mining is unique compared to traditional industries that require complex production pipelines, storage and transportation.

3.3.2 Difficulty adjustment

Bitcoin mining difficulty is a measure of how difficult it is to find a hash below a given target. The Bitcoin network automatically adjusts the difficulty of mining every 2016 blocks[1], or approximately every two weeks, to ensure an average block time of 10 minutes. This is because the total hashrate of the network, or the total computing power being used to mine new blocks, can fluctuate over time.

If the total hashrate of the network increases, the difficulty will increase to ensure that blocks continue to be mined at an average rate of one every 10 minutes. Conversely, if the total hash rate decreases, the difficulty will decrease to ensure that blocks are still being mined at the target rate.

The difficulty adjustment algorithm used by the Bitcoin network is designed to adjust the difficulty in such a way that it will produce an average block time of 10 minutes, regardless of the total hashrate of the network. This helps to ensure the stability and security of the network and prevents any one miner or group of miners from having too much control over the network.

The difficulty adjustment makes the revenue of Bitcoin miners a function of their competitive advantage (mainly electricity price and hardware efficiency) instead of the Bitcoin price because the difficulty will increase/decrease if the Bitcoin price increases/decreases until reaching an equilibrium.

3.3.3 Hardware efficiency

Hardware efficiency is a critical aspect of Bitcoin mining, as it directly affects the profitability of mining operations. A more efficient hardware will consume less electricity for each hash it performs. Hardware efficiency is expressed in joules per terahash (J/Th). The smaller this value, the better.

Bitcoin miners need to consider the hardware efficiency of mining equipment because the cost of electricity is the most important variable associated with mining. Miners who use more efficient hardware will be able to reduce their electricity costs, which will increase their margins and improve their overall profitability.

In addition to electricity costs, hardware efficiency also affects the overall competitiveness of mining operations. With the increasing difficulty of mining and the growing competition within the industry, miners who use more efficient hardware will be better positioned to remain profitable and compete effectively against other miners.

3.4 Bitcoin Mining and Grid Optimization

The problem of grid optimization [2] is the following: The nature of energy demand is such that it fluctuates greatly during the day, weeks, and seasons. Energy producers need to constantly predict the population's energy usage (using complex predictive methods) to optimize their output and minimize losses by avoiding excessive energy production. Even if these predictive methods can be very accurate, energy producers always need to produce more energy than is needed at any given time to avoid a portion of the population being left without electricity. Also, most energy sources cannot be scaled on-demand because energy is harnessed either intermittently (e.g., wind and solar) or constantly (e.g., geothermal and nuclear).

This excess energy not only has no buyer but also degrades the infrastructure. Bitcoin mining is the only process today that can harness this excess energy due to its simplicity and flexibility. Indeed, Bitcoin miners balance the demand of the grid by turning on and off their machines, a

process that can be automated and is measured in seconds. These mechanisms are called *valley filling* and *peak shaving* (see Figure 3.2), which lifts the base load without lifting the peak load.

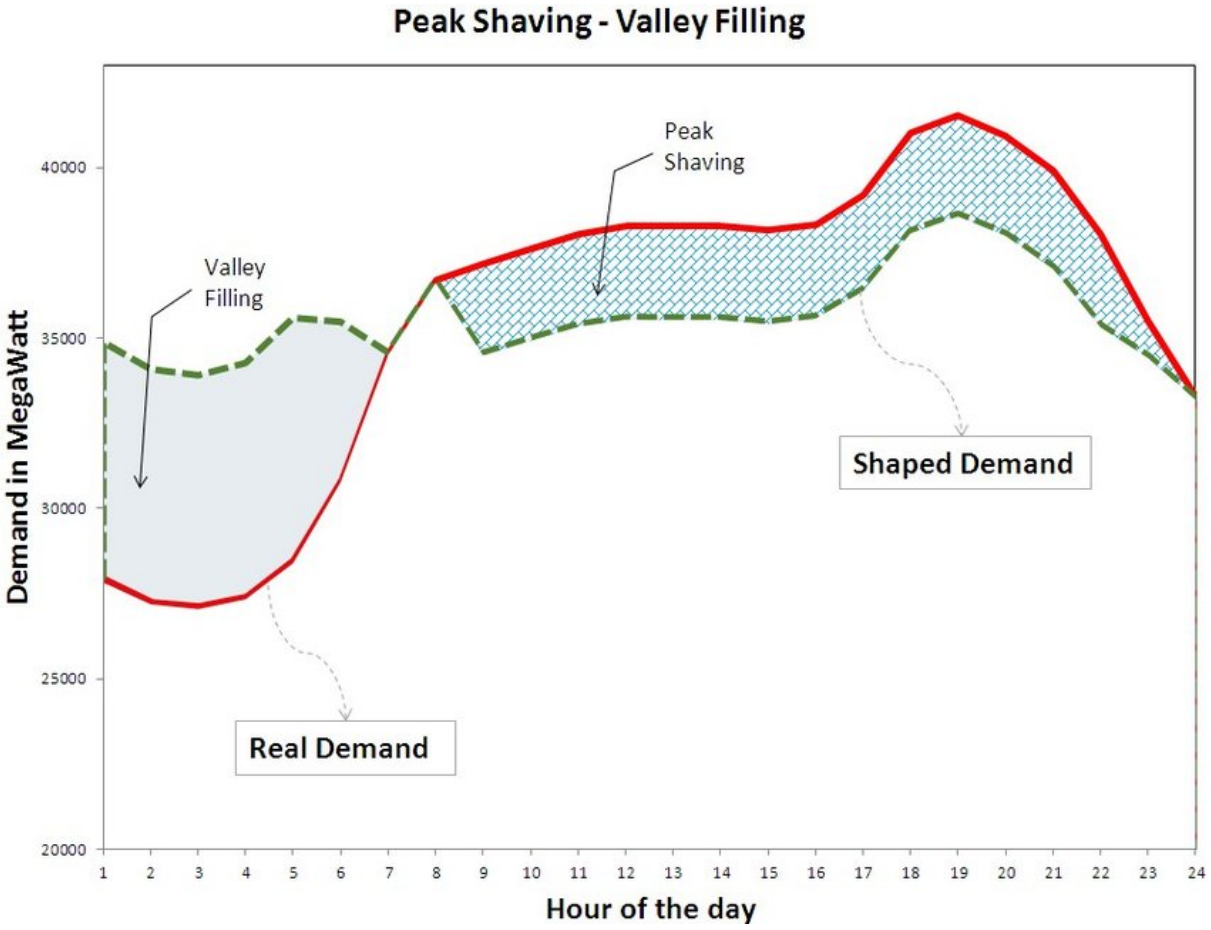

Figure 3.2: Valley filling and peak shaving

The consequences of this unique property are manifold:

- **Grid stabilization**: Bitcoin miners can shut down (or turn on) their activities at any moment, allowing them to adapt to energy demand in real time. When there is increasing demand from the grid, driving energy prices higher, Bitcoin miners scale down their operations. When the opposite happens, Bitcoin miners can profit from the low energy prices and scale up. This greatly stabilizes the grid, allowing energy producers to have a more constant and optimal output at all times.
- **Preservation of infrastructure**: When electricity is not harnessed when produced, it can lead to infrastructure degradation. For example, dams may overflow (see subsection 3.6.2 for more details), and wind turbines may break from mechanical stress.
- **Increase in profitability for renewable energy producers**: By partnering with Bitcoin miners, renewable energy producers increase their profitability, allowing them to decrease prices for the general population or use the proceeds to invest in infrastructure improvements (which lead to more renewable energy and decreased prices eventually).
- **Reduction in greenhouse emissions**: Bitcoin mining is emerging as the superior technology for reducing natural gas flaring. The previously flared natural gas is pumped into a generator, where it is burned inside a controlled environment to produce electricity. This electricity is then used to power Bitcoin miners. The income from the operation is used to finance the infrastructure. See section 3.6.3 for more details.

- **And more**: More benefits could be mentioned such as heating and heat targeting, without forgetting that Bitcoin mining's main purpose is securing the Bitcoin network, used by millions of people around the world.

2022 saw the continued convergence of the mining and energy industries and we expect this trend to continue in 2023. Electric Reliability Council of Texas (ERCOT) established the Large Flexible Load Task Force (LFLTF) which recognized miners as a flexible load resource and key contributors to grid stability. In winter storm Elliot that occurred on December 24th in the US, Bitcoin miners curtailed as much as 100 EH of hashrate representing 40 percent of the Texas network hashrate to help stabilize the grid.[3].

3.5 SWOT Analysis

This section presents a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of Numeraire within the Bitcoin mining industry.

3.5.1 Strengths

- **State-of-the-art infrastructure**: Numeraire utilizes the latest Bitcoin mining hardware and technology, including water-cooled hardware and autotuning mining firmware, providing a competitive edge in terms of efficiency and profitability.
- **Access to low-cost electricity**: Numeraire secures electricity at a lower cost by harnessing excess on-grid renewable energy directly at the source.
- **Renewable energy usage**: Using renewable energy sources reduces the environmental impact of the mining process, making it more sustainable and attracting environmentally conscious customers who support sustainable and responsible practices. Additionally, using renewable energy can lead to government incentives and subsidies, further lowering operating costs.

3.5.2 Opportunities

- **Growing demand for Bitcoin**: The increasing popularity and value of Bitcoin are driving demand for mining operations, providing Numeraire with a growing market to participate in. In the US, it is estimated that 57 percent of millennials (born 1981-1996) own cryptocurrencies[1].
- **Bitcoin price increase**: A rise in the price of Bitcoin can significantly benefit Numeraire as the margin of all miners temporarily increases until the network difficulty reaches a new equilibrium. This delay is due to the limited speed at which manufacturers and miners can add new hashrate to the network.
- **Increasing efficiency of mining hardware**: As mining hardware becomes more efficient, the market will converge to using water-cooling ASICs. By acquiring this type of equipment early, Numeraire ensures a long-term position in the market and can benefit from an increase in the price of the hardware.

3.5.3 Weaknesses

- **Obsolescence of mining hardware**: Old hardware becomes obsolete as new hardware with better performance hits the market, and Bitcoin mining companies need to replace

[1] https://www.bankrate.com/investing/cryptocurrency-statistics/

their old machines. State-of-the-art hardware with water cooling technology mitigates this weakness, but not indefinitely.

- **Decrease in Bitcoin reward**: The Bitcoin reward acquired for successfully mining a Bitcoin block is halved every 210'000 blocks[1] (4 years), which can lead to unprofitability for miners. While historically Bitcoin halvings have been inconsequential for miners, there is no proof that this trend will continue in the future. At Numeraire, we predict that future halvings will increase competition and favor the ones that use excess energy. The next halving will take place in Q1 2024.

3.5.4 Threats

- **Bitcoin price decrease**: A decrease in the price of Bitcoin can be a significant threat due to the time difference between the price decrease and the subsequent difficulty adjustment. The Bitcoin operation can become unprofitable, forcing miners to turn off their machines or continue mining at a loss. During such events, only the most efficient miners and the ones with the best-handled treasuries may survive.
- **Regulatory uncertainty**: Lack of regulation, which leads to uncertainty, can be harmful in the case of a ban or higher taxes for miners. Nevertheless, Bitcoin mining as a global industry does not depend on the laws or regulations of any specific country. The best example being the Chinese mining ban of June 2021 where the Bitcoin network lost almost 50 percent of its hashrate (from 177 EH/s to 91 EH/s)[4], only to recover it all and break new all time highs 6 months later in January 2022 (as seen in Figure 3.1). It stays nonetheless a potential threat if involving relocation.

3.6 Environmental Impact

One of the greatest misrepresentations in our industry is the misunderstanding of the environmental impact of Bitcoin mining. At Numeraire, we see this as an opportunity to pioneer in the field and educate individuals, companies, and governments through our consulting division.

Most of the criticism around Bitcoin mining's environmental impact comes from the amount of energy that the Bitcoin network consumes. We often read headlines such as "*The Bitcoin mining industry consumes more energy than entire countries*". Although these headlines sound alarming at first, they are based on the flawed logic that the energy consumed has a direct positive correlation with carbon emissions. The truth is that if the Bitcoin network used the 700 TWh a year wasted by vented/flared methane alone, it could mitigate more than 240 megatons of CO2 emissions (the equivalent of around 50 million cars) (Figure 3.3) by consuming more energy than most countries in the world [5].

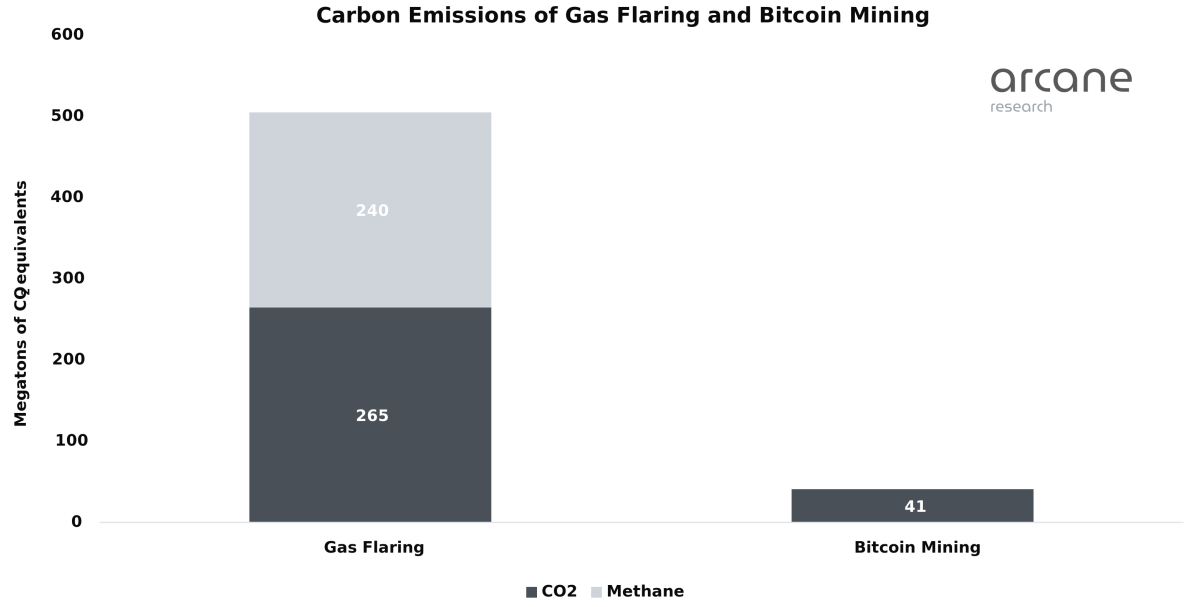

Figure 3.3: Comparison of carbon emissions between gas flaring and Bitcoin mining

This section aims to clarify that Bitcoin mining is not only beneficial for the environment but is also the most effective technology for enabling an increase in the use of renewable energy and a significant reduction of greenhouse emissions worldwide. In this section, we describe how Bitcoin mining is beneficial to different types of energy producers.

3.6.1 Wind and Solar Energy

Wind and solar are dilute and intermittent forms of energy that are mainly used in the process of electricity production. Due to their intermittency and possible divergence with demand, there are plenty of moments when the energy produced by the solar panels or wind turbines goes to waste. This phenomenon is famously described by the *duck curve* (see Figure 3.4), where excess energy at peak production times starts damaging the grid and increases grid instability.

Additionally, any grid containing wind and solar plants must include a source of controllable energy as well. The reason is that because of solar and wind intermittency, there are moments when not enough energy is produced relative to demand, and the controllable source of energy must take over. This creates a constant need to decrease or increase the power output of the controllable source depending on the demand and on the output of the solar and wind power

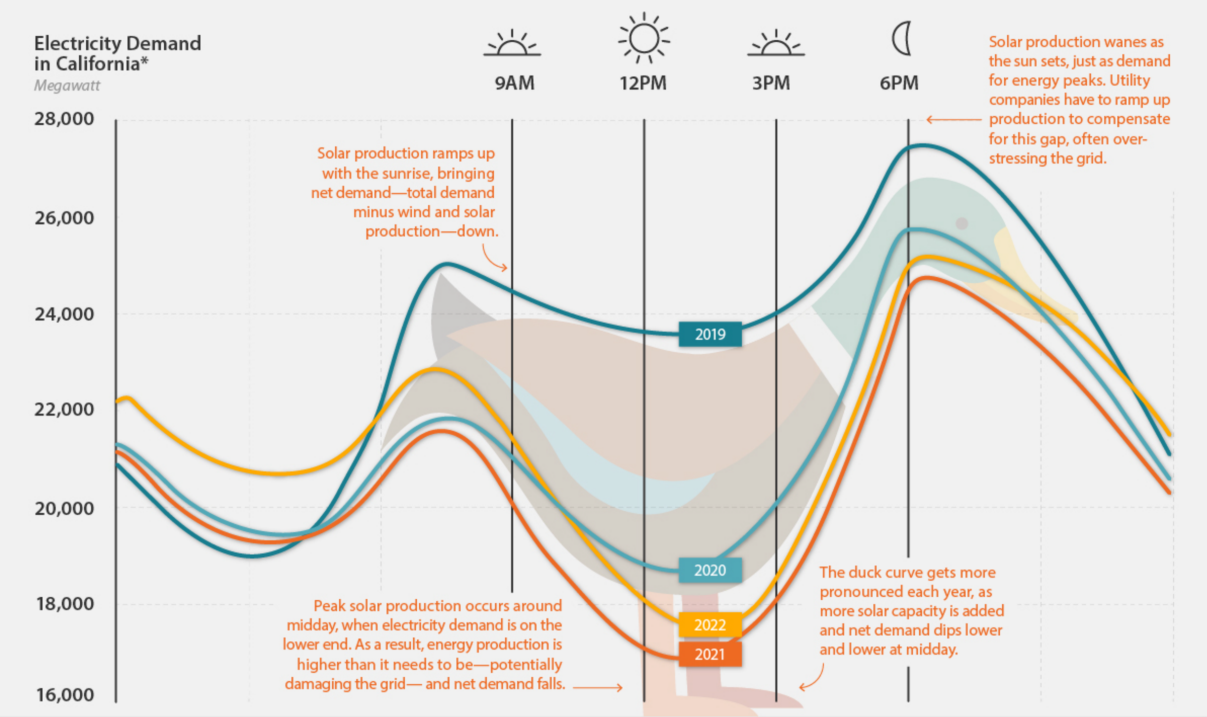

Figure 3.4: Solar duck curve

plants. The constant load following that ensues creates an inefficiency, increasing the cost of energy production in the grid.

Finally, because solar and wind are dilute forms of energy, farms are built at long distances from the grid to harvest the maximum amount of sun and wind, using wide areas. Long transmission lines are needed to transmit the electricity from producer to consumers. The longer the transmission distance, the more energy is lost in the process and the higher the costs. It is estimated that between 8 and 15 percent of the energy is lost in transmission and distribution [6].

When Bitcoin mining is introduced into solar and wind grids, it helps offset the costs of intermittency and dilution by harvesting the excess energy when there is low demand, either from the solar and wind plants or from the controllable power station by decreasing load following inefficiency. Bitcoin miners can also be placed directly at the solar and wind farms to reduce the loss of transmission lines (meaning cheaper prices). Bitcoin mining makes using wind and solar more profitable and resilient, enabling improvements in the infrastructure and lower costs for the consumer.

3.6.2 Hydroelectric Energy

Hydroelectric energy uses falling water to generate electricity through a turbine and represents about 6 percent of the world's energy. At Numeraire, we are particularly interested in hydropower because Switzerland's topography and high levels of annual rainfall provide ideal conditions for its use (see Chapter 4 for a market analysis of the state of hydropower in Switzerland).

Hydroelectric power plants produce a flow of electricity that is neither constant nor intermittent because water stored in dams and rivers can flow continuously to create a base load, but the amount of water varies throughout the seasons. Therefore, hydroelectric energy faces similar issues as wind, solar, and geothermal energy.

For run-of-river power plants, electricity generation is constant and unused when demand is low. For storage power plants (dams), electric generation is controllable, but the energy is lost when the dam reaches maximum capacity. The optimization problem of the grid (described in Section 3.4) also forces the dam to produce more energy than is needed at any given time, which could be bought by Bitcoin miners as it is easier and more economical to turn the miners on and off rather than to open and close the dam valves.

The degradation of infrastructure for hydroelectric storage power plants is even more dangerous and harmful than alternatives because of water spilling outside the dam when it reaches capacity, a phenomenon called *overtopping*. Overtopping of a dam is often a precursor to dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest accounts for approximately 34 percent of all U.S. dam failures[2] (see Figure 3.5). Switzerland's modern dams possess controlled and uncontrolled built-in spillways to avoid erosion, but that still constitutes a significant amount of excess energy that goes to waste. Other methods consist of opening the water turbines and letting the transmission lines take the hit/heat.

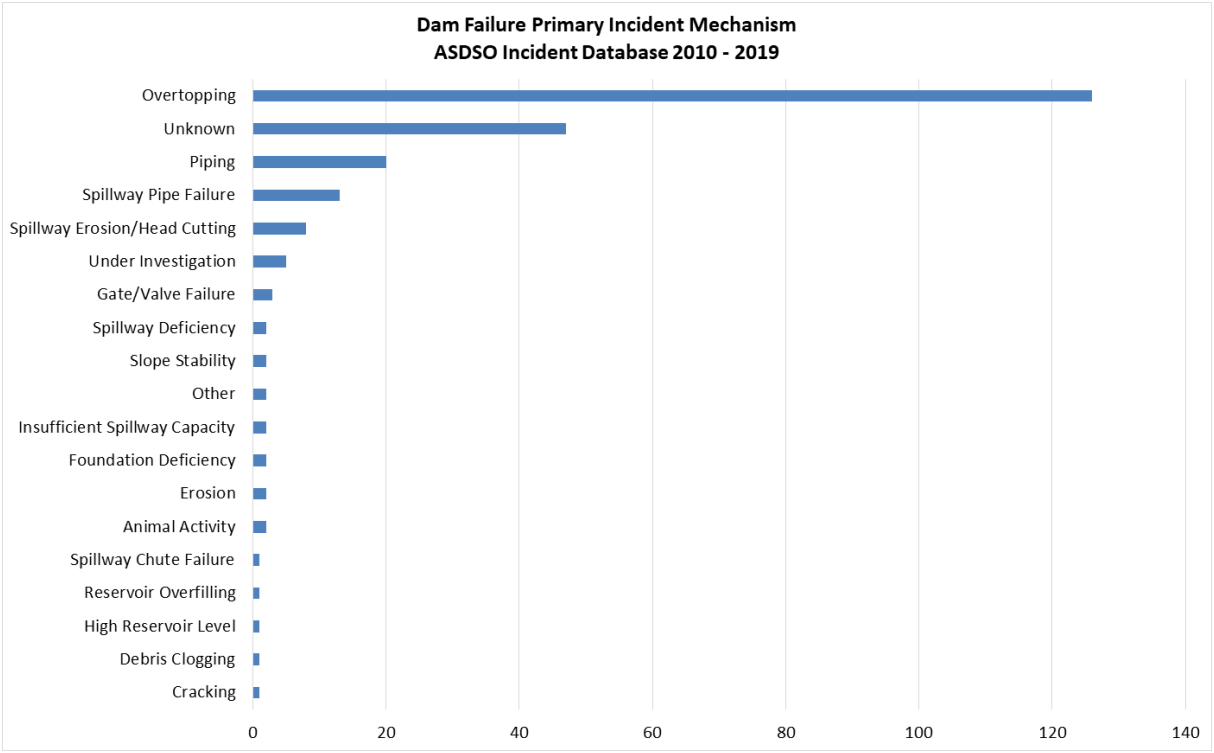

Figure 3.5: Dam failures are primarily due to overflowing

Today, some energy producers (like Axpo in Switzerland) have tried mitigating the dam spilling problem by implementing batteries to store the excess energy. Unfortunately, this solution is not sufficient as batteries have a significant cost of production, a relatively small lifetime, and the problem remains the same when the batteries are full because the amount of energy that can be stored in batteries relative to their cost is not significant compared to the amount lost. As proven by the recent partnership of Blockstream, Tesla, and Block for the creation of a 100 percent renewable energy Bitcoin mine[3], batteries and Bitcoin mining are complementary.

Like other forms of electricity production, hydropower plants greatly benefit by partnering with Bitcoin miners directly on-site (avoiding transmission lines) to mitigate the issues of dam spilling,

[2]https://damsafety.org/dam-failures
[3]https://cnbc.com/2022/04/08/tesla-block-blockstream-to-mine-bitcoin-off-solar-power-in-texas.html

grid stabilization, and usage optimization. Ultimately, this partnership induces a decrease in the price of electricity for consumers by making production more profitable.

3.6.3 Fossil fuels: Flared and Vented Methane

Contrary to popular belief, the energy domain where Bitcoin mining is the most beneficial by helping reduce inefficiencies and greenhouse emissions is the fossil fuel industry. This business plan analyzes the specific effect of Bitcoin mining on the process of fossil fuel extraction, without delving into the vast subject of fossil fuels, which represent 80 percent of global energy usage compared to 3 percent for wind and solar[4].

Globally, 143 billion cubic meters of natural gas were flared in 2021, equivalent to the total volume of natural gas imported into Germany, France, and the Netherlands. This resulted in the direct release of 270 million tonnes of CO2 and nearly 8 million tonnes of methane (240 million tonnes CO2 equivalent) into the atmosphere, as well as black soot and other greenhouse gases [7].

Methane may be flared or vented rather than captured and used for several reasons. For example, the natural gas may be found in remote or difficult-to-access areas, making it too costly to transport to a location where it can be used or processed. Additionally, the natural gas may contain impurities, such as sulfur or other chemicals, that make it difficult or expensive to clean or process. In these cases, the natural gas may be flared or vented to dispose of it safely. Sometimes, the demand for natural gas is low, and the cost of capturing and storing the gas exceeds the revenue from selling it. Companies may choose to flare or vent the gas to avoid the costs associated with storing it. Moreover, in some countries, regulations or lack of infrastructure do not provide adequate conditions for capturing the flared methane.

With current global operations and maintenance practices and regulations, the average global combustion efficiency (including both normally operating and extinguished flares) is estimated to be around 92 percent [7]. Crusoe Energy's Digital Flare Mitigation® technology can combust 99.89 percent of the methane by burning the natural gas in a controlled environment inside an electric generator. This reduces CO2 equivalent emissions by about 63 percent compared to continued flaring [5].

Bitcoin miners, as buyers of energy at any given location or time, allow fossil fuel energy producers to sell their excess natural gas that is currently negatively priced (i.e., a burden for them) directly on-site. This drastic reduction in methane emissions will eventually make the Bitcoin mining industry carbon negative in the near future. Figure 3.6 shows the cost-effectiveness of mining Bitcoin using flared methane instead of wind and solar.

In addition to reducing emissions by preventing methane leaks, oil field Bitcoin miners outcompete grid-connected Bitcoin miners and thus offset their energy consumption [5].

Exxon Mobil, the largest and most profitable oil and gas company in the U.S, has been mining Bitcoin in North Dakota since 2021 in partnership with Crusoe Energy Systems using wasted flared methane[5].

3.6.4 Geothermal Energy

Geothermal energy is earth's geological heat reservoirs either used directly or used to produce electricity. Electricity from geothermal power plants is constant (as opposed to intermittent) and the power output highly predictable and stable.

[4]https://ourworldindata.org/fossil-fuels
[5]https://cnbc.com/2022/03/26/exxon-mining-bitcoin-with-crusoe-energy-in-north-dakota-bakken-region.html

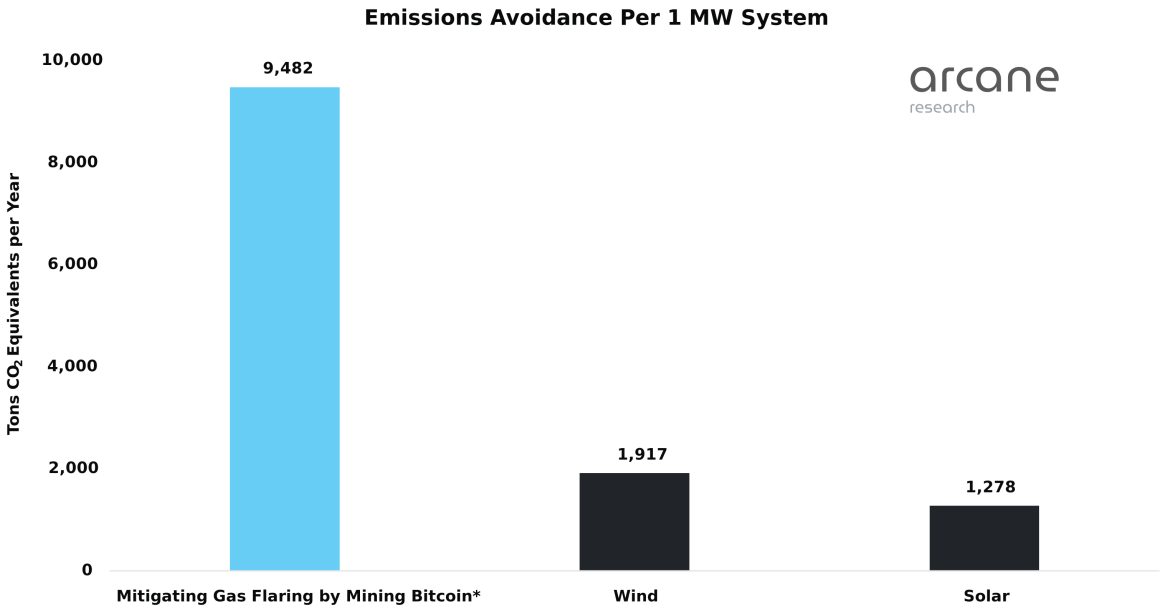

Figure 3.6: Effectiveness of emissions avoidance per 1MW

This scenario is inverted compared to wind and solar but the consequence relative to demand on the grid is similar. Geothermal energy will provide a constant flow of electricity but the demand will vary throughout the days, weeks and seasons. Due to the varying demand and stable offer, there will be moments when excess energy is available relative to demand.

Bitcoin miners, as buyers of last resort, dynamically optimize demand at any point in time by turning on and off their machines, enabling the grid to be optimized by harvesting the excess energy that is produced.

Using geothermal energy to mine Bitcoin has been done for almost a decade now at the Enigma site in Iceland by Genesis Mining [6].

The recent development in geothermal energy from El Salvador, a Central American country under the regime of Nayib Bukele, is very popular among Bitcoin advocates. The country started mining Bitcoin in 2021 in a geothermal power plant located at the Tecapa volcano and has plans to create a new site at the Conchagua volcano [8].

3.6.5 Nuclear Energy

Nuclear energy is a type of energy that is derived from a radioactive material such as uranium isotopes. The energy is produced by stimulating the material to release the energy that holds the nuclei of atoms together. Given current technology, nuclear power stations deliver thousand of times more energy density than oil and coal.

Nuclear power plants are designed to provide consistent and reliable power. They can operate continuously for extended periods of time without interruption. Unlike wind and solar power, which are dependent on weather conditions and are intermittent, nuclear power plants can provide consistent power regardless of weather conditions. This makes nuclear energy well-suited to providing baseload power in a grid, which is the minimum amount of electricity required by a grid to meet ongoing demand.

[6] https://www.genesis-mining.com/enigma

Partnering with Bitcoin miners, nuclear power stations can increase their baseload power as miners can absorb excess energy. This optimization of nuclear power station grids can increase profitability and reliability for both parties. Due to the lack of CO2 emissions, extreme energy density, and cost-effectiveness of nuclear energy, Numeraire believes that the most profitable Bitcoin mining operations will be those that harness electricity from nuclear power stations.

TeraWulf, a publicly traded Bitcoin mining company, is currently operating the most efficient Bitcoin mine in the world, the Nautilus Cryptomine. The company sources reliable, carbon-free, and 24x7 baseload power from the 2.5GW Susquehanna nuclear generation station in Pennsylvania[7], which allows them to secure a power agreement for an incredibly low price of 2 cents per kilowatt hour (kWh) of power for five years. This low price is unprecedented for any other source of energy outside of nuclear.

[7] https://www.terawulf.com/nautilus-cryptomine/

Chapter 4

Market Analysis

This section provides an overview of the current state of the Bitcoin mining market in Switzerland, including market size, growth, demographics, and competition. Note that Numeraire is not bound to Switzerland for its mining operations and can develop mining farms in any location offering suitable conditions and cheap energy prices. We focus primarily on Switzerland as that is where Numeraire is legally located and will start operating.

4.1 Market Size and Growth

The Bitcoin mining market is international, and every miner in the industry is in competition. The Bitcoin market for exchanges or users is not geographically bounded. Nevertheless, an analysis of the local Swiss market is needed to understand the available opportunities.

Switzerland has a strong tradition of innovation and technological development, which makes it an attractive location for Bitcoin mining operations. Additionally, Switzerland has an abundant supply of hydroelectric power, which can be used to power mining operations at a lower cost.

The market size for Bitcoin in Switzerland is difficult to estimate, but it is growing fast. The number of companies and individuals active in Bitcoin, the blockchain, and cryptocurrency space has been growing rapidly, and it is expected to continue growing in the future as initiatives such as Lugano's Plan B take hold.

Axpo Holding AG is Switzerland's largest producer of renewable energy, mainly hydroelectricity.

In Switzerland, the federal government wants to promote the future use of hydropower to a greater extent through a variety of measures. In order to exploit the realizable potential, existing power plants are to be renovated and expanded while taking into account the related ecological requirements. The instruments to be used here are investment contributions for new installations, renovation and expansion of existing hydropower plants, as well as the price market for operators who have to sell electricity on the market below the production costs. In addition, other measures to support hydropower are planned, such as easing the authorization procedures and providing investment contributions for planning[1].

4.2 Demographics

In Switzerland, hydropower represents around 55 percent of domestic electricity. There are 682 hydropower plants in Switzerland as of December 2021, each with a capacity of at least 300 kilowatts. These plants produce an average of around 37.172 gigawatt hours yearly (GWh/y),

[1] https://www.bfe.admin.ch/bfe/en/home/supply/renewable-energy/hydropower.html

with 48.3 percent produced in run-of-river power plants, 47.5 percent in storage power plants (dams), and approximately 4.2 percent in pumped storage power plants. Roughly 63 percent of hydroelectricity is generated in the mountain cantons of Uri, Grisons, Ticino, and Valais[2].

The cold conditions in the alps allow ASIC miners to be cooled more efficiently if installed near the power source in the mountains, whether using fans or water cooling technology.

4.3 Regulations and Compliance

The Bitcoin mining industry is subject to a wide range of regulations and compliance requirements, depending on the specific country or region in which the operation is located. These regulations can cover issues such as taxes, licenses, and permits, as well as environmental and energy-related regulations.

In Switzerland, the mining industry is relatively unregulated, and there are no specific laws or regulations that apply to Bitcoin mining operations. However, the company will still be subject to general business regulations, such as taxes, as well as regulations related to energy consumption and environmental impact.

It's important for Numeraire to be aware of the regulations and compliance requirements that apply to its operations in each country or region where it operates and to ensure that it is in compliance with all relevant laws and regulations. This can include obtaining any necessary licenses or permits, as well as adhering to any environmental or energy-related regulations. The company should also stay informed about any changes in regulations and be prepared to adapt its operations accordingly.

4.4 Competition

As stated before, every entity that increases the Bitcoin network's hashrate is theoretically a competitor, so local competition does not matter more than the global one, except for access to local opportunities such as mining locations.

The most important variable to take into account for a Bitcoin mining operation is the cost of electricity. By accessing wasted energy directly at the source such as unused hydroelectric power at a dam (avoiding the transmission lines), we are guaranteed to obtain the best prices since that energy is negatively priced for the producer (it is a burden). The rest of the variables (except the ASICs' efficiency), described in chapter 5, tend to be global and affect every other competitor, such as the Bitcoin price, the mining pool fees, the network's difficulty, and the amount of transactions in the network.

In Switzerland, except Alpine Tech SA and Lugano's Plan B announcement to mine Bitcoin using Ticino's hydropower, no other company seems to have publicly announced mining using hydroelectric energy (or any other form of zero-carbon energy source).

4.5 Plan B Initiative

Lugano's Plan B is a joint initiative between the City of Lugano and Tether[3] to accelerate the use of and leverage Bitcoin technology as the foundation to transform the city's financial infrastructure. The plan will scale Bitcoin throughout the city to positively impact all facets of daily life for the residents of Lugano. From small transactions with local merchants to larger

[2]https://www.bfe.admin.ch/bfe/en/home/supply/renewable-energy/hydropower.html
[3]https://tether.to

efforts – such as paying annual taxes – Bitcoin will serve as the foundation for the city's financial exchanges[4].

Numeraire is delighted that such initiatives are arising in Switzerland, proving the huge interest and favorable regulation for Bitcoin and blockchain companies in the region. Here is a description of Lugano's Plan B initiative.

4.5.1 Investment Pool

The Plan B initiative is setting up a 100 million Swiss Franc investment pool for startups to develop Blockchain and Bitcoin technology as well as to promote the relocation of existing businesses.

4.5.2 Bitcoin Hub

Plan B will build a hub to house 300+ Blockchain experts and enthusiasts. Serving as a global point of reference in Lugano, it is designed to attract talent, encourage networking, and knowledge sharing. Numeraire would seek to obtain a permanent position in the Hub and help educate, advise, and develop Bitcoin solutions for individuals and companies.

4.5.3 Bitcoin Mining

Lugano's Plan B supports the activation of sustainable Bitcoin mining facilities in the region. It will actively support Research and Development and projects that are developing in this direction. This could present a big opportunity for Numeraire to collaborate with Lugano's government and gain access to the region's hydroelectric infrastructure.

[4]https://planb.lugano.ch

Chapter 5

Financial Projections

Numeraire's Bitcoin mining operation financial projections are based on a number of assumptions, including the price of Bitcoin, the difficulty of mining, the hardware's efficiency, and the company's costs, including electricity costs and costs associated with acquiring, maintaining, and upgrading mining equipment.

The financial projections detailed in this chapter are solely for the Bitcoin mining operation.

5.1 Revenue projections

The main source of revenue for Numeraire's Bitcoin mining operation will be the sale of mined Bitcoin. The company will use its mining hardware and software to mine Bitcoin and will sell them at the current market price.

Any excess Bitcoin profit will be stored in the company's treasury and sold at the sole discretion of the board of directors, depending on market conditions and future projections. These treasury management strategies are commonly called HODL ratio in the industry and can vary from 100 percent HODL or the totality of the Bitcoin produced sold at market prices. Numeraire will apply a hybrid strategy. Having an effective treasury management strategy will be essential for long-term survival. Whether it be through systematic liquidations of mining rewards, locking in proceeds through Bitcoin derivatives, or entering into hashrate derivatives contracts, miners must pay careful attention to how they manage their liquidity profile.

5.2 Expense Projections

The main expenses for Numeraire will be the costs associated with electricity, acquisition, maintenance, and upgrading of mining hardware, and employee salaries. The company will also incur other expenses such as office rent, legal, and accounting services.

These expenses are included in the CapEx, OpEx, and electricity price variables described in the next section.

5.3 How to Calculate Bitcoin Mining Profitability

The methodology for calculating the expected profitability of mining Bitcoin can be complex, but most of its parameters are public and easily accessible. This section breaks down all the factors that affect profit.

- **Months to halving**: Time until the next halving event in months.
- **Bitcoin price**: Value of 1 BTC in dollars.
- **Network difficulty**: Bitcoin network's difficulty to mine 1 BTC.
- **Hashrate**: Estimated amount of hashes being generated to solve new blocks. Every model of mining hardware has a factory-estimated hashrate in the product details. Hashrate is generally measured in terahashes per second (TH/s). This value represents the total hashrate for all operational machines and can be increased significantly using auto-tuning firmware.
- **Consumption**: Miners measure their power consumption in watts per hour (W/h) or kilowatt-hours (kWh). Every Bitcoin mining machine specifies its factory-estimated power consumption in the product details.
- **Electricity price**: The cost of power is one of the data points miners care about most. The price is defined in USD per kWh and is often derived from a contract with the energy producer.
- **Block subsidy**: The number of bitcoins created per new block. This number changes after each halving event.
- **Average Transactions Fees**: Average transaction fees per block over the specified period.
- **Pool Fee**: Fee for the usage of the mining pool.
- **Price Increment**: Expected annual Bitcoin price increase. Bitcoin's price is difficult to predict, so we consider different bullish and bearish scenarios.
- **Difficulty Increment**: Percentage increases of difficulty per year. Each year difficulty changes approximately 24 times (twice per month), so the percentage increase would reflect the total change from the first adjustment to the last over that period.
- **Capital Expenditures (CapEx)**: Capital expenditures are funds spent by an entity to purchase, replace, upgrade, or otherwise manage physical assets (e.g., mining machines, facilities). Common expenditures in mining include buying and maintaining ASICs, cooling equipment, and containers.
- **Monthly operating expenses (OpEx)**: Operating expenses are recurring or cyclical costs independent of mining revenue that maintain the operation. The sum of expected monthly OpEx does not include power costs. OpEx funds include salaries, site security, insurance, taxes, and legal fees.
- **HODL ratio**: How much of the newly mined bitcoins a miner plans to hold. Most miners sell some portion of their revenue to cover operating costs. But it's common to hold some portion of mined Bitcoin on the balance sheet, giving exposure to potential price appreciation. For example, a miner that does not sell any bitcoins has a HODL ratio of 100 percent.

Note that the profitability projections are not computed using different values for the Bitcoin price and network difficulty but by using the current values and projecting an optional linear increment or decrement over the specified time period.

5.4 Profitability Projections

There is no fixed cost for mining Bitcoin. The real cost depends on over a dozen variable data points. In this analysis, we have fixed the value of the less volatile parameters and allowed the most important ones to vary to create different projection scenarios.

The profitability of the company will be determined by the difference between its revenue and expenses. The projected revenues and expenses will be used to calculate the projected profits, which can then be compared to the projected costs to determine the projected return on investment (ROI).

The following tables represent the profitability projections of a single **mining unit**, which consists of the most efficient hardware infrastructure currently available on the market. This unit will be composed of a container ANTSPACE HK3[1], filled to maximum capacity with 210 Bitcoin Miner S19 XP Hyd from Bitmain[2] (**18.1 J/TH efficiency** using auto-tuning firmware), and the parameters seen in Table 5.1.

Parameter	**Value**
Projection time period	24 months
Months to halving	14 months
Bitcoin price	22'333 USD
Network difficulty	43.05T
Hashrate	60'375 TH/s
Consumption	1'092'000 W
Electricity price	(varying) USD/kWh
Block subsidy	6.25 and 3.125 after halving
Avg. Transaction fees	0.2 BTC
Mining Pool Fee	0%
Price Increment	(varying) %/year
Difficulty Increment	(varying) %/year
CapEx (per mining unit)	2'000'000 USD
OpEx (per mining unit)	15'000 USD
HODL ratio	50% on profit

Table 5.1: Parameters used in the profitability projections

[1]https://shop.bitmain.com/product/detail?pid=18450211231118285350583K2a0P505EF
[2]https://shop.bitmain.com/product/detail?pid=18450220307155532760z9tPWK4w06B6

We present the corresponding profitability projections for different Bitcoin price increments (X-axis) and difficulty increments (Y-axis) scenarios over a period of 24 months for different electricity prices in Tables 5.2, 5.3, and 5.4:

	-25%	**0%**	**25%**	**50%**	**75%**	**100%**
75%	75'100	345'010	620'292	903'212	1'194'933	1'496'098
50%	272'645	527'764	789'038	1'057'652	1'334'274	1'912'960
25%	476'299	789'038	1'112'320	1'447'260	1'794'448	2'526'703
0%	789'038	1'194'933	1'619'298	2'063'078	2'526'703	3'514'045
-25%	1'334'274	1'912'960	2'526'703	3'176'019	3'860'966	5'337'028

Table 5.2: Profit over 24 months at **0.04 USD/kWh**

	-25%	**0%**	**25%**	**50%**	**75%**	**100%**
75%	-307'537	-37'627	237'656	520'575	812'296	1'113'461
50%	173'038	145'127	472'834	812'296	1'164'603	1'530'324
25%	16'904	406'401	812'296	1'236'661	1'680'441	2'144'066
0%	307'612	812'296	1'345'763	1'909'757	2'504'919	3'131'408
-25%	812'296	1'530'324	2'303'052	3'131'408	4'015'333	4'954'392

Table 5.3: Profit over 24 months at **0.06 USD/kWh**

	-25%	**0%**	**25%**	**50%**	**75%**	**100%**
75%	-690'174	-420'263	-144'981	137'938	429'659	730'825
50%	-555'674	-237'510	90'197	429'659	781'966	1'147'687
25%	-365'733	23'764	429'659	854'024	1'297'804	1'761'429
0%	-75'025	429'659	963'126	1'527'121	2'122'282	2'748'771
-25%	429'659	1'147'687	1'920'415	2'748'771	3'632'696	4'571'755

Table 5.4: Profit over 24 months at **0.08 USD/kWh**

The profitability projections illustrate the reality of Bitcoin mining; if the Bitcoin price and network difficulty evolve proportionally, as they are expected to by the protocol design, the only variables that truly matter for a Bitcoin mining operation are the hardware efficiency and electricity price. In other words, the competitive advantage relative to other miners.

5.5 ASIC Liquidations and Market Dynamics

The market for ASICs was significantly affected by the broader downturn in 2022. Worsening economics squeezed operating cash flow for miners and, after layering in other operating expenses, debt obligations, and capex payments, cash balances were depleted rapidly. Miners that

could neither raise capital nor had enough cash or Bitcoin on hand were forced to sell ASICs and re-evaluate expansion plans to stay solvent.

The ensuing influx of supply on the secondary market drove ASIC prices to as low as 15 USD per TH, as observed on Luxor's ASIC Index, and forced Bitmain, MicroBT, and Canaan to also decrease prices for direct purchases.

Today, ASIC manufacturers are flush with inventory, and secondary market supply has grown tremendously. In the US, secondary supply has ballooned, which will likely result in miners pivoting away from entering into ASIC futures orders in the near-term. The ease by which miners can now procure ASICs allows them to prioritize their time and capital towards building out infrastructure as opposed to procuring ASICs.

This presents a great opportunity for Numeraire as a new Bitcoin mining operation focused on water cooling technology. While the competition is struggling to survive and focused on acquiring old-generation discounted miners and sees no need for upgrading due to low ASIC prices, Numeraire can acquire niche water cooling miners of greater efficiency at lower prices while demand for ASICs is low. The most efficient hardware on the market is the Bitcoin Miner S19 XP Hyd.

For these reasons, we expect the price of water-cooling ASICs to increase over time as we believe they have reached a bottom. Taking into consideration that hardware efficiency is one of the most decisive variables driving profitability, miners will eventually need to upgrade their mining equipment by installing water-cooled ASICs and will be forced to compete for this niche asset while Numeraire will already be equipped.

Chapter 6

Conclusion

In conclusion, we believe that our Bitcoin mining operation has great potential for success thanks to its significant competitive advantages. We understand that hardware efficiency and electricity price are the two most important variables for a Bitcoin mining operation. Our team has taken a strategic approach to these variables by investing in the most efficient hardware available and harnessing electricity from renewable sources and wasted/excess energy. This approach ensures that we are well-positioned to compete in the market and generate significant profits for our investors.

Our location in Switzerland provides us with a stable and secure regulatory environment, which will allow us to focus on growing our business without unnecessary regulatory obstacles. Our team is highly experienced and has a deep understanding of the technical and financial aspects of Bitcoin mining.

Our Bitcoin mining operation is determined to take advantage of the current market conditions and capitalize on the opportunities presented by the current ASIC price decline. By acquiring cutting-edge hardware at a lower price, we will obtain a long-term competitive advantage.

As we continue to expand our operations and increase our mining capacity, we are committed to reinvesting a portion of earnings back into the business to stay at the forefront of the industry. We will also maintain a strong focus on risk management and financial discipline to ensure the long-term sustainability of our operation.

Thank you for considering our Bitcoin mining operation for investment. We are excited about the potential of our business and look forward to building a successful partnership with you.

Glossary

ASIC Application-Specific Integrated Circuit. 1, 5, 17, 23, 24

autotuning mining firmware Per-chip autotuning is the process of software calibrating the frequencies and voltages on every individual chip on a hash board so that they produce the best possible performance. This means that the software tests the chip's performance at different frequencies and narrows in on the optimal settings to get the most hashes from each chip per Watt of energy consumed (maximize W/TH). 1, 8

baseload power Minimum amount of electricity required by a grid to meet the ongoing demand for electricity. It is the level of power that is consistently required by the grid 24 hours a day, 7 days a week, and 365 days a year. 14

consensus A general agreement. 1

distributed systems Distributed systems is a field of computer science that studies the design and implementation of networked systems that consist of multiple autonomous computers working together to achieve a common goal, allowing for the distribution of resources, processing, and data storage across multiple nodes to improve reliability, scalability, and fault tolerance. 2

ERCOT Electric Reliability Council of Texas. 8

hashrate The Bitcoin hashrate is a measure of the computational power of the Bitcoin network, expressed in hashes per second (h/s). 5

LFLTF Large Flexible Load Task Force. 8

LLC Limited Liability Company. 2

Proof of Work A Proof of Work (PoW) protocol (or consenus algorithm) is an economic measure to deter denial of service attacks and other service abuses such as spam on a network by requiring some work from the service requester, usually meaning processing time by a computer. 1

protocol A protocol is a set of rules and standards that dictate how communication should occur between systems or devices in a computer network, allowing for efficient and consistent data transmission and processing. 1

SWOT Strengths, Weaknesses, Opportunities and Threats. 4, 8

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