

**Farmer, Miner, Builder, Trader:
Re-humanizing the distributed infrastructures of Bitcoin**

by

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Dalian University of Technology, 2015

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Farmer, Miner, Builder, Trader: Re-humanizing the distributed infrastructures of Bitcoin

by

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ABSTRACT

The concept of bitcoin is powerful and charming. Social scientist gurus, transnational corporations' CEOs, and mass media journalists all emphasize that cryptocurrency will lead humanity to a future of increasing extraordinary financial and spatial decentralization. However, although bitcoin has been around for 10 years, existing bitcoin geopolitics have not been significantly addressed. If we try to thoroughly understand bitcoin, it is crucial to ask the following questions: What are bitcoin's dynamic urban landscapes and what ramifications have they brought to us? What will the future of bitcoin's technology offer to us?

In this thesis, I challenge the common imagination that cryptocurrency contributes to the creation of public goods by conducting the investigation through four aspects that fall under the umbrella of bitcoin geopolitics, including: algorithm modeling, computational accelerating, global positioning, and human scaling. I argue that bitcoinization is not a process that "literally codes the world we wish to see." It is not a decentralized system; rather, it aligns with the existing geopolitical power concentrations and reflects current geopolitical relations and competition.

The thesis reveals a more dynamic bitcoinization process which remains a fundamentally capitalist urban process from the lens of architecture and urbanism. I conclude by exploring a design question: how do designers envision a dystopia fueled by bitcoin, perhaps combatting it, based on the relationship between ourselves, as humans, and bitcoin technology? With this exploration, I develop a more substantial critique of the potential paradoxes raised by bitcoin technology, in order to raise awareness of the politics of cryptocurrency mining, whose underlying desperation and hysteria are concealed by the rhetoric of liberation and decentralization.

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FARMER, MINER, BUILDER, TRADER

Re-humanizing
the distributed
infrastructures of
Bitcoin

Yue Wu

Spring 2019
Master Thesis

Master of Science in Architecture Studies, Urbanism
Department of Architecture
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Massachusetts Institute of Technology



Screenshot of
Bitcoin Adder
or Generator
Ultimate 2017

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A diagram consisting of three circles and an arrow. The circles are arranged in a roughly triangular pattern. The bottom-left circle is yellow and contains the text 'Bitcoin geopolitics'. The top-right circle is light green and contains the text 'Computational accelerating'. The middle circle is light grey with a dashed border and contains the text 'Algorithm modeling'. A curved arrow points from the top-right circle towards the middle circle. The background features several large, faint, concentric arcs.

***Bitcoin
geopolitics***

**Algorithm
modeling**

**Computational
accelerating**

1

INTRODUCTION

The age of bitcoinization

Global
positioning

Humans

INTRODUCTION

The age of bitcoinization

1

[01] Nakamoto, Satoshi. 2008. Bitcoin: A Peer-to-Peer Electronic Cash System.

[02] Daniel Osorio, "Without help, Venezuela cannot pay liabilities," April 22, 2019, <https://www.cnn.com/video/2017/09/22/without-help-venezuela-cannot-pay-liabilities-daniel-osorio.html>

Admit it or not, when Satoshi Nakamoto introduced the word “bitcoin” in his whitepaper “bitcoin: a peer-to-peer electronic cash system” at the end of October 2008, we entered the age of cryptocurrency⁰¹. Indeed, people had already begun to use the word **bitcoinization** to refer to the phenomena wherein bitcoin became the new transaction medium instead of fiat, which occurred in the sovereign state of Venezuela⁰². This was the first time that people saw the opportunity to get rid of a centralized bank system—one that was extremely powerful. The simple genius of the cryptocurrency technology is that it excludes the middleman, yet maintains an infrastructure that allows different stakeholders to engage in economic transactions with one another. At their core, cryptocurrencies are built around the principle of a universal, inviolable ledger which is made fully public and is constantly verified by highly powered computers through mining. Each computer is essentially generating hash power (computation power) while acting independently of the others⁰³. The concept of this technology is so powerful and charming that social scientist gurus, transnational corporations CEOs, and mass media journalists are emphasize that cryptocurrency will lead humanity

[03] Vigna, Paul, Michael Casey, and Sean Pratt. 2015. The age of cryptocurrency: how bitcoin and digital money are challenging the global economic order. <https://www.overdrive.com/search?q=1174138E-CC7F-416D-B30C-F58D1AB86376>.

[04] Thomas, Andrew. 2018. "6 Trends in Blockchain and Cryptocurrencies I Learned at San Francisco Blockchain Week." Inc.Com. October 31, 2018. <https://www.inc.com/andrew-thomas/6-trends-in-blockchain-cryptocurrencies-i-learned-at-san-francisco-blockchain-week.html>.

[05] Euny Hong. 2019. "How Does Bitcoin Mining Work?" April 29, 2019. <https://www.investopedia.com/tech/how-does-bitcoin-mining-work/>.

to a future of increasing extraordinary financial and spatial decentralization ⁰⁴.

But how does bitcoin work? It gets a little intricate because bitcoin deploys mining as a mechanism to generate value - apart from trading and exchange as a currency, participants can get extra bitcoin by contributing computation power to solving the math problem associated with transactions on the ledger. That said, by mining, people can earn bitcoin without having to spend money. In reality, mining is the only way to release new cryptocurrency into circulation, which is quite similar to minting currency ⁰⁵. Based on this process, people have generally adopted the idea that cryptocurrency gives personal computer users the opportunity to participate in the global financial system via mining, which corresponds to the work each individual contributes to the bitcoin system. In fact, at the early stage of the system, a personal computer's computation power was capable of mining. Cryptocurrency, especially bitcoin, thus gained great popularity and expanded at a quick speed. What gets futurists most excited about bitcoin is that cryptocurrencies are able to offer a decentralized financial network capable of benefiting the public at large.

Bitcoin(ization) = decentralization

However, although bitcoin has been around for 10 years with all the dynamic voices from either fanatic believers or skeptical conservatives—existing bitcoin geopolitics has not been significantly addressed. When discussing bitcoin and bitcoinization, which is extremely important if we are trying to thoroughly understand exactly what bitcoin is, it is critical to ask

BITCOIN CHANGES THE WORLD!

NO MEDIATOR

#a decentralized system



#get rid of a central authority

#benefited the public at large



#decentralized



UNITY

YOUR ARE
Satoshi NAKAMOTO

TIME FOR NO BANK

THE BITCOIN REVOLUTION

KEEP CALM
AND
BUY
CRYPTOCURRENCY

INVEST BITCOIN

centralized bank system X

#a virtual utopia X

centralizing the old finance and power X

Bitcoin's propoganda

questions such as the following. What is bitcoin's dynamic urban landscape and the ramifications it has brought to us? And what will the future of bitcoin's technology offer to us?

Therefore, in this thesis, I try to challenge the common imagination that cryptocurrency contributes to the creation of public goods by conducting the investigation through four aspects that fall under the umbrella of bitcoin geopolitics, including its algorithm modeling, global positioning, human scaling, and computational acceleration. I argue that bitcoinization is not a process that “literally codes the world we wish to see” – it is not a decentralized system, but rather it aligns with the current geopolitical power concentration and reflects current geopolitical relations and competition, which is manifested in these four categories:

***Bitcoin geopolitics =
1. algorithm modeling +
2. computational accelerating +
3. global positioning +
4. human scaling***

I am not attempting to write the history of bitcoin; nor am I trying to predict bitcoin's supposed future. The thesis begins from a more personal observation. When I came across a diary documenting a miner's life in a bitcoin mining farm at a ghost city, I became interested in integrating human agency in the cryptocurrency industry. By asking broader questions—for example, what is the space and spatial ideology produced by cryptocurrency? What is the new production and consumption relationship led by cryptocurrency? What are the similarities and distinctions of the regional development with respect

to cryptocurrency's production and consumption ecosystem? What are the different forces (resources, energy, urban policies, etc.) that lead to uneven regional and global development? And what agencies (centralized government, monopolized capitalists, decentralized anonymous individuals, etc.) makes decisions about cryptocurrency that affect urbanism? I reveal a more dynamic bitcoinization process which remains a fundamentally capitalist urban process from an architecture and urbanism lens. I conclude by exploring a design question: **how do designers envision a dystopia fueled by bitcoin, perhaps combatting it, based on the relationship between ourselves, as humans, and bitcoin technology?**

Bitcoin(ization) ≠ decentralization

One thing I consistently ask is if the market price of Bitcoin has shrunk to less than 85% compared with its peak value, is bitcoinization still a topic that is worthwhile for us to discuss? The answer is yes. Even if the day when bitcoin's market price bottoms out will ultimately arrive in the future, which is likely to happen, it does not necessarily mean that all most of the miners will quit the mining industry. Nevertheless, to explain the global economic system of bitcoin mining is thus to forecast bitcoin's market price is the topic of a different thesis. However, without this economic puzzle, I still consider this thesis worthwhile - only with this exploration can we begin to develop a more substantial critique of the potential paradoxes led by the bitcoin technology, in order to raise awareness of the current cryptocurrency mining situation, whose underlying desperation and hysteria are concealed by the rhetoric of liberation and decentralization.

A diagram consisting of three overlapping circles and an arrow. The circles are arranged in a roughly triangular pattern. The bottom-left circle is yellow and contains the text 'Bitcoin geopolitics'. The top-right circle is light green and contains the text 'Computational accelerating'. The top-left circle is dashed and contains the text 'Algorithm modeling'. A curved arrow points from the top-right circle towards the top-left circle. The background is light gray with faint, larger-scale curved lines.

***Bitcoin
geopolitics***

**Algorithm
modeling**

**Computational
accelerating**

2 ALGORITHM MODELING

A proof-of-work model is a pyramid scheme

Global
positioning

Humans

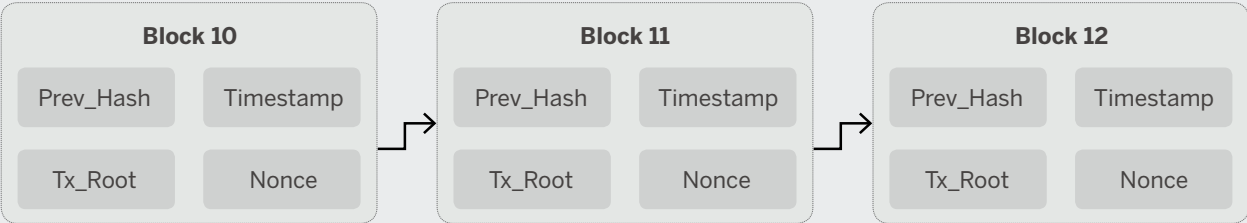
ALGORITHM MODELING

2

A proof-of-work model is a pyramid scheme

Let's start with the virtual world and try to figure out what bitcoin's mining algorithm can tell us? In this chapter, I discuss the algorithm behind bitcoin mining to reveal a fact that might betray our collective unconscious; instead of allowing everyone to participate in the mining system equally, the algorithm actually categorizes individuals along a political caste by their initial investment in this system, and empowers the people who invested more with more political clout. This is contradict to a just legal framework implied by bitcoin's original manifesto.

To rehearse the early design of bitcoin – this popular cryptocurrency is a network that is built on blockchain, which consists of a financial ledger formatted in a sequence of individual blocks. Each of these blocks contains transaction data. The idea of allowing users to join the network equally forces the storage and verification of the transactions, meaning no authorities are able to manage the funds and balances. Every miner's reward can be measured by (although not directly corresponds to, but has a high correlation with) the computation power they contributed to the network, and the problem they have solved through the blockchain. This was



[06] Bitcoin Wiki. "Proof of work". May 21, 2019. https://en.bitcoin.it/wiki/Proof_of_work.

[07] Blockgeeks. "Proof of Work vs Proof of Stake: Basic Mining Guide." April 02, 2019. <https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/>.

the original decentralized model – a proof-of-work model⁰⁶. That said, this model rewards miners' work of solving mathematical problems with the goal of validating transactions and creating new blocks⁰⁷.

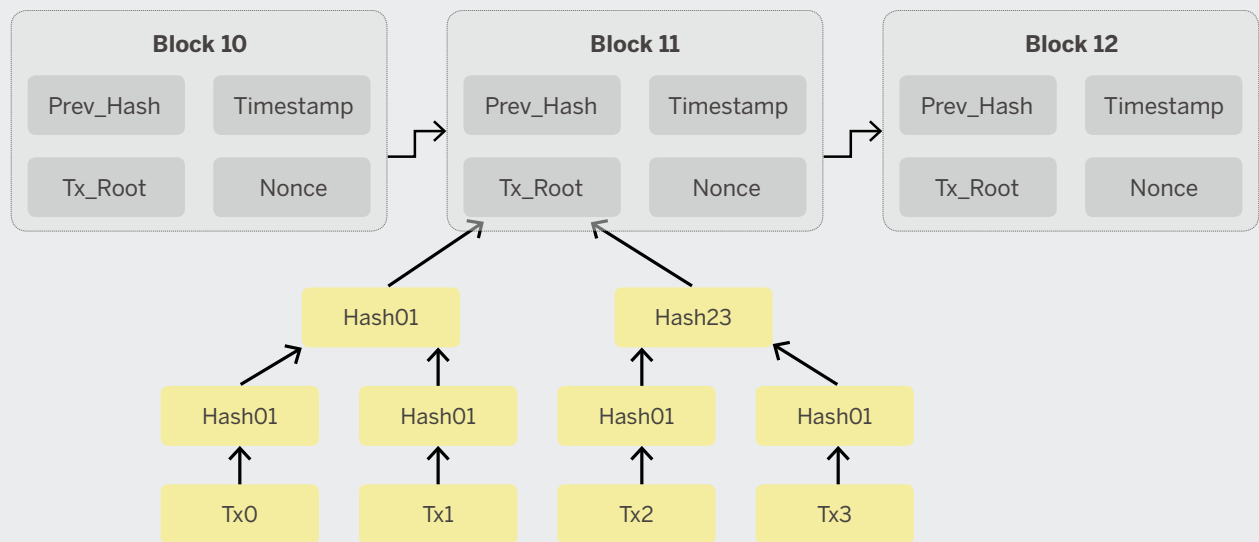
Validating = mining

However, as pointed out by Derek Leung from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL), decentralization will lead to a scalability problem. To be specific, in order to join a cryptocurrency, new users are required to download and store all transaction data from hundreds of thousands of individual blocks. Only by storing this data are the users able to contribute their power to further transaction verifications. This makes the process slow or computationally impractical for some cases⁰⁸. But what's more significant is that the growing blockchain system actually refers to a chronical bias which makes sustainability impossible, meaning that the later you join the system, the less likely you will earn a fortune. This partially explains the fact that most of the early bitcoin miners accumulated more wealth during the first years of the bitcoin age, while the more recently-join users are less able to acquire wealth⁰⁹. In this way, the proof-of-work model here is, in reality, a pyramid scheme.

[09] Rob Matheson. "A faster, more efficient cryptocurrency" January 23, 2019. <http://news.mit.edu/2019/vault-faster-more-efficient-cryptocurrency-0124>.

Proof-of-work modeling = pyramid scheme¹⁰

Apparently, the idea of the proof-of-first-served model complicates the new users and therefore is unable to create a framework for everyone to profit, which has been noticed by the scientists as well. Among the solutions proposed by the scientists who try to solve this traditional cryptocurrency problem, some



[08] Bitcoin Wiki. "Proof of work". May 21, 2019. https://en.bitcoin.it/wiki/Proof_of_work.

**The players who entered
bitcoin mining earlier**

[10] Bitcoin's proof-of-work mining algorithm-a pyramid scheme



The players who entered
bitcoin mining recently

promising ones embedded the concept of a “proof-of-stake” model in order to allow existing participants to more efficiently verify the blocks and better enable new users to join.

Nevertheless, what if we take a closer examination of this concept and try to understand what “proof-of-stake” is telling us? According to the “proof-of-stake” framework, a representative verification “committee” is selected. That said, the transactions no longer need to be verified as legal through all the users on the network, but on by a user committee instead. By adopting this concept, the efficiency of the verification can be accelerated extremely even if the network keeps scaling up. In short, it’s an excellent model.

[11] Blockgeeks. “Proof of Work vs Proof of Stake: Basic Mining Guide.” April 02, 2019. <https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/>.

But what are the stakes? During the selection of the verification representative “committee”, users with more money and investment in the cryptocurrency network have a higher probability of being selected. The creator of a new block is therefore chosen in a deterministic way, depending on its wealth, also defined as stake¹¹.

With this new model, the existing hierarchical committee system has clear geopolitical implications. Hypothetically, if this system were truly decentralized, the mining system embedded within the bitcoin is highly likely to link the cities and territories with equal opportunities for a global financial system. However, when we juxtapose the global bitcoin hash power distribution with the physical financial center network, we discover that the distribution pattern of these two components is indeed highly overlapped – following the algorithm, the virtual computation power’s distribution is another projection of the



20%



25%



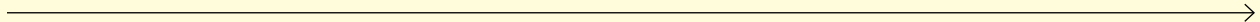
50%



60%



90%



A validators chance of mining a block

Diagram of how the verification representative "committee" is selected by the proof-of-stake model

**Representative
verification committee**

[12] Bitcoin's proof-of-stake mining algorithm-a pyramid scheme



Other players

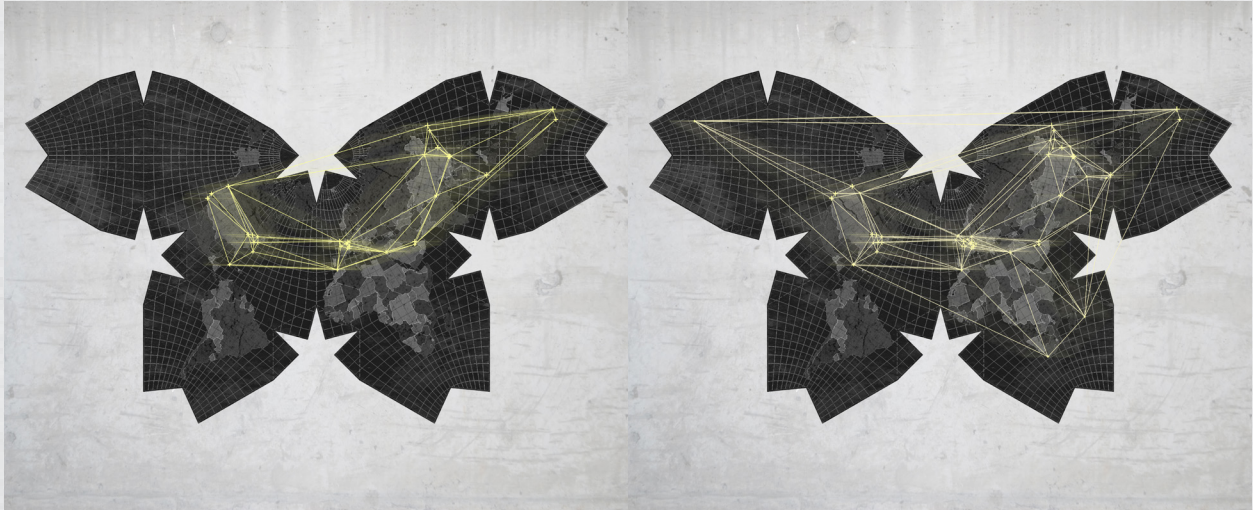
financial power's distribution in our real world. What does the overlap tell us? It challenges the hypothesis that the system is truly decentralized while the mining system embedded with the bitcoin is likely to link the cities and territories with equal opportunities towards the global financial system. That said, the algorithm modeling of the bitcoin system is another representation of the current global capital distribution.

***Proof-of-stake modeling = current capital
distribution
≠ decentralization¹²***

[13] Rob Matheson. "A faster, more efficient cryptocurrency" January 23, 2019. <http://news.mit.edu/2019/vault-faster-more-efficient-cryptocurrency-0124>.

Although the idea of a committee system has already been implemented and the capital to support this system is extraordinary dynamic among different territories - no matter if the capital is solid money or virtual social capital – they all tell us one truth: individuals who invested at different times with different amount have different political say, which defies the core of bitcoin's distributed algorithm modeling¹³.

At the end of the day, it is useless for us to position ourselves in the virtual world of bitcoinization: what seem to be equal opportunities for pursuing public is never guaranteed.



01. The mapping labels world's current top 30 financial centers

02. It will link secondary cities into the financial network



03. It will involve suburban cities' engagement

04. Finally, the cities with different financial capacities will all become the vertices in the decentralized global network

The hypothesis about how bitcoin changes the world's capital distribution

The diagram features three circles of varying colors and styles: a yellow circle at the bottom left, a dashed black circle in the middle, and a solid light green circle at the top right. Three large, thin, grey curved lines sweep across the page from the top left towards the right. A grey arrow points from the dashed circle towards the green circle.

***Bitcoin
geopolitics***

**Algorithm
modeling**

**Computational
accelerating**

3 COMPUTATIONAL ACCELERATING

The new bitcoin miner production oligarchy

Global
positioning

Humans

COMPUTATIONAL ACCELERATING

3

The new bitcoin miner production oligarchy

Looking into bitcoin's algorithm modeling enables us to reveal the hidden layer of its hierarchical framework, which allows us to understand the political implications of its design. We can then interrogate cryptocurrency's computational accelerating devices in the physical world. This helps us understand the geopolitics of bitcoin mining further.

***Bitcoin mining power =
algorithm + computation power***

Holding the algorithm solely will lead the participants to nowhere in the bitcoin world unless they own the computation power which enables them to run the algorithm endlessly. In this way, the bitcoin mining power can be regarded as the combination of algorithms and computation power. Considering algorithms in this equation as a constant since it hasn't been violated over the development of bitcoinization (although scientists keep proposing alternatives), the computation power then becomes a scalar in measuring the power in the bitcoin mining field¹⁴.

[14] Jin, Xin. Information abstracted from the interview with Xin Jin, 2018

Bitcoin mining power = computation power

Using personal computer's CPU to mine bitcoin died some ten years ago, if not earlier. Since that, technologists have never given up on developing machine generating computer power to be used exclusively for bitcoin mining. That said, these devices can do nothing else except mining bitcoin, nor can they be converted to other types of machines which can be applied to other functions.

Today, this kind of mining machine has already been updated to its 17th version, from FPGA (Field Programmable Gate Arrays) to ASIC (Application-Specific Integrated Circuit), with the computation power of a single unit boomed 10 thousand times:

2012 Butterfly Lab began to raise funding for developing ASIC miners;

2013 Avalon released the first ASIC miner;

2014 Bitmain announced its 2nd version of ASIC miner;

2015 Avalon invented its 6th version of ASIC miner;

2016 Bitmain launched its 7th version of ASIC miner;

2017 EBIT developed miner E10 using 10nm chip;

2019 Bitmain released the 17th version of ASIC miner using 7nm chip¹⁵

[15] Jing Data, Node Capital. "The evolution of the miners," March 18, 2019. <https://www.huoxing24.com/>.

By rehearsing the history of the mining machine's development, I propose that:

Computation power = mining device technology

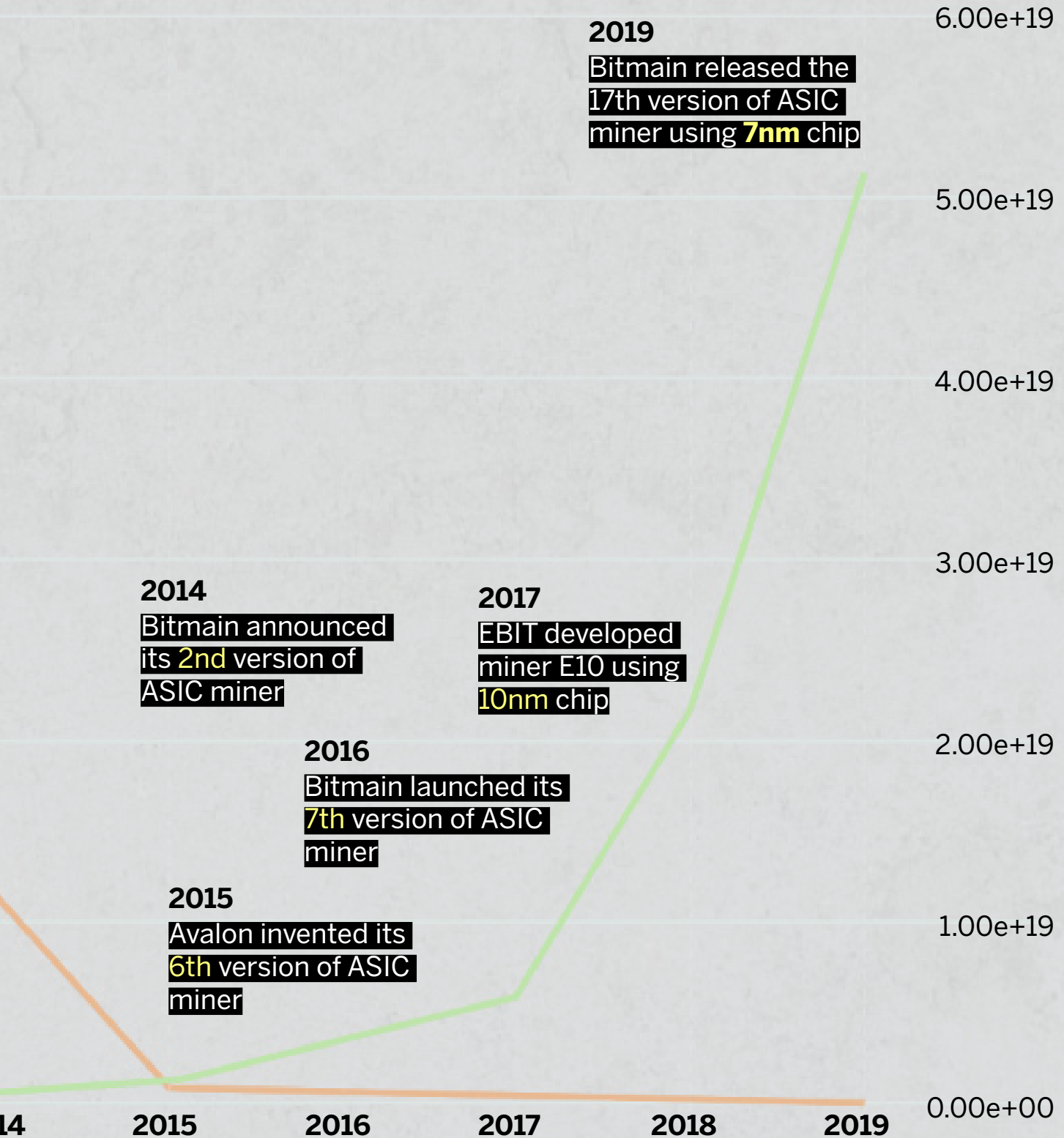
However, the technology of developing as well as manufacturing these machines are not distributed.

Left
Machine efficiency
Hashrate/electricity



by Jing Data

Right
Network Hashrate



Let's take a deeper look into this mining device technology and figure out the geopolitics embedded within it. To simplify, the ASIC can be regarded as the combination of raw material and assembling technology.

***Mining device technology =
raw material + assembling technology***

When I am talking about the raw materials of the mining device, I am referring to the integrated chips in these miners, which actually run the mining algorithm. In fact, only particular countries (e.g. the US, Japan, and the Netherlands) can produce the required mining chips for the machine manufacturing. From the earliest stage when the chips were measured at the 130nm level, there were multiple global players in this arena who were able to make these chips. Nevertheless, when the chips evolved to 55nm and 40nm, the players decreased drastically to certain companies such as IBM (the US), Intel (the US) and TSMC (Taiwan). Although the technologies of developing advanced chips are controlled by these oligarchies, the centralized tendency here does not appear extremely apparent. Competition still exists among these different players. Hence, downstream manufacturers and buyers can still preserve their negotiation rights when deciding which producer to collaborate with¹⁶.

[16] Jin, Xin. Information abstracted from the interview with Xin Jin, 2018

However, when it comes to the assembling process, only China owns the technology of assembling and developing mature ASIC miners, due to its earlier fundamental exploration of the integrated circuit design, as well as the complete supply chain provided in Pearl River Delta Region. In this way, because

[17] Jing Data, Node Capital. "The evolution of the miners," March 18, 2019. <https://www.huoxing24.com/>.

of the technology hegemony, China becomes the mining machine manufacture oligarchy globally. According to the estimation by Jingdata, until February 2018, Bitmain, the largest ASIC mining machine manufacturer in China, has already claimed more than 70 percent of the market in the mining industrial¹⁷. Here, the geopolitics refers to the power of specific machine manufacture oligarchies as China in bitcoinization.

[18] Prieur Leary. Information abstracted from the interview with Prieur Leary, 2019

Not surprisingly, if the power of making these mining devices is extremely concentrated, it will not bring us to a new era of decentralization, but instead, a more monopolized one. The experience of Prieur Leary, a miner who used to purchase these machines from Bitmain, validates this hypothesis. There was a time that Bitmain individually raised the price of the newly released mining machines without telling the buyers¹⁸. Nevertheless, the buyers like Leary could not find anywhere else to purchase these machines rather than accepting this uninformed trade, since these devices were only available from Bitmain. Imagine that everyone was equally empowered by their personal computer at 2009. The fact is that with the bitcoin mining technology's development, this tool lost the capacity to bring more public goods for general people, but gradually became the medium for oligarchies to hoard wealth. The faster the mining technology is accelerated, the more polarized the wealth is distributed.

Mining device technology hegemony = machine manufacture oligarchies ≠ decentralization

[19] Carla Tardi. "Moore's Law," April 22, 2019. <https://www.investopedia.com/terms/m/mooreslaw.asp>.

However, when discussing the technology of the bitcoinization, one thing to keep in mind is that although the early growth of the hardware's mining speed and capability fits Moore's Law, which means that this technology is expanding steadily and rapidly over time¹⁹. The current status of the mining chips is that there's an absolute technology barrier to the increase of



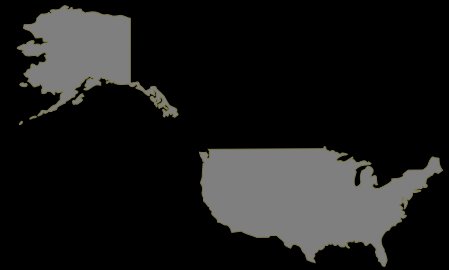
Diagram of machine, its components and origin places

Battery



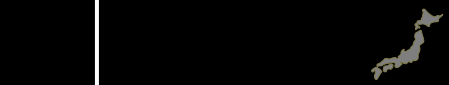
Shenzhen

Application Specific
Integrated Circuits



US

(55nm to 40nm)



Japan (130 nm)

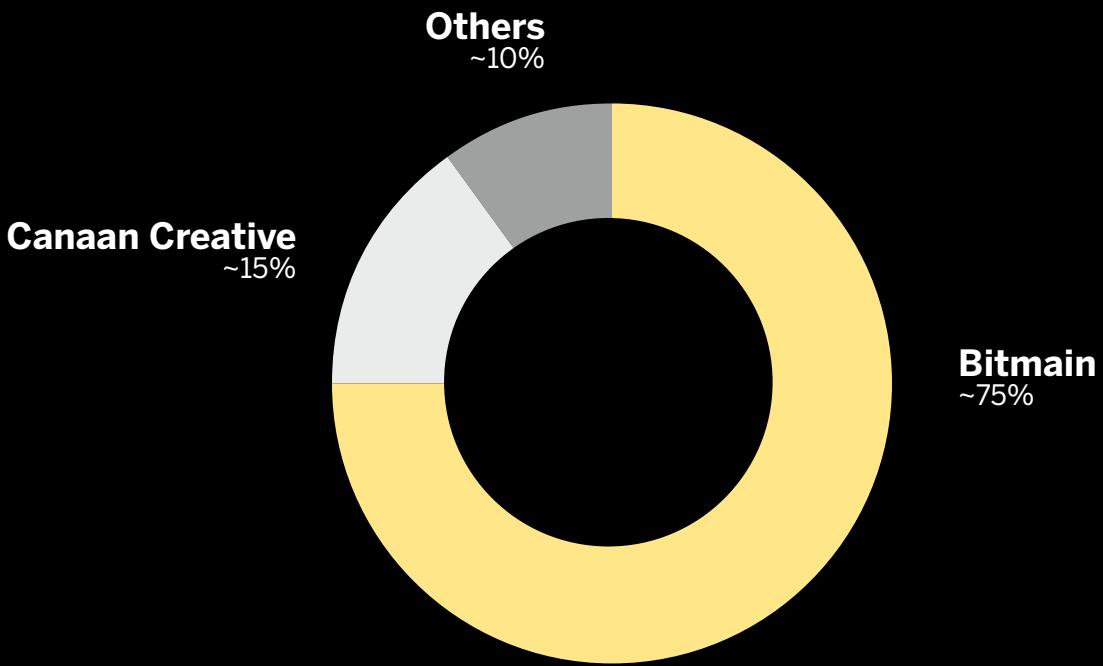


Netherland
(130 nm)

Hardware
Accessories
Assemblage



Pearl River Delta Region



Bitmain's market share
by Bloomberg

[20] Odaily, "The miner's technological threshold is higher than its capital threshold," April 22, 2019. http://www.sohu.com/a/305498673_104421.

the computational speed regarding the physical requirements of the technology implementation. For example, as mentioned by the chip designer Yang from Bitmain, when the accuracy of the integrated circuits reaches 7nm, which is exactly the parameter of the current most updated mining device- Antminer S17 released by Bitmain in April 2019-the quantum effect (which resists the increase of the chip's accuracy) caused by approaching the chip's physical limitation becomes more obvious. Based on this effect, the development pace gets slower while the cost for achieving 5nm accuracy becomes exponential. An ultimate plateau can be clearly observed with other minute intermittent plateaus when we are investigating the growth of efficiency of these mining devices. Finally, this reminds us of the limitation in terms of how the computational power is going to influence geopolitics²⁰.

A diagram consisting of three circles and an arrow. The circles are arranged in a roughly triangular pattern. The bottom-left circle is yellow and contains the text 'Bitcoin geopolitics'. The top-right circle is light green and contains the text 'Computational accelerating'. The middle circle is light grey with a dashed border and contains the text 'Algorithm modeling'. A grey arrow points from the top-right circle towards the middle circle. The background features several large, thin, grey curved lines that sweep across the page.

***Bitcoin
geopolitics***

**Algorithm
modeling**

**Computational
accelerating**

4 GLOBAL POSITIONING

Extractions between cities and suburbs

**Global
positioning**

Humans

GLOBAL POSITIONING

Extractions between cities and suburbs

4

Investigating the algorithm modeling and computational accelerating makes us understand the (limited) bitcoin geopolitics that is embedded within. In this chapter, I shift my focus to a broader geopolitical scope - the global positioning, in order to analyze the spatial consequences and typologies, as well as their related ideologies led by bitcoin mining activities, as part of the urban implication during bitcoinization, which has been barely addressed.

At the very beginning of mining, the strategy of mining individually was able to generate enough wealth for earlier miners due to limited miner number on the network. Participants before 2012 could get all the reward if they were fortunate to guess the correct answer to the computational question attached to the new block. However, after the specialized ASIC miners were invented, the network hash power has exponentially rocketed. The propensity of successfully mining new bitcoin by individual miners becomes less. These miners are no longer competitive. Based on this context, the concept of mining pool increasingly receives popularity among individual miners parallel to the development of the mining device. Players collect computation powers into the mining pool

together, in order to pursue a more stable mining revenue. By gathering the computation powers, the probability of successfully mining a block highly increases.

When returning to the physical space, mining pools become farms-the fundamental global production infrastructure in the bitcoin world. These mining infrastructures usually contain millions of the mining machines. The farm owners used to import tons of devices from Hong Kong, place them on the custom-designed shelves, and operate them 24/7. But how to make this happen? **My exploration reveals that the operation of a mining farm requires specific geospatial conditions.** Let us hover over the earth and figure out where these mining farms posit, why they locate in these places, and what geopolitics they represent instead of solely decentralized rhetoric.

First, the infrastructure should be able to continuously provide electricity supply to these mining facilities. According to a rough estimation performed by Narayanan, a computer scientist from Princeton University, these mining facilities obtain approximately 5 gigawatts for bitcoin mining today, which is slightly under 1% of world electricity consumption²⁰. Hence, the accessibility to a substantial electricity supply becomes the prior consideration that influences the positioning of operating a mining farm. However, it makes no sense if a mining farm owner is asked to pay more for the electricity than the reward he/she can earn through bitcoin mining, even if the farm can extract endless electricity power. Otherwise, the mining itself will no longer be considered as a profitable activity. Therefore, we have to add a price dimension to the electricity to ask how much it costs.

[20] Arvind Narayanan, "Written Testimony of Arvind Narayanan, United States Senate, Committee on Energy and Natural Resources Hearing on Energy Efficiency of Blockchain and Similar Technologies" August 21, 2018. https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=8A1CECD1-157C-45D4-A1AB-B894E913737D.

[21] Jordan Tuwiner, "Bitcoin Mining in China," January 28, 2019. <https://www.buybitcoinworldwide.com/mining/china/>.

[22] Jocelyn, "Miner normal operating temperature range," May 29, 2018. <https://support.bitmain.com/hc/en-us/articles/360005088914-Miner-normal-operating-temperature-range>.

Based on the data provided by IEA and EIA, India, China, Mexico, Canada, and South Africa are the five countries with the lowest national electricity prices in 2011. Mapping the countries with the low electricity cost will provide us the first layer of our bitcoin global positioning atlas ²¹.

Second, the temperature of the miners appears to be another physical barrier. Based on the data provided by Antminer, the temperatures can reach to about 150 Celsius during operation ²². Therefore, a constant cooling system that can extract the heat from the machines become necessary. It is why engineers put a large fan around the machine. However, this is far from enough if one is running millions of these devices simultaneously. Therefore, being able to build a mega cooling infrastructure is also essential which allows the mining pool to come into reality. Whereas, just as what we have discussed for the electricity component, the cost of building such a cooling system also needs to be considered when making positioning decisions. Imagine constructing a mining farm in Venezuela (although it has cheap electricity supply), the majority part of the fixed cost needs to be spent on ventilation. Therefore, a natural cooling system always becomes the priority—it is totally free—all the farm owners need to do is to sit the farm in a cold-climate territory. Based on this positioning preference, we are able to add the second layer to our preliminary mapping.

Additionally, to find a place that can hold these devices becomes another physical parameter. The places which are less urbanized (e.g. the ghost cities, deserts, forests or other greenfields) become mining farms' preferences. It is because businessmen can not only get abundant land to build their mining farm

[23] Luping Zhou, "The Ordos city-from coal to bitcoin, it can't get rid of the destiny of being excavated and harvested," October 06, 2017. <https://www.gelonghui.com/p/148038>.

[24] The information center of Shanghai factory building, March 18, 2019. <http://www.changfang.net/>.

[25] Prieur Leary. Information abstracted from the interview with Prieur Leary, 2019

[26] Allison Lampert, "Canada's Quebec halts crypto mining projects, may raise fees," June 07, 2018. <https://ca.reuters.com/article/technologyNews/idCAKCN1J31Q5-OCATC>.

[27] Prieur Leary. Information abstracted from the interview with Prieur Leary, 2019

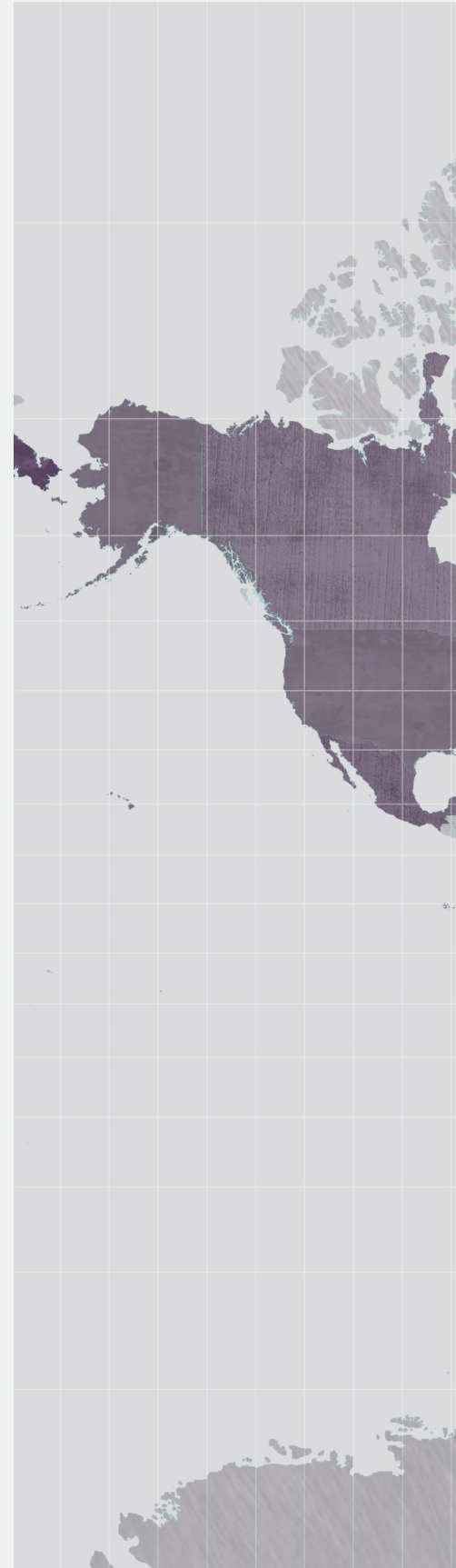
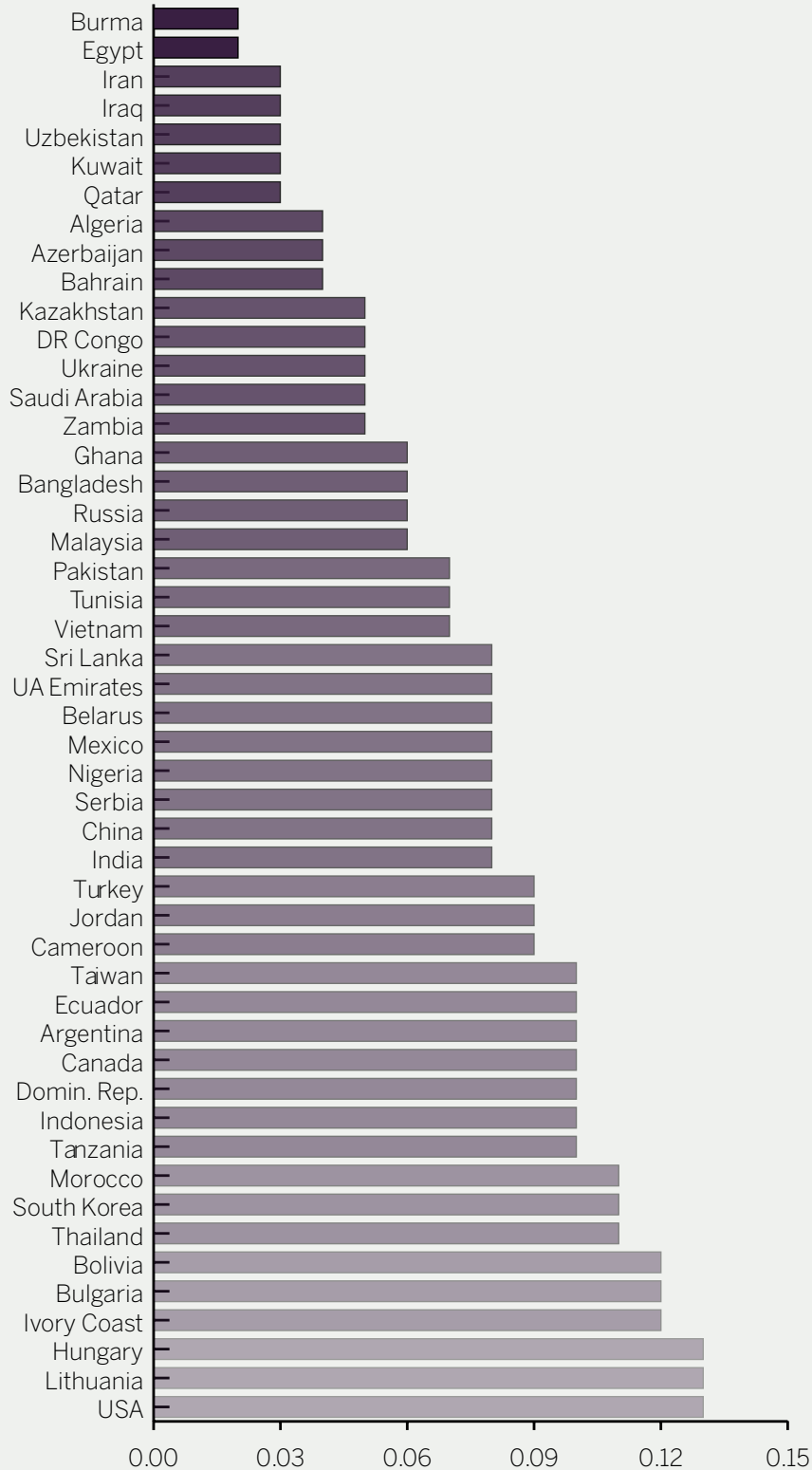
in these positions but with extremely low rent. For example, in 2014, Bitmain built their mining factory in an industrial park-Sanshangliang located in the suburb of the Ordos city, paying local government around 5 million rent annually for an area of around 10 thousand square meters²³. Instead, people have to pay more than 7 times of the rent if they want to build the facilities with the same scale in Shanghai, the eastern part of China, although the industrial parks own more convenient transportation system and better service support²⁴. To map the places with low rent overlaps our mapping with a third layer.

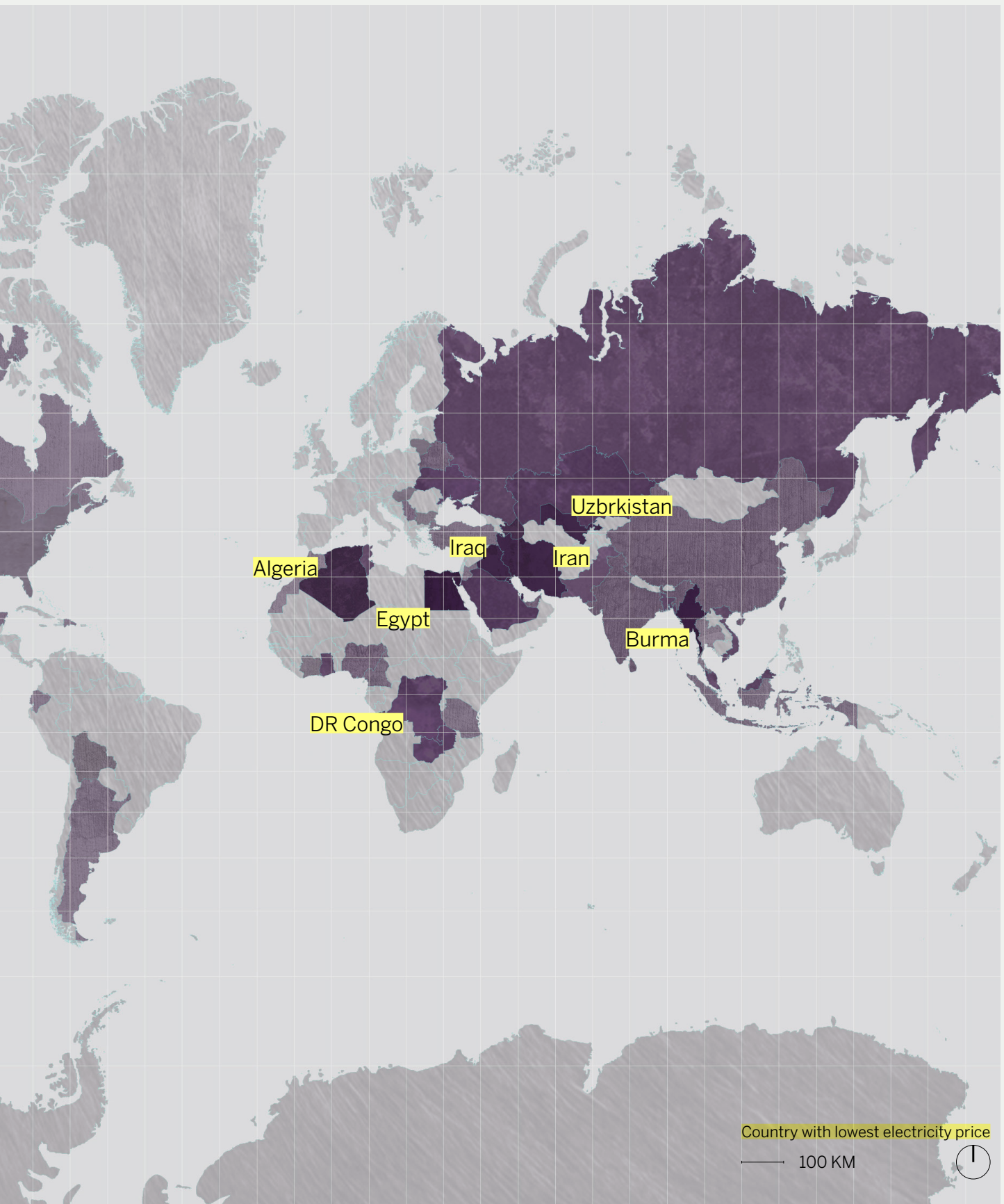
Meanwhile, the low rent is usually packed with local government's stable political support. For example, according to Leary who runs a mining farm in Upstate New York, the Massena local government offers a 20-year land lease for him to operate the business locally, with a written stable rent²⁵. On the contrary, Quebec City recently launches policies that halt cryptocurrency mining and indicate the possibility of raising fees for this business, due to the consideration of energy consumption. New projects then become impossible to enter these mining-unfriendly places²⁶. Moreover, although developing countries as Iran has both ideal low electricity price as well as rent for bitcoin mining, the substantial political riots make it difficult for mining farm owners to operate locally, without worrying about whether the farm might be destroyed in the future due to the potential capital it might bring. "I don't want soldiers with AK47 to surround my farm", said Leary²⁷. Therefore, the solid financial offer, a supportive attitude as well as a stable political environment become huge incentives for these mining industries to operate in these geolocations.

Electricity Price

U.S. Dollar/kWh

Resource: Global Petrol Prices, 2018





High Latitudes Territories

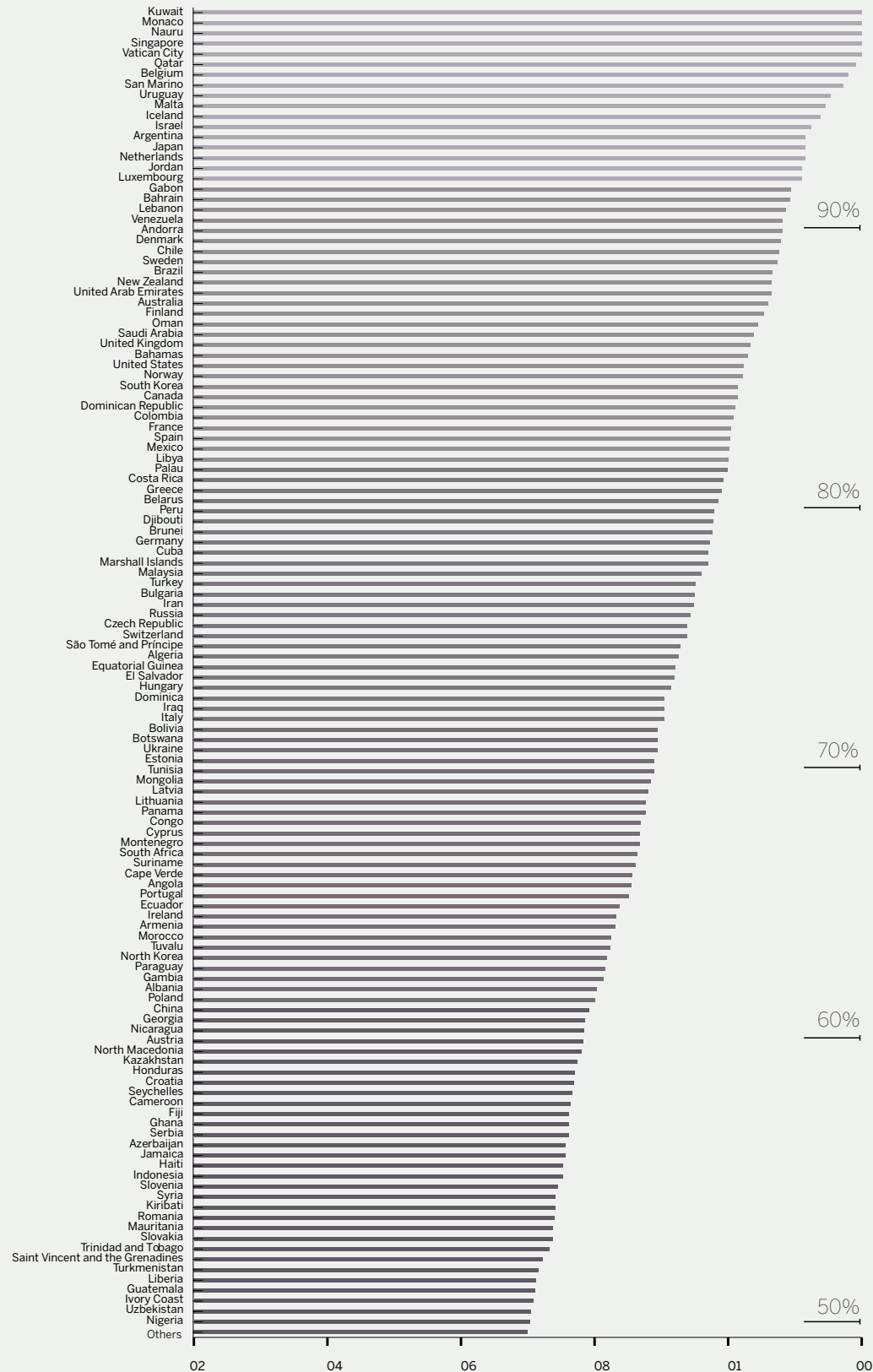
* using 60th parallel north as the boundary





Urbanization by country

Resource: Central Intelligence Agency, 2018





Legality of bitcoin by territory

Resource: BitLegal, 2014

Permissive legal to use bitcoin

USA	Belarus
Canada	Ukraine
Mexico	Turkey
South Africa	Iran
Brazil	Japan
Argentina	South Korea
Colombia	Indonesia
French Guiana	Philippines
European Union	Malaysia
United Kingdom	Australia
Bulgaria	New Zealand

Contentious some legal restrictions on usage of bitcoin

China
India
Vietnam
Thailand
Syria

Contentious interpretation of old laws but bitcoin is not prohibited directly

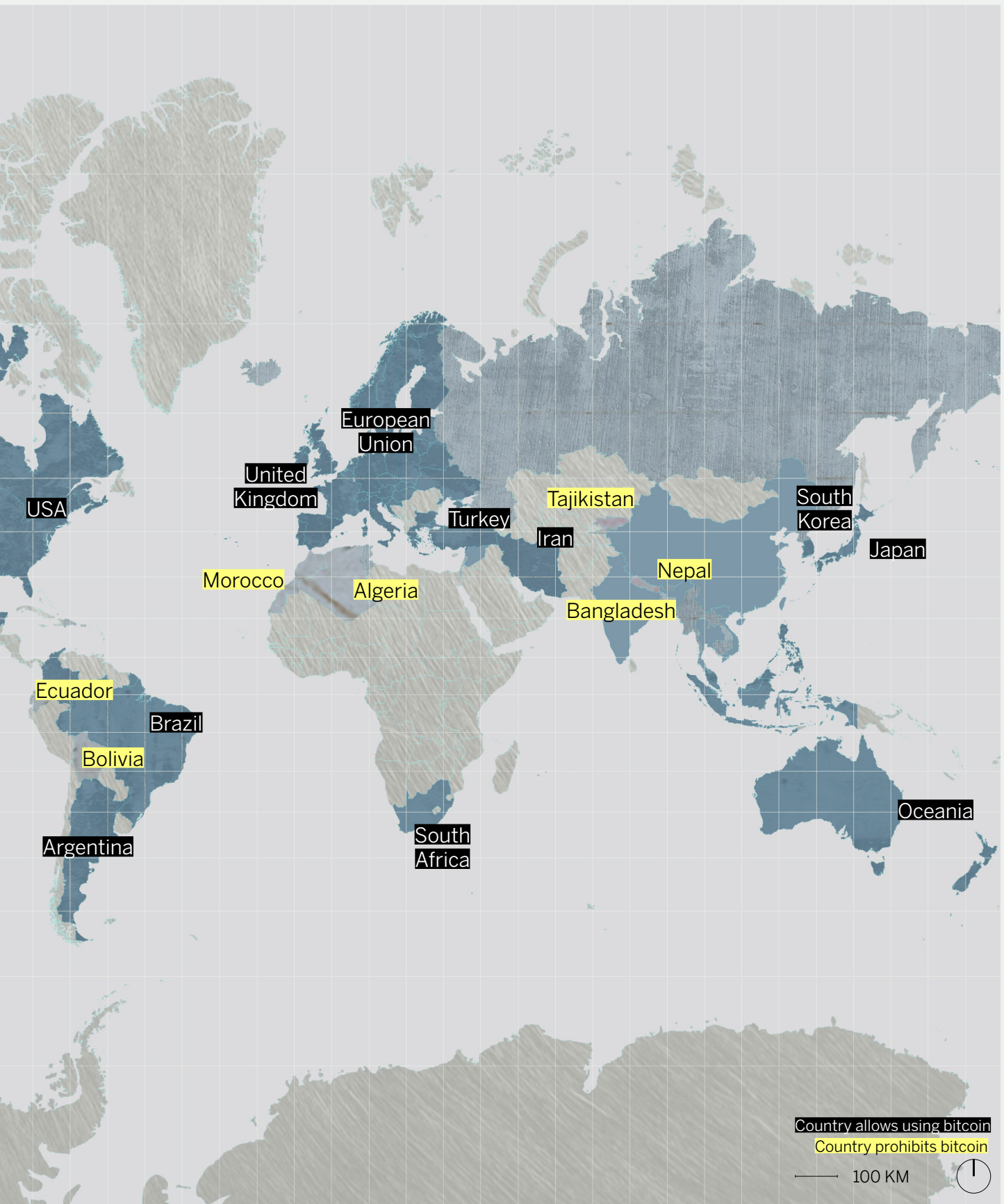
Russia
Tunisia
Iceland

Hostile full or partial prohibition

Ecuador
Bolivia
Morocco
Algeria
Bangladesh
Nepal
Tajikistan
Dominican Republic

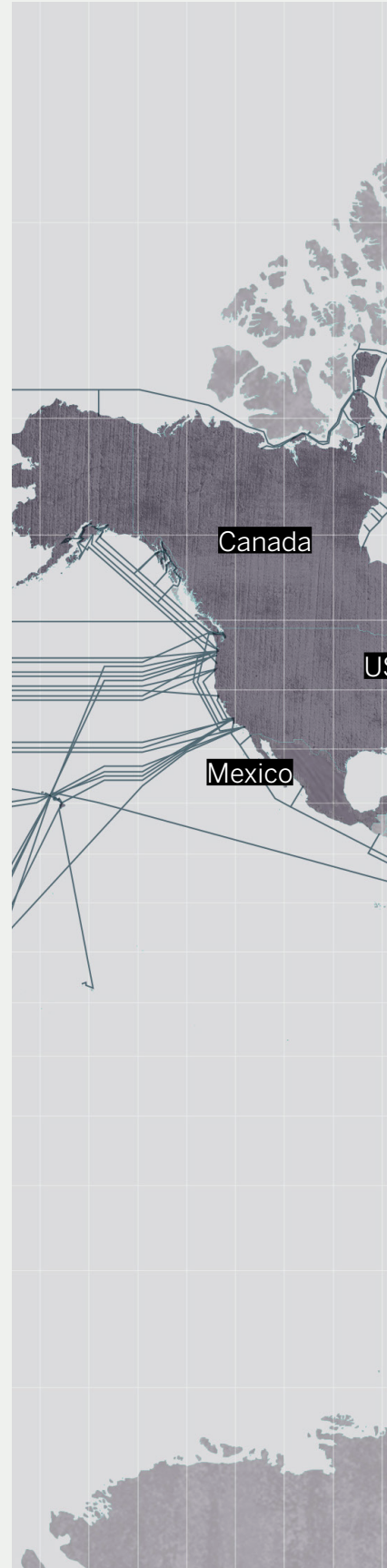
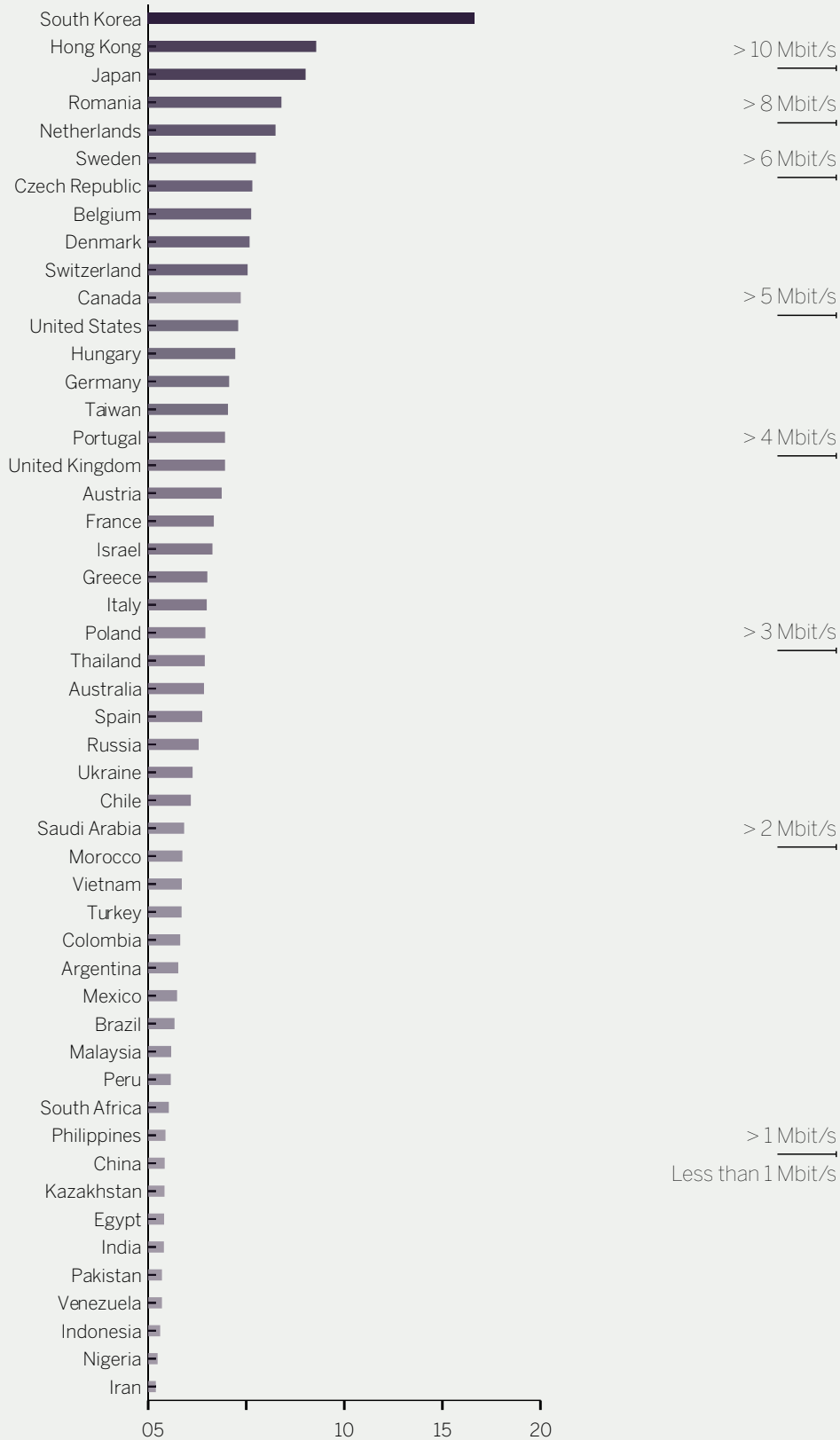
Unknown

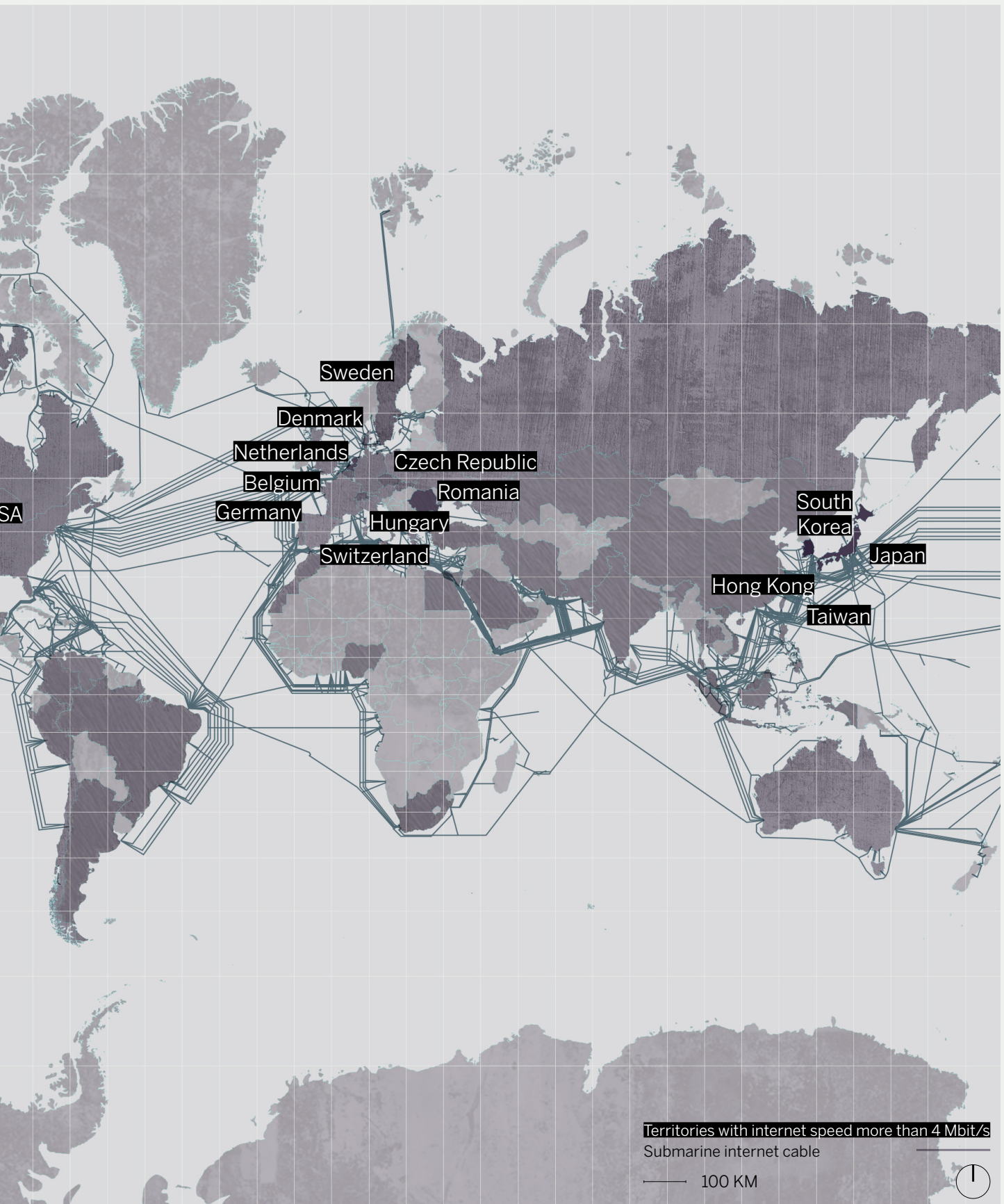




Global Internet Speed

Akamai, 2010





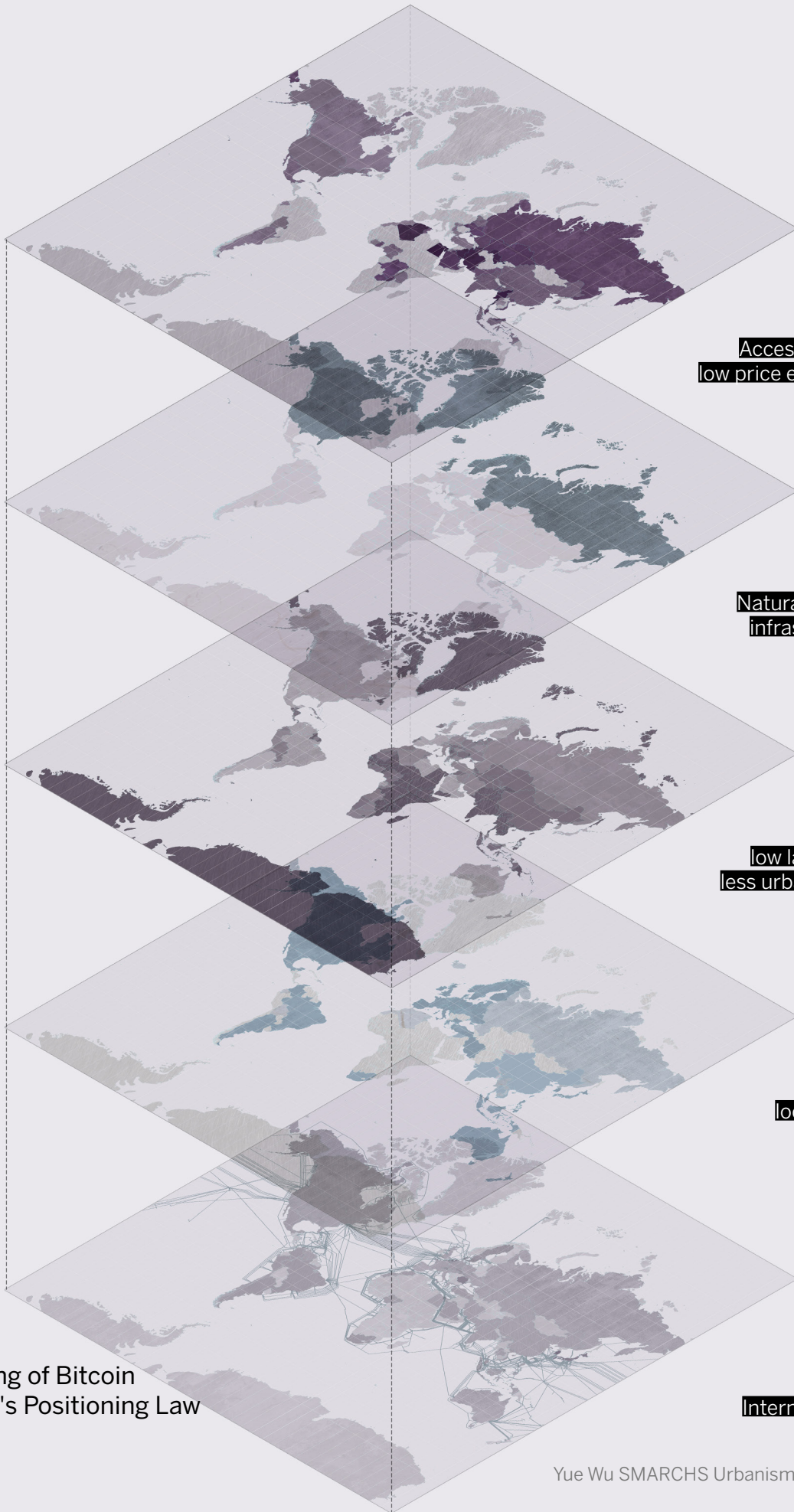
Last but not least, we need to understand that bitcoin mining cannot be done merely by offline. Instead, each individual mining unit needs to be connected with the whole network in order to run the mining algorithm, which is required by the public verification. Therefore, although the mining is the process of generating random numbers, which embeds uncertainty, the high speed of internet will inarguably increase the propensity of successfully mining a block. Mining thus becomes a dependent of the internet speed. The uneven global internet speed distribution then influences the geopolitics of bitcoinization in a way that is not decentralized. Having the most oil storage was once an indicator of great national power and wealth; it is now the fastest internet speed.

To sum, I am now proposing bitcoin mining's positioning law:

***Global positioning =
accessibility to low price electricity +
natural cooling infrastructure +
low land price +
local policy support +
internet speed
= natural resources***

Although not all the positions hold mining factories follow this law absolutely by satisfying all the four parameters simultaneously (for example, we can see that the mining factories located in Ordos are not borrowing the natural cooling, instead building their own water cooling system, however, with a low technology and expense), the intention of applying this law is always to minimize the expenses related to positioning. On the one hand, mining industries use

[28] Merrifield, A.
"Metromarxism: A
Marxist Tale of the City,
London: Routledge."
2003.



Accessibility to
low price electricity

Natural cooling
infrastructure

low land price
less urbanization

local policy
support

Internet speed

Mapping of Bitcoin Mining's Positioning Law





Mapping of Bitcoin Mining Farms and their Forces, Bitcoin Exchange Guide News Team, 2018





Mapping of Bitcoin
Mining Pool's Global
Distribution

Mapping the Mining Farms' Growth with the Market Price Change of Bitcoin

10k

5k

Bitcoin was launched first in 2009.

Till 2012, all the existing mining pool counted 50% computation power on the internet, indicating that the age PC mining terminated

2013
the
de
me

2009 Nov 2009 Jan 2009 Jul 2010 Jan 2010 Jul 2011 Jan 2011 Jul 2012 Jan 2012 Jul 2013 Jan 2013 Jul



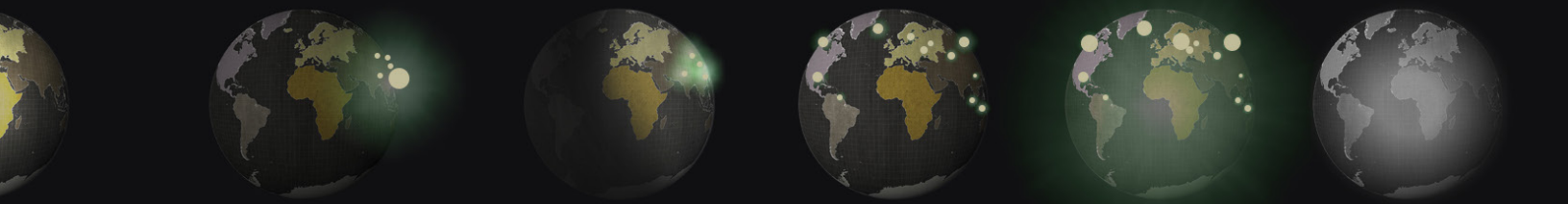
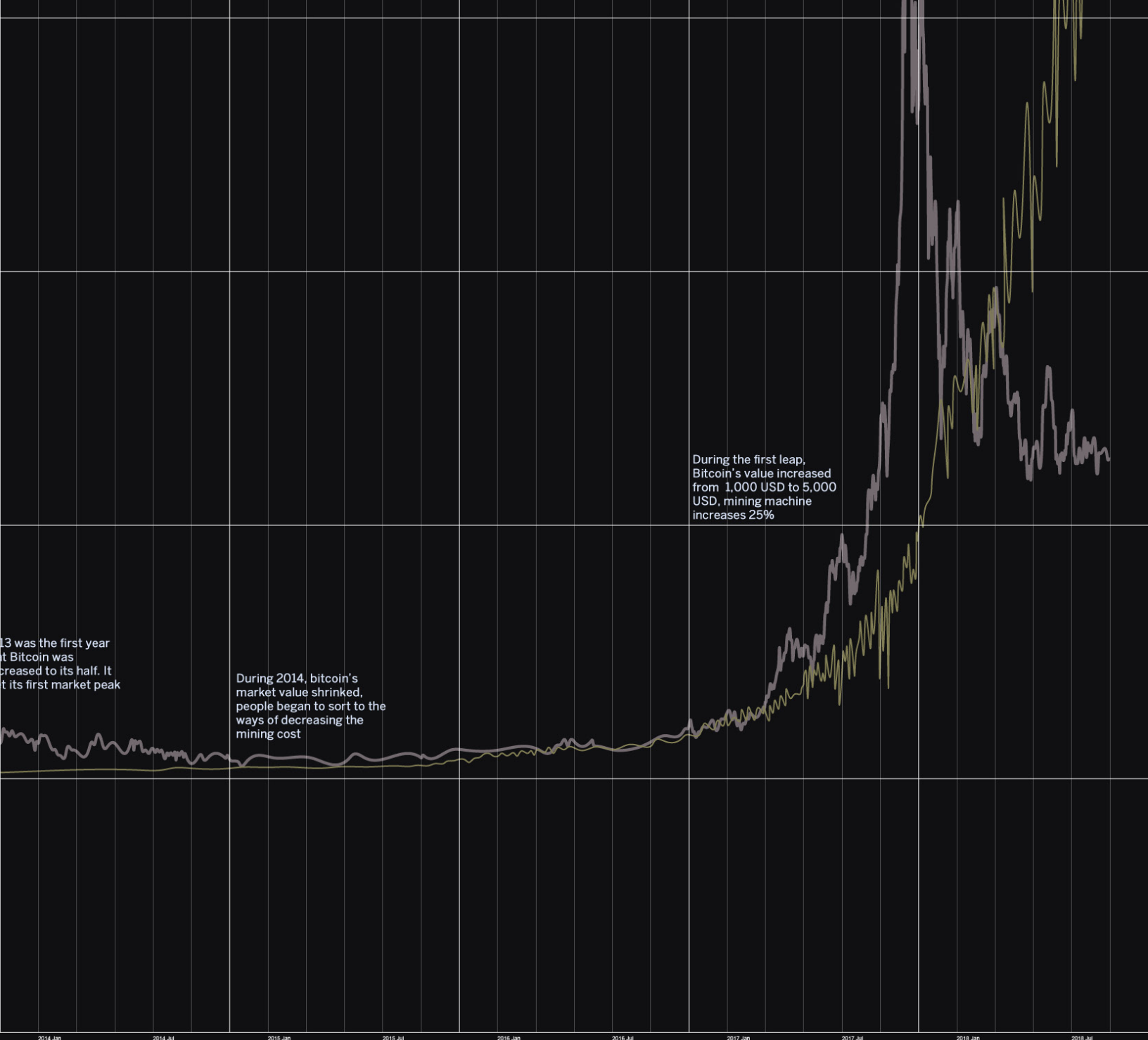
Launched in 2009, the difficulty of generating every single Bitcoin block was designed to increase automatically after creating every 2016 new blocks



First mining pool - Eligius was introduced on port 3334 by May, 2011. Till 2012, all the existing mining pool counted 50% computation power on the internet, indicating that the age PC mining terminated



Bitcoin's market price skyrocketed from 2012 to 2013, reaching 900 USD on 2013 - the company's mining machine established



Bitcoin's value first rose from 120 USD to 1,150 USD in 2013. Bitmain specialized in mining, and its production was 1.2 million units.

ASIC chip 1.0 was invented for Bitcoin mining since 2014. The first miners got the mining machines in Shenzhen, and brought them back to hometown for mining due to the cheap electricity.

When stealing electricity was strictly prohibited, the miners moved to places near hydropower stations. During winter, they migrated to hinterland. This process reversed when spring came.

Due to the official government of ICO in 2017, Bitcoin mining companies build mining factories/farms in Singapore, Switzerland, Texas, Canada, Iceland, Russia, Kyrgyzstan, Belarus, Iran, Malaysia, etc.

Bitcoin's market value grew 500% from Sep 2017 to Dec 2017. The computation power across the internet keeps increasing, which means it becomes even harder to generate a unit Bitcoin.

Since January 2018, the computation power across the internet keeps increasing, which means it becomes even harder to generate a unit Bitcoin block. Bitcoin market meets the winter.

[29] Accenture LLP, A. "Digital Density Index: Guiding digital transformation D." May 20, 2019. https://www.accenture.com/t20150523T023959__w_/it-it/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_13/Accenture-Digital-Density-Index-Guiding-Digital-Transformation.pdf

[30] Bitcoinist. "Norway partners with Bitfury for Bitcoin mining." <https://bitcoinist.com/norway-partners-bitfury-bitcoin-mining/>

[31] Cinerama. "New York State Prepares to Welcome Bitcoin Miners With Cheaper Electricity Rates." July 14, 2018. <https://www.bitcoinisle.com/2018/07/14/new-york-state-prepares-to-welcome-bitcoin-miners-with-cheaper-electricity-rates/>

[32] Thomson Reuters, "Chinese bitcoin miners eye sites in Quebec, Manitoba," Jan 12, 2018. <https://www.cbc.ca/news/business/china-cryptocurrency-quebec-manitoba-mining-1.4484307>

this law to maximize their profit by choosing the right place to sit. On the other hand, dynamic places also use this law to maximize their abilities to fix the capital generated by mining farms²⁸. The past political power is used to be measured by the area of territories and the storage of historical natural resources, by the numbers of missiles and submarines, and by the production of iron and silicon chips. Today, following the positioning law, we see a new measurement called bitcoin mining. Similar to the concept of Digital Density proposed by Accenture, governments and business leaders can now measure and manage the cryptocurrency strategies in order to more effectively compete with each other²⁹. Norwegian territory is delighted to welcome new bitcoin mining datacenter by Bitfury, by proposing a fairly liberal tax policy³⁰. New York State launched new regulations for miners to be able to negotiate a more favorable price for them to utilize the abundance of low-cost electricity. These new regulations are believed to attract customers and to encourage economic development in the region³¹. Hydro Quebec claimed it as a place for "green bitcoin" and even launched a campaign by the public utility to attract bitcoin data centers which they see will trigger local interest³².

"I am delighted that the Bitfury Group has chosen to establish their new data center in Norway and Mo i Rana. Data will become an increasingly important resource for the business community as well as for society in general. This represents a major economic opportunity for Norwegian businesses. The data center industry is growing fast, and provides Norway with opportunities of economic

[33] Bitcoinist.
"Norway partners with
Bitfury for Bitcoin
mining." [https://
bitcoinist.com/norway-
partners-bitfury-
bitcoin-mining/](https://bitcoinist.com/norway-partners-bitfury-bitcoin-mining/)

*growth and new jobs."*³³

If we consider algorithm modeling and computational accelerating as limited influential components in bitcoin geopolitics, the old geopolitics of military and resources now begin to shift since we start to talk about the component of global positioning - bitcoin mining's real spatiality. All local governments, businessmen are playing and competing with this component.

A diagram featuring three circles of varying colors and styles. A yellow circle at the bottom left contains the text 'Bitcoin geopolitics'. A dashed black circle in the middle right contains 'Algorithm modeling'. A solid light green circle at the top right contains 'Computational accelerating'. A curved arrow points from the dashed circle towards the green circle. The background is light gray with several large, thin, curved lines.

***Bitcoin
geopolitics***

**Algorithm
modeling**

**Computational
accelerating**

5

HUMAN SCALING

A cyborg manifesto

Global
positioning

Humans

HUMAN SCALING

A cyborg manifesto

5

As we discussed previously, the algorithm modeling, computational accelerating, and global positioning define bitcoin's own geopolitics. However, to be fully civilianized, algorithm modeling + computational accelerating + global positioning need human scaling, which allows us to further understand the human's position in the cryptocurrency industry. In this chapter, I am going to show that bitcoin is unable to retrieve human from the current centralized financial system and to create more even access to global financial resources. It leads to a direction where mining is keeping increasingly easier for users but more obsoleted for workers. It finally creates a new concentration in human mining power.

Nowadays, with the continuous development of the online mining pool, individual miners are no longer able to compete with it. Therefore, almost all the miners choose to become subsidiaries of the big-scale cooperation, which provides centralized data management service. Today, most of the mining can be done remotely, with no need for users to physically manipulate the mining algorithm and devices. The users can simply purchase the mining rigs or assembled mining machines, ask the mining farm owners to place them in their farms, and hire specific workers to operate them. In Huaqiangbei,

the exchange center of bitcoin mining equipment, we can see advertisements indicating that the stores which sell these instruments also offer depository service for these devices. The buyers can easily select their preferred machines and ask manufacturers to deliver them to the target mining farms, without physically interacting with them. Moreover, big mining farms even launch a service that allows participants and investors to rent computational power. Mining farm platform as Miningrigrentals (MMR) lists more than ten benefits for renting hash power from it. The platform claims that customers can maximize profits and minimize risks, due to the fully automatic configuration, the artificial intelligent adjustment algorithm, and the extremely user-friendly interface.

*Welcome to the faster, smarter, more powerful way to rent or lease cryptocurrency mining rigs. Whether you're new and want to try mining out before you buy equipment or you're a veteran looking for more hash at a coin launch, MiningRigRentals.com is your one-stop website. Our service has been developed from the ground up by miners for the mining community. Choose an algorithm to get started!*³⁴

[34] Miningrigrentals, "Miningrigrentals" May 10, 2019. <https://www.miningrigrentals.com/>

Mining at this age soon becomes a jargon that only the farm operators and senior players understand – we even don't need to know what it exactly means. All we are concerned is the number that keeps increasing in your bitcoin wallet mobile application, indicating what these mega mining infrastructures have done for us. We constantly wish that the number will eventually exceed what we have paid for renting the hash power.

Finally, we become increasingly lazier, less sensitive about what happens around us – we become the cyborg that only cares about these binary numbers since we already give our mining right to the mining pool owners. In reality, these centralized mining pools also overlap with their geo-positions. The easier the users are mining, the less powerful they become.

Lim (human presence) -> 0

When powerless miners completely return to the virtual world, what happens with the workers in these mining facilities? These humans who are exactly providing these services apart from the investors display a completely different picture. It is in a video taken by a journalist Peng Liu from the Ordos that I find the bitcoin mining farm constantly spewed heat and noise in the background³⁵. Few workers were recorded patrolling among different shelves of the mining machines, holding the repair tools. These mining machines were operating 24 hours every day while huge fans were working for cooling these heat producers down. Exposed to the extraordinarily hot and noisy circumstance, the workers were still asked to inspect every machine as daily routines. Meanwhile, they found themselves extremely difficult leaving the factory, since the factory was located in the middle of nowhere. They worked together, ate together, and slept together. The only recreation facilities they had was a basketball court. The workers' accessibility to basic everyday-life infrastructure was apparently fragmented by the cryptocurrency. They were left as non-human components in the extreme physical conditions, being objectified as a dependency of the virtual mines in the video. According to a recruiting advertisement on Douban, the worker's monthly

[35] Liu, Peng. 2017. "The secret of how Chinese monopolize the Bitcoin mining", Tencent Lingjing, Sep 18, 2017.

[36] Douban, "Bitcoin Mining Farm Worker Recruiting", May 10, 2019. <https://www.douban.com/group/topic/105298911/>

[37] Chengdu Bureau of Statistics Internet, 2018.

[38] Graham, Stephen, and Simon Marvin. 2009. *Splintering urbanism: networked infrastructures, technological mobilities and the urban condition*. London: Routledge.

payment is around 570 USD in a mining farm near Chengdu ³⁶, while the average salary in Chengdu is approximately 770 USD by month ³⁷. Similar to the paradox that David Harvey observed - whilst the African American women cleaners who crossed the skywalk system were serving the world's famous hospitals of Baltimore, they were unable to access health services when they were ill because of lack of health insurance ³⁸ - today, these workers were continuously producing the virtual cryptocurrency whose actual unit market value is more than 4 thousand dollars, whilst being obsoleted from the normal urban life, they spent every moment doing probably the world's most boring and tedious job. The workers' diary describes it as a place that was deafening, extremely hot that could not tolerate, troublesome, hard, and designed for machines instead of humans. Unsurprisingly, these words take us back to the age of old-school mining, where the miners shared a squeezed dark space under the earth that defies their sense of being.

[39] Brian Ashcraft. "Inside a Bitcoin Mine in Rural China." May 22, 2019. <https://kotaku.com/inside-a-bitcoin-mine-in-rural-china-1624318708>

If we look into other similar mining farms, it is also not easy for us to find the exact trace of humans – the people's presence is minimized as well. For example, Coinmint's mining farm in Massena, NY recruits only 4 workers monitoring the operation of the devices, while the farm in Northeastern China owns only 3 workers looking after the machines in the 1000 square-meters space ³⁹. It seems like these workers are the people who are closest to these coin-minting machines. However, when the limited workers are looking after the mining facilities, they are actually not managing the mining-they have no political right dealing with it. These workers are not required to have degrees in engineering or specialty in electricity but simply the





Resource: Giulia Marchi

[40] Brian Ashcraft. "Inside a Bitcoin Mine in Rural China." May 22, 2019. <https://kotaku.com/inside-a-bitcoin-mine-in-rural-china-1624318708>

[41] Cox, Judy. 1998. An Introduction to Marx's Theory of Alienation. Issue 79 of International Socialism, Quarterly Journal of the Socialist Workers Party (Britain). Published July 1998.

[42] Haraway, Donna Jeanne (1991). "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century". *Simians, Cyborgs and Women: The Reinvention of Nature*. Routledge. ISBN 0415903866.

passionate in the mining field. All they are required is to walk around the farm all day long, holding a detector to figure which device is malfunctioning-they then replace the failure machine with a new one, and send the old one back to the manufacturers to fix it. Besides, they are also exposed to the environment above 40 Celsius with 90dB in this system⁴⁰, these workers are becoming increasingly dependent on the farm owners who own the means of the coin mining, as well as the manufacturers who own the means of production. In reality, they are both intellectually and physically depressed to the level of a machine, and from being a man becomes an abstract activity and a stomach. As Coinmint indicated, original the company hired 60 people during the time when bitcoin's market value is at its peak time. However, it dismissed the majority of the employees when bitcoin's price shrunk. In this way, the employees also become more dependent on every fluctuation in the market price, as well as in the investment of capital and on the whims of the wealthy. It becomes impossible for these workers to live independently of bitcoin. But to continue mining means to be reduced to a human machine⁴¹. At the end of the day, bitcoin still doesn't enable the workers to own their own wealth. However, their bodies are growingly adapted to the extreme built environment, making their natural organisms similar to technical machines. The ambiguity of the human body and machines increases, and it becomes a cyborg, too⁴².

Human = machine

Here, I am proposing human law in bitcoinization. Even if human interaction is eased along with the development of mining, this is not equal to the mining

with more humane. Instead, the mining oligarchies still control the distribution of bitcoin, while the large-scale centralized management of mining pool keeps intensifying the geopolitical power. Bitcoin is then, indeed unable to retrieve human from the current centralized financial system, and to create more equal access for everyone to global financial resources. Finally, we arrive at the equation of bitcoin geopolitics:

Bitcoin geopolitics =
1. algorithm modeling +
2. computational accelerating +
3. global positioning +
4. human scaling

November 26th
2018
Cheng

Two weeks ago, I suddenly received a friend invitation on my WeChat, which was from a Bitcoin mining group on my WeChat. I did not think much but approved it since the person was usually active in the group. The most popular things in his moments were the pictures of various mining machines and mining farms, as well as information on mining machine renting and second-hand mining machine sales.

Cheng is a native of Hangzhou with big eyes, using self-portrait as WeChat avatar. After a short conversation, he began the topic of mining, which was obviously his most interest. He graduated from 2016, and entered a mining chip design company through campus recruitment, working as a seller in the marketing department. In the first month, he learnt the mining machines and mining farms by asking colleagues and searching online, becoming interested in them. He kept updating and sharing the parameters of different machines' parameters, price and supply situation with colleagues every day.

After working for a month in the company, the marketing department had a quota for on-site training in a mining farm. Cheng did not hesitate to sign up, and the result was announced a week later- he won this opportunity.

After two-hour flight and five-hour driving, he finally arrived in a small town on the edge of Shangri-La, Yunnan, tired and dizzy. "I split twice on the road." Cheng sent a Face with Tears of Joy to me.

"It was an occluded place. The mining farm was built next to a hydropower station. The electricity for the mining farm was directly from the power station. The roaring water was deafening. There were three factories on a small terrace. The walls of the factories were rusty. The space from factory to factory was less than 5 meters. There were almost two thousand mining machines in the mining farm, most of which were Avalon Bitcoin mining machines." He saw five workers in the mining farm, all of whom were darker than Cheng. They always rolled their dirty trousers up, with cigarettes between their lips.

The daily work of Cheng was to assemble and connect the mining machines. "The condition of the mining farm was actually bad. The wires and network cables densely twined around the shelves, on which the mining machines were displayed in rows. In order to maximize the use of the space of the mining, the gaps between the mining machines were squeezed. It was very troublesome to install the machines and wires – the gaps only allow one arm to do the assembly." A few days later, Cheng followed a worker to learn the initialization, testing and wiring of the mining machines.

"Compared with watching online operation tutorials, it was fulfilling working in the real mining farm." Cheng said, "Every day I was commuting between farm stay and the mining farm. My farm stay provided food - it was fried rice forever. It was not difficult to eat, but I really wouldn't eat it again in my life." In August, Shangri-La was extremely hot. With the heat generated by mining machines in the mining farm, the workers were sweaty.

"There was no way to avoid the heat. I would find a shade outside the factory and sat for a while it would be a little cooler - I really couldn't stand it." Cheng said, "There was only one moment with comfortable temperature during the day – the midnight." Cheng's training period finally ended after one month. "I believe that people who have worked in the mining farms must have similar experiences and feelings with me - although the work was hard and boring, it was valuable to me."⁴³

[43] 36Kr. "The Year When I was a Miner". March 20, 2019. <https://36kr.com/p/5112823>

**Bitcoin
geopolitics**

**Algorithm
modeling**

**Computational
accelerating**

6

BITCOIN GEOPOLITICS An evolutionary dynamic landscape



BITCOIN GEOPOLITICS

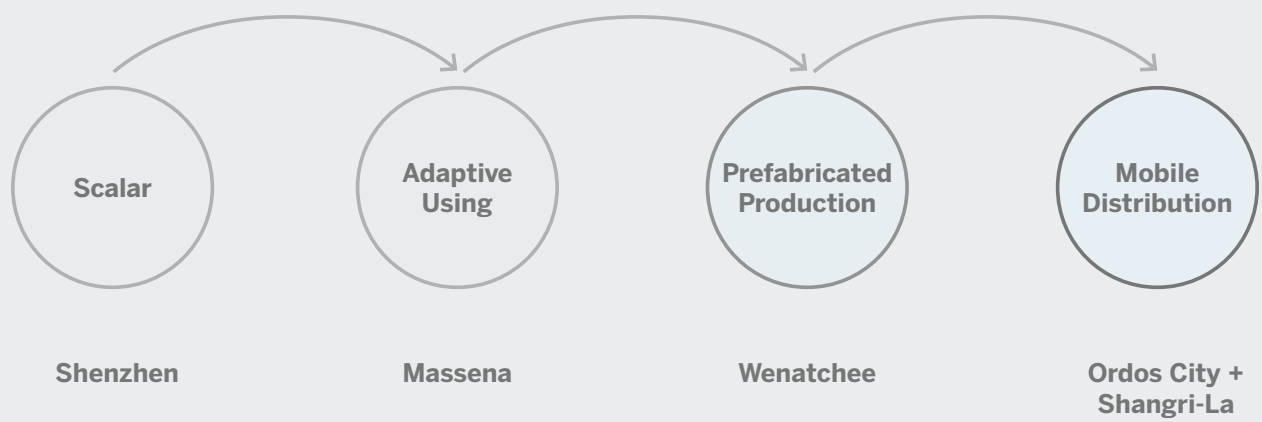
An evolutionary dynamic landscape

6

In this chapter, let us further play with the equation of bitcoin geopolitics to verify our hypothesis: bitcoin can neither lead to financial decentralization nor spatial decentralization by centralizing all the mining activities. These repurposed activities align with the current geopolitical power concentration and reflect current geopolitical relations and competitions. By exploring such equation, we understand that apart from the limited influence of the algorithm modeling and constant influence the computational accelerating, as well as the increasingly tiny influence of the human scaling, the bitcoin geopolitics is finally dominated by the global positioning at most.

***Bitcoin geopolitics =
1. algorithm modeling +
2. computational accelerating +
3. global positioning +
4. human scaling***

Hence, it is still inherently another format of resource extraction that retrospect to what mining itself originally means—an extraction of electricity power—which, in the end, a competition for electricity power among different territories. Now, I am going to exactly show these dynamic resource extraction landscapes by rehearsing the history of mining architecture prototype and studying the evolution across these



The evolutionary
landscape of bitcoin
mining

prototypes.

2013 Bitmain the mining oligarchy was first established;

2014 the traditional shopping mall SEG Mall converted into a centralized system that served global mining machine exchange; Shenzhen becomes the mining machine assembly center;

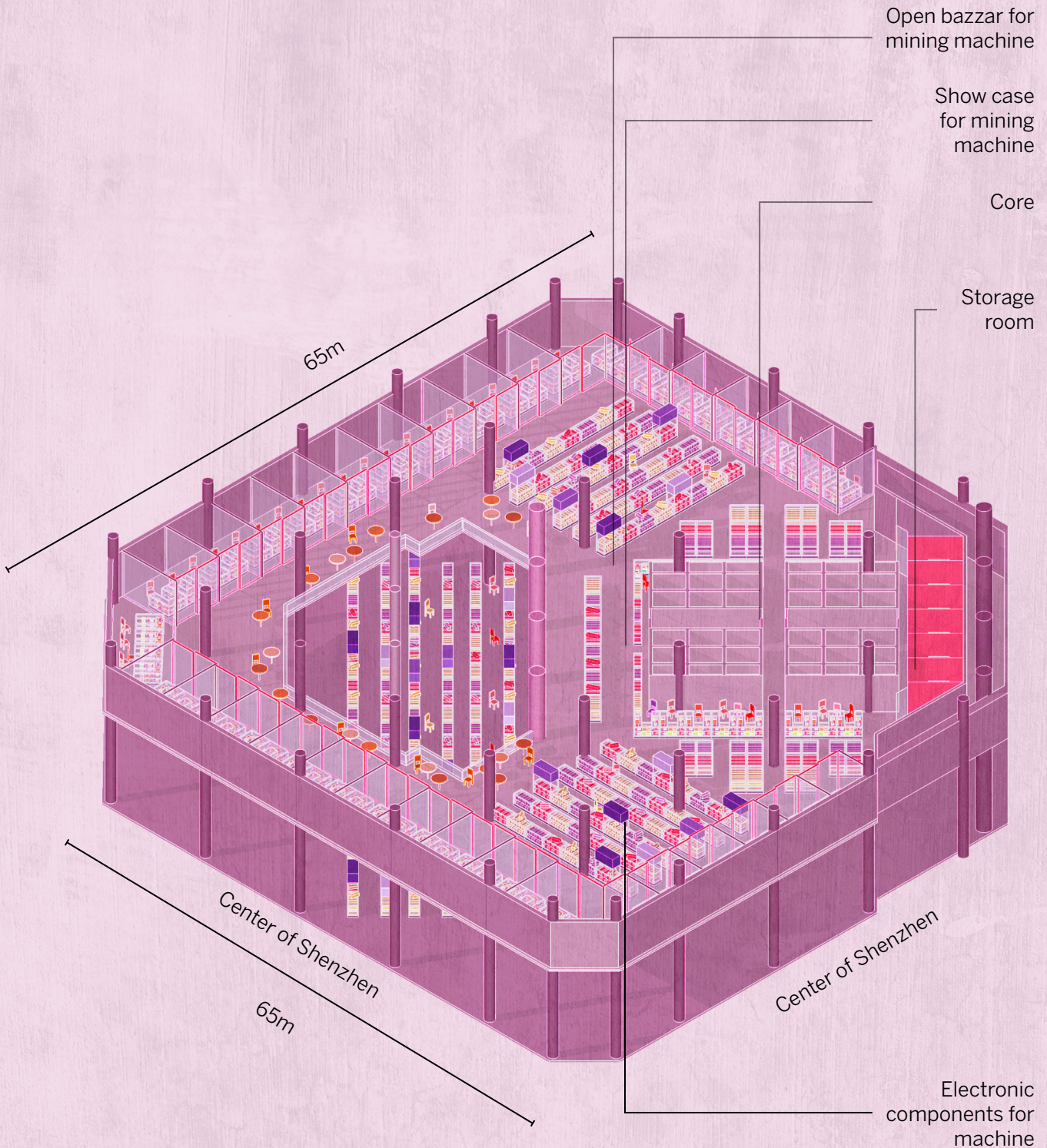
2017 Massena, New York lease the obsoleted Alcoa factory to Coinmint for 10-year bitcoin mining use

2017 Wenatchee, Washington unveiled pre-fabricated suitcase-like mining architecture;

2017 Bitmain launched its mining data center in the Ordos, Inner Mongolia;

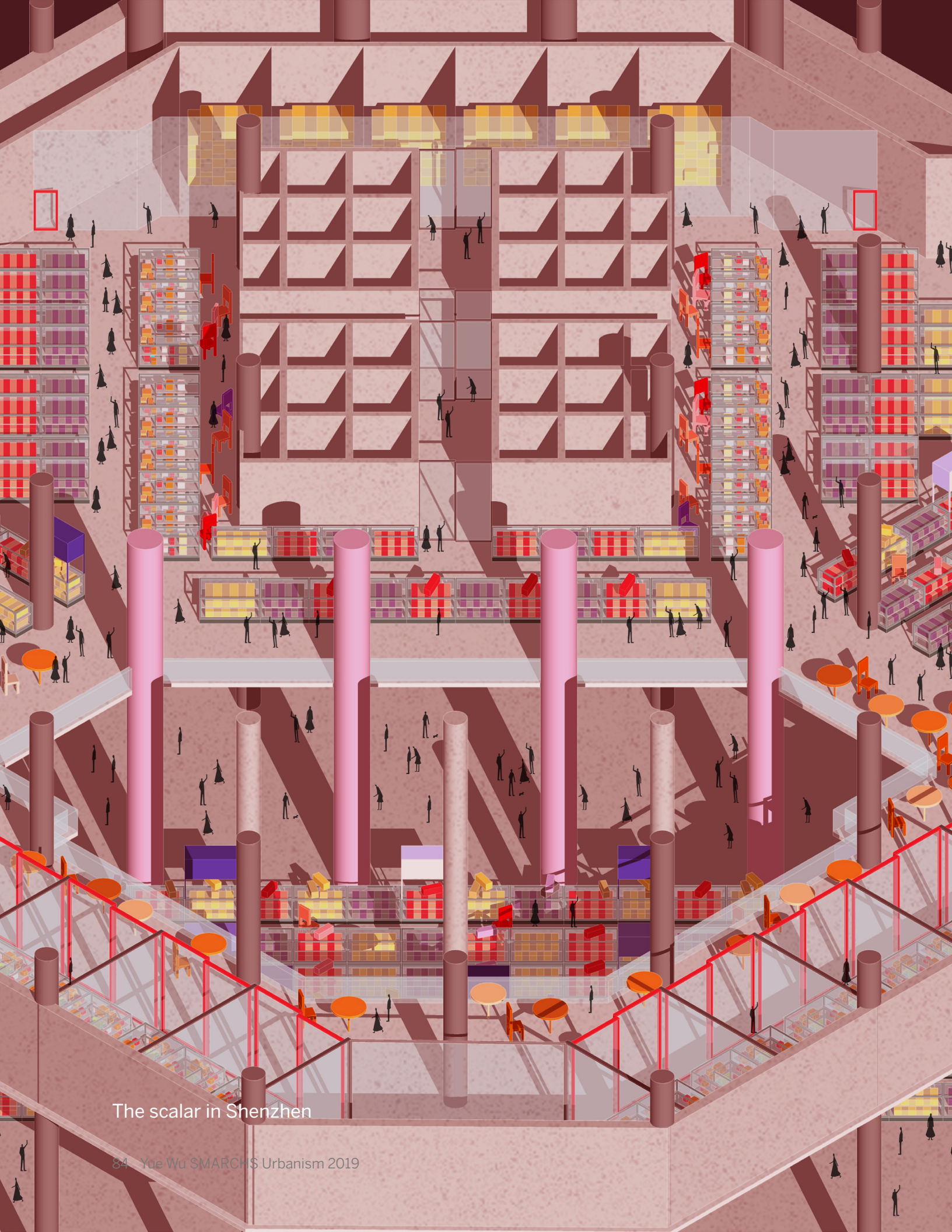
2019 Bitmain Deployed 100,000 Mining Rigs near Shangri-La

The first stage of the architecture is **scalar**, which refers to the machine manufacturing space happen in Shenzhen. Recall that Bitcoin mining is the way to generate value by keeping running these machines. After the professional mining machine invented in 2012, people begin to mine collectively. Under this context, Huaqiangbei in Shenzhen becomes the distributing center for the bitcoin mining machines. In its most prosperous time, almost all the spaces within SEG Plaza, a traditional 72-floor shopping mall were selling these machines. By investigating the machine's manufacture line, we understand that because raw materials, components, and human resources are local dependent, which takes large advantages from Shenzhen, Huaqiangbei becomes the place to get a most updated machine with the lowest expense. On the other hand, the cryptocurrency's value bubble in early 2018 has influenced the manufactures of the



SEG Electronic Mall

The scalar in Shenzhen



The scalar in Shenzhen

[44] Jin, Xin.
Information abstracted
from the interview
with shop owners in
Huaqiangbei, 2018

bitcoin mining machines drastically. As indicated by the bitcoin-related startup owner Xin Jin, it is extremely difficult for a buyer to find a ready-made mining machine on the market in 2017, since all the products have been ordered in advance due to the prosperity of cryptocurrency market. However, with the fluctuation of the bitcoin global market, the manufacturing of the mining machine quickly shrinks this year, leaving many of the previous workshops discarded in the suburbs of Shenzhen⁴⁴. In this way, these manufacturing and selling activities are physically centralized in this consuming space.

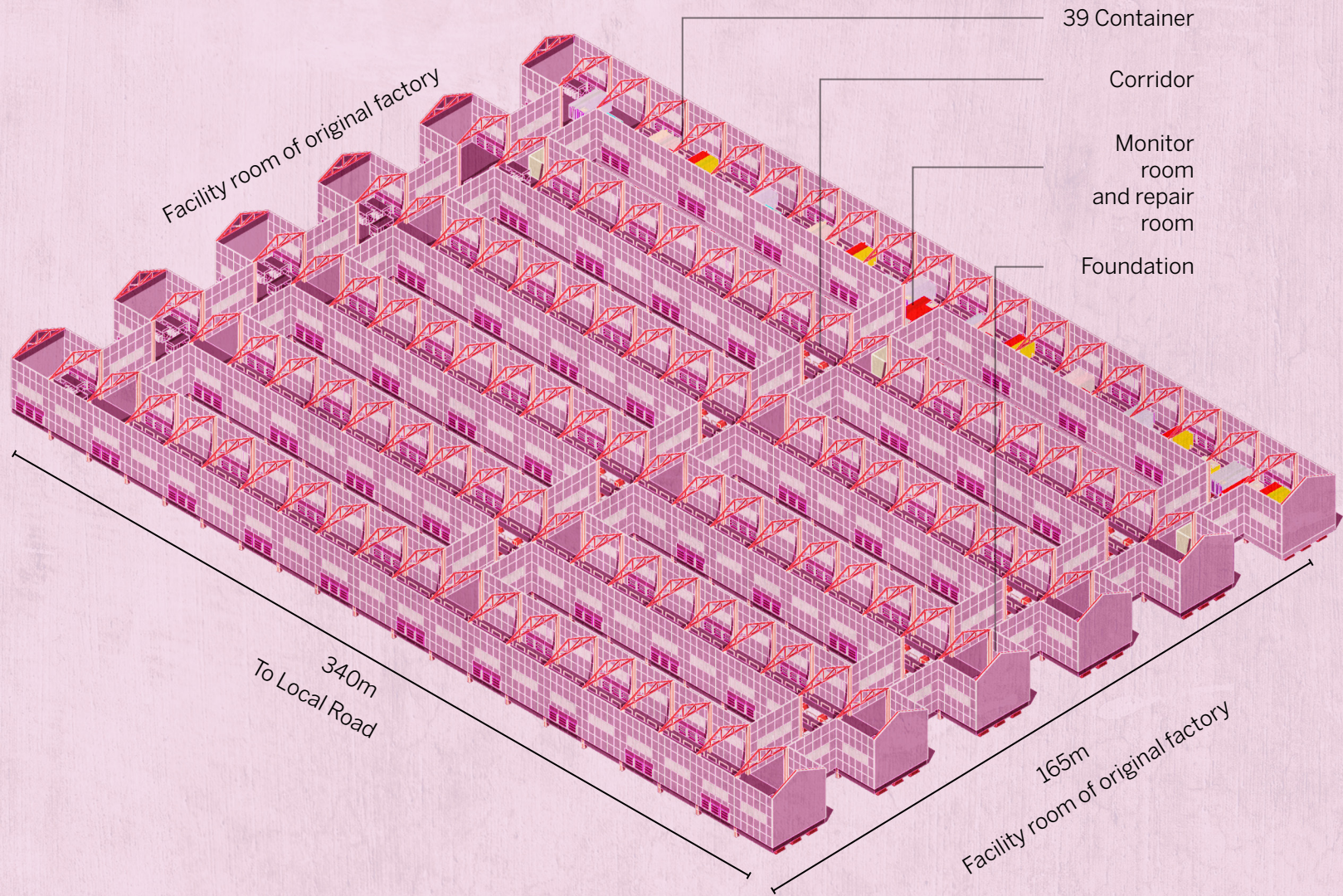
[45] McGeehan, Patrick. 2018. "Bitcoin Miners Flock to New York's Remote Corners, but Get Chilly Reception." The New York Times, September 19, 2018, sec. New York. <https://www.nytimes.com/2018/09/19/nyregion/bitcoin-mining-new-york-electricity.html>

The second stage is the bitcoin mint. The preliminary mint space can be summarized as **adaptive using**. Massena, in NY's most remote corner, is a good example of this typology⁴⁵. In order to mine collectively, as well as maximize the mining revenue, the mining industry spontaneously tries to find the regions with lower cost (i.e. the lower rent with cheaper electricity price). Therefore, with the market electricity price already cheap enough due to the abundant hydropower resources in Massena, the mining companies entered this remote town-this region that once attracted heavy industry is busily accommodating the influx of bitcoin speculators recently. This mega infrastructure covers an area of more than 1300 acres. The miners are making use of hulking aluminum plant 24 hours a day, using the electricity to power cracker box size machines stacked inside rusty cargo containers. Since 2017, Coinmint began to fill 39 similar containers in one lane 2. A monitor and repair room locates in the middle. Usually, there are 2 workers and 1 manager in this room. This space is designed by an electrical engineer targeting on these machines. Two containers



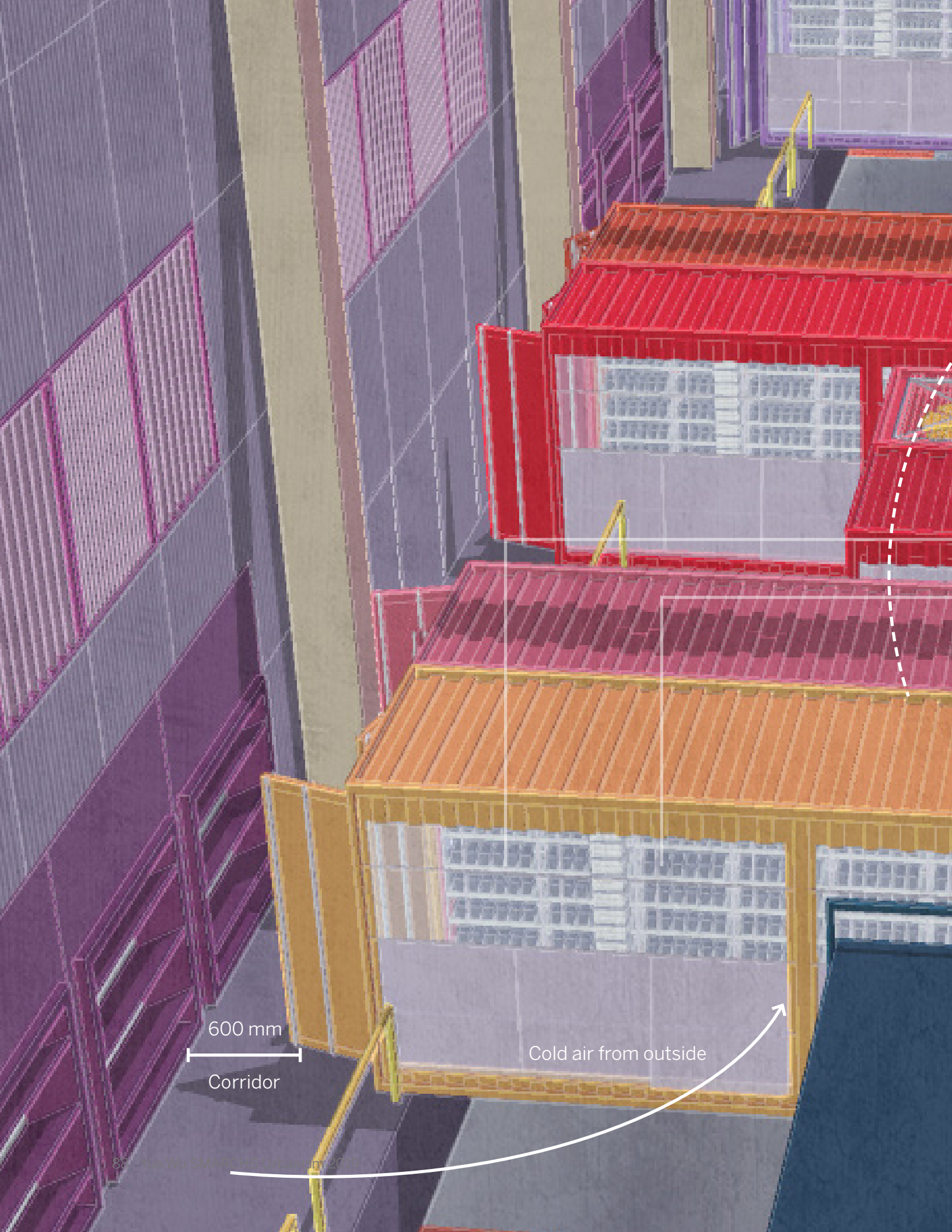
A dam on the St.
Lawrence River
between Canada
and the United
States provides
hydroelectric power

**Resource: Patrick
McGeehan**



North data center

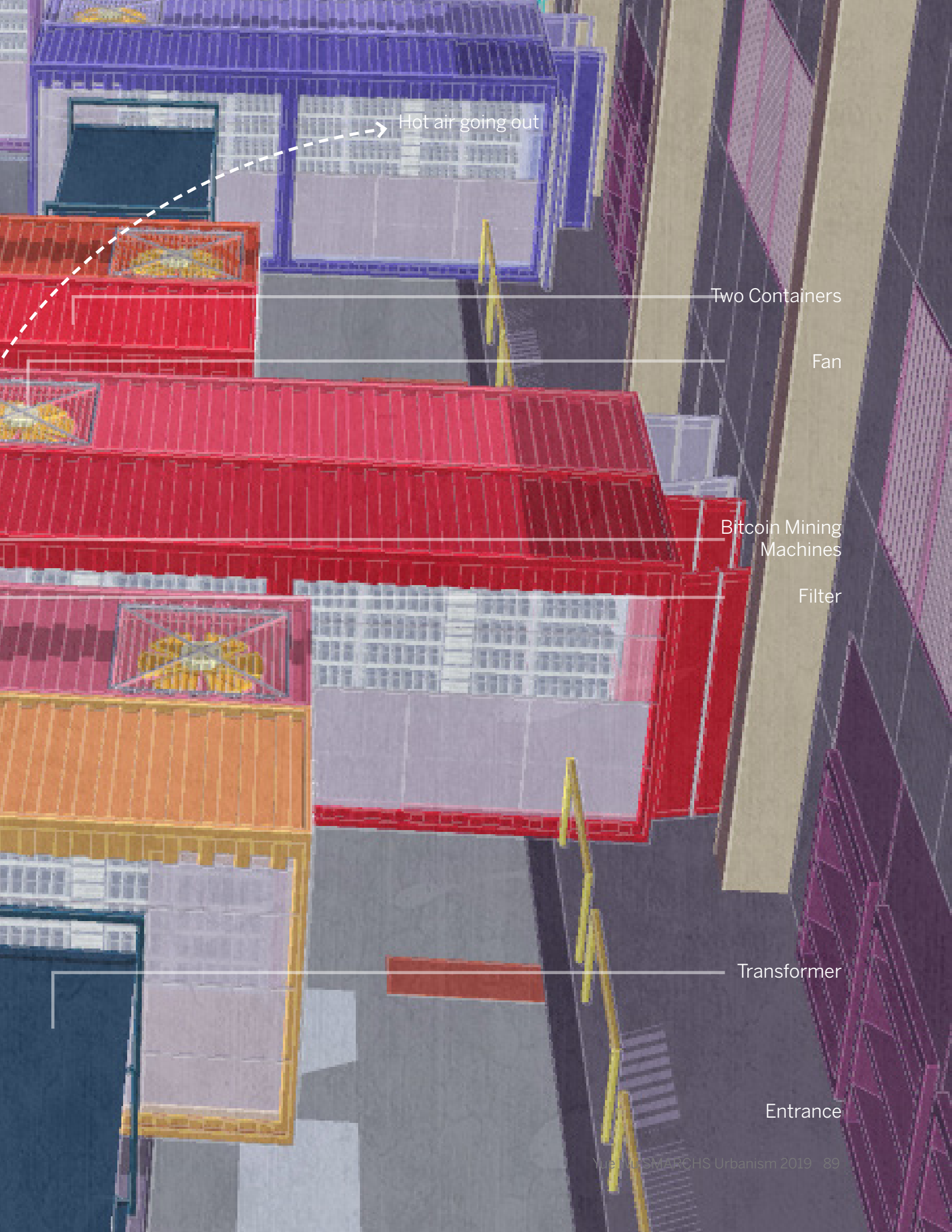
The adaptive using in Massena



600 mm

Corridor

Cold air from outside



Hot air going out

Two Containers

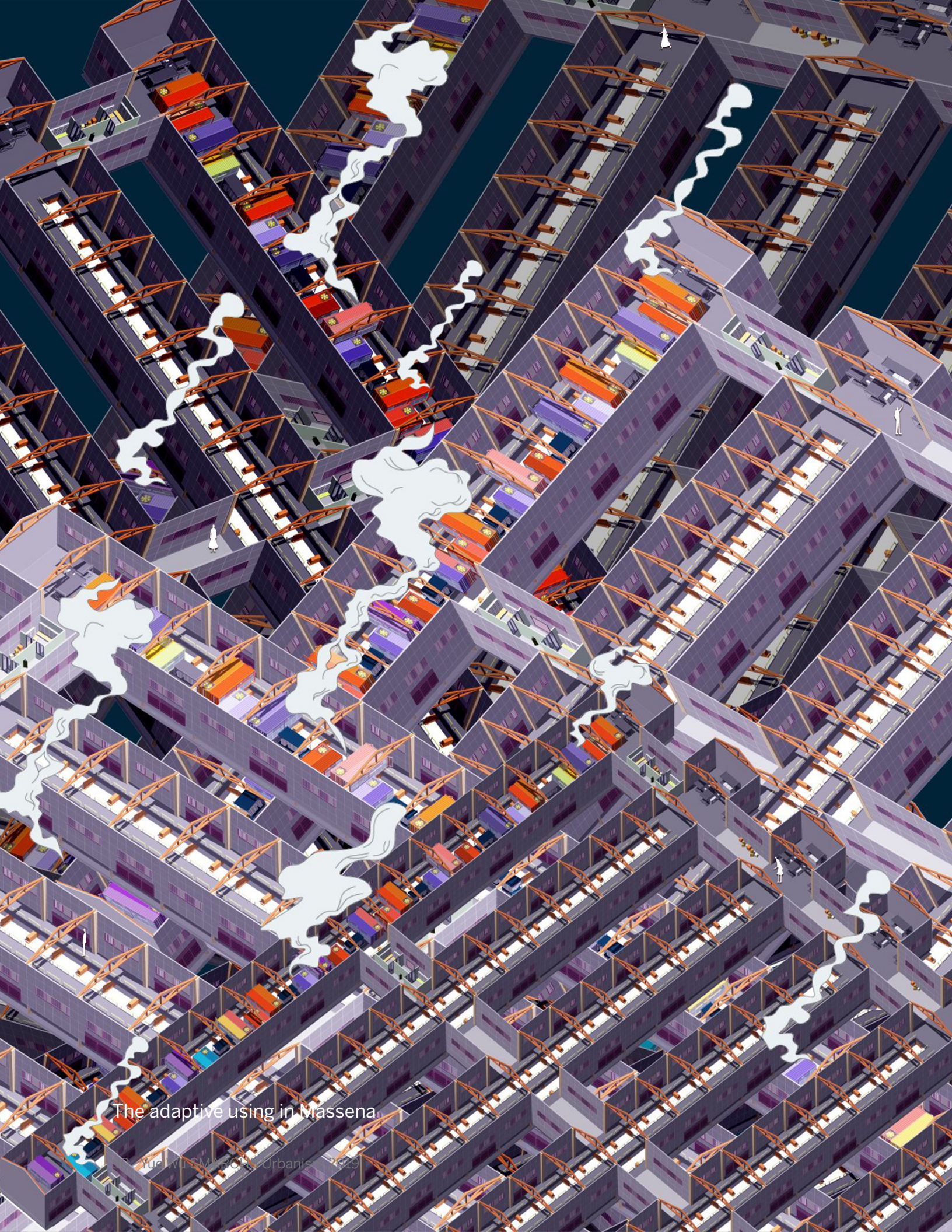
Fan

Bitcoin Mining
Machines

Filter

Transformer

Entrance



The adaptive using in Massena

are cut and stick together, creating a shared space for machines. With the transformer, filter, natural and artificial cooling system, the environment of these machines can maintain a comparatively stable temperature and ventilation. Nothing here is designed on a human scale. Again, in Massena, all the mining activities are centralized and fixed within the megastructure. With the extremely cheap electricity used by both bitcoin miners, the city's electricity consumption exceeded its allocation on several days since the cryptocurrency mining market grew locally. Consequently, "the Municipal Lighting Department had to purchase additional power at much higher prices - a cost it spread across its customers." Faced with similar energy consumption due to bitcoin mining, Plattsburgh became the first American municipality to impose a law to ban the cryptocurrency mining industry. Colin Read, the mayor of Plattsburgh argues that "the concerns are part of a broader battle over the enormous carbon footprint of Bitcoin mining, which on a global scale uses as much energy as a medium-sized country"⁴⁶. In other Bitcoin-overwhelmed region, city officials are also "adapting building codes to account for the fire hazards posed by the servers, each of which can generate as much heat as a small space heater". As suggested by the officers and local residents, the arrival of the speculators has been met with the fears of their outsize thirst for the cheap electricity⁴⁷.

If we consider Massena a case for the spatial fix, Bitcoin mining begins to have more flexibility in Wenatchee. This typology can be summarized as **prefabricated production**. In Wenatchee of Washington State, across the three rural counties of the Mid-Columbia Basin, orchards and farm fields are

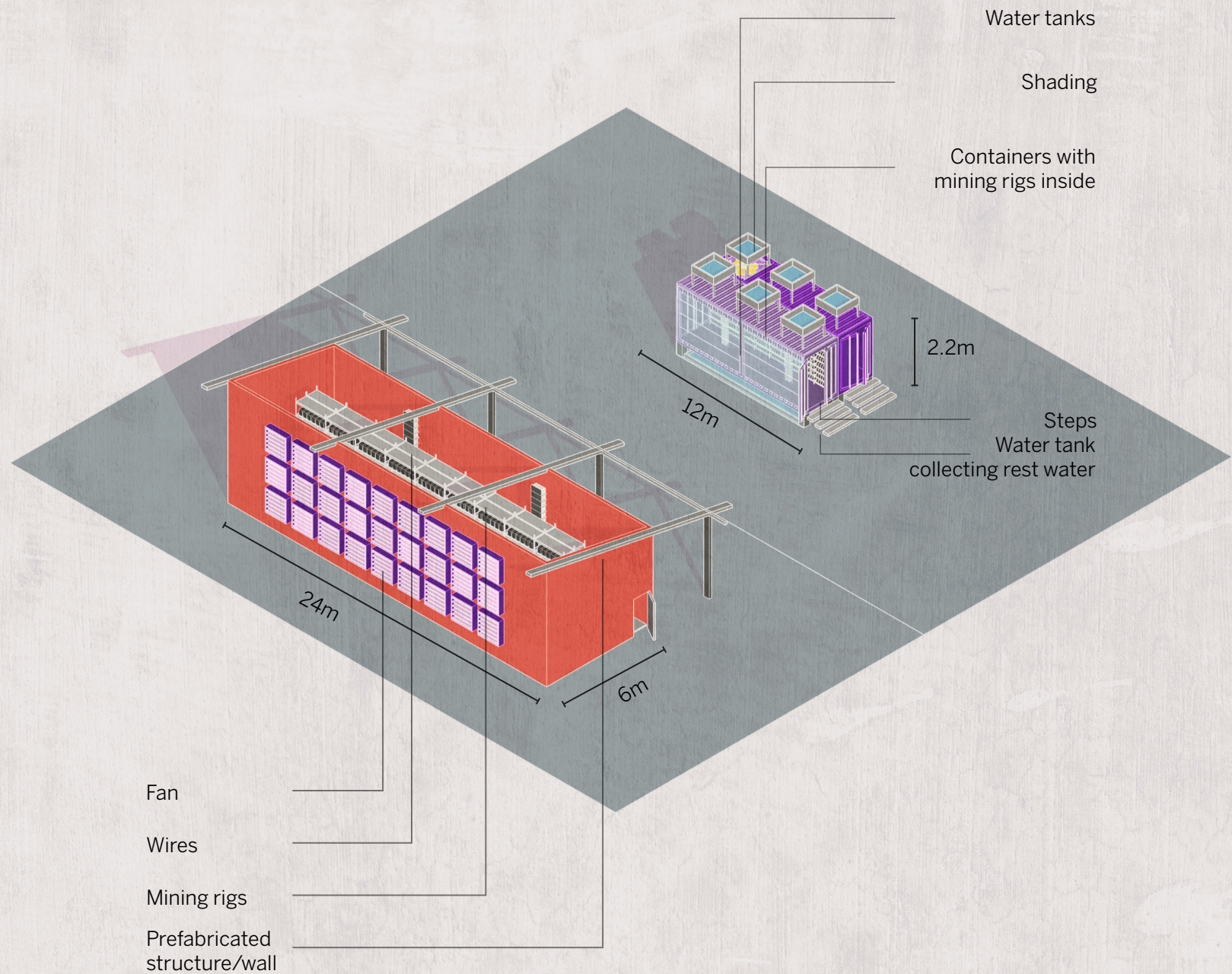
[46] Ong, Thuy. 2018. "Plattsburgh Has Become the First City in the US to Ban Cryptocurrency Mining - The Verge." n.d. Accessed November 19, 2018. <https://www.theverge.com/2018/3/16/17128678/plattsburgh-new-york-ban-cryptocurrency-mining>

[47] McGeehan, Patrick. 2018. "Bitcoin Miners Flock to New York's Remote Corners, but Get Chilly Reception." The New York Times, September 19, 2018, sec. New York. <https://www.nytimes.com/2018/09/19/nyregion/bitcoin-mining-new-york-electricity.html>

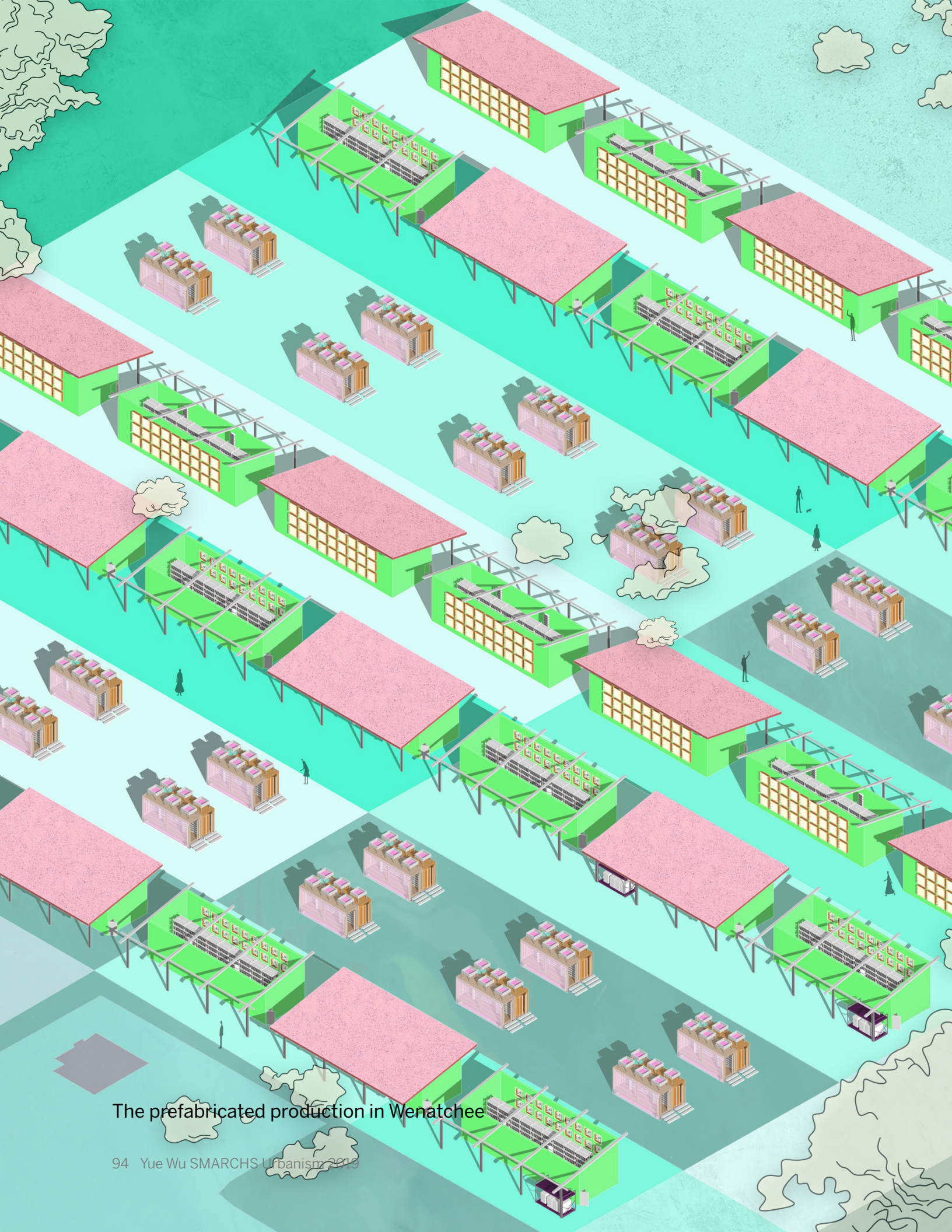
Eastern Washington
had cheap power and
tons of space. Then the
suitcases of cash started
arriving.

Resource: Paul
Roberts





The prefabricated production in Wenatchee



The prefabricated production in Wenatchee

now sharing the rolling landscape with miners of every size. These miners are from industrial-scale facilities to repurposed warehouses to cargo containers and even backyard sheds. The most prevailing ones are these prefabricated mining house designed by a local electrical engineer, which can be assembled within a limited time, and these cargo containers with a simple cooling system, which can be easily put on trucks and moved to the places with the lower local electricity prices. Although small stakeholders in this area can build a simple facility with a limited certain freedom, these facilities are still spatially centralized in the region.

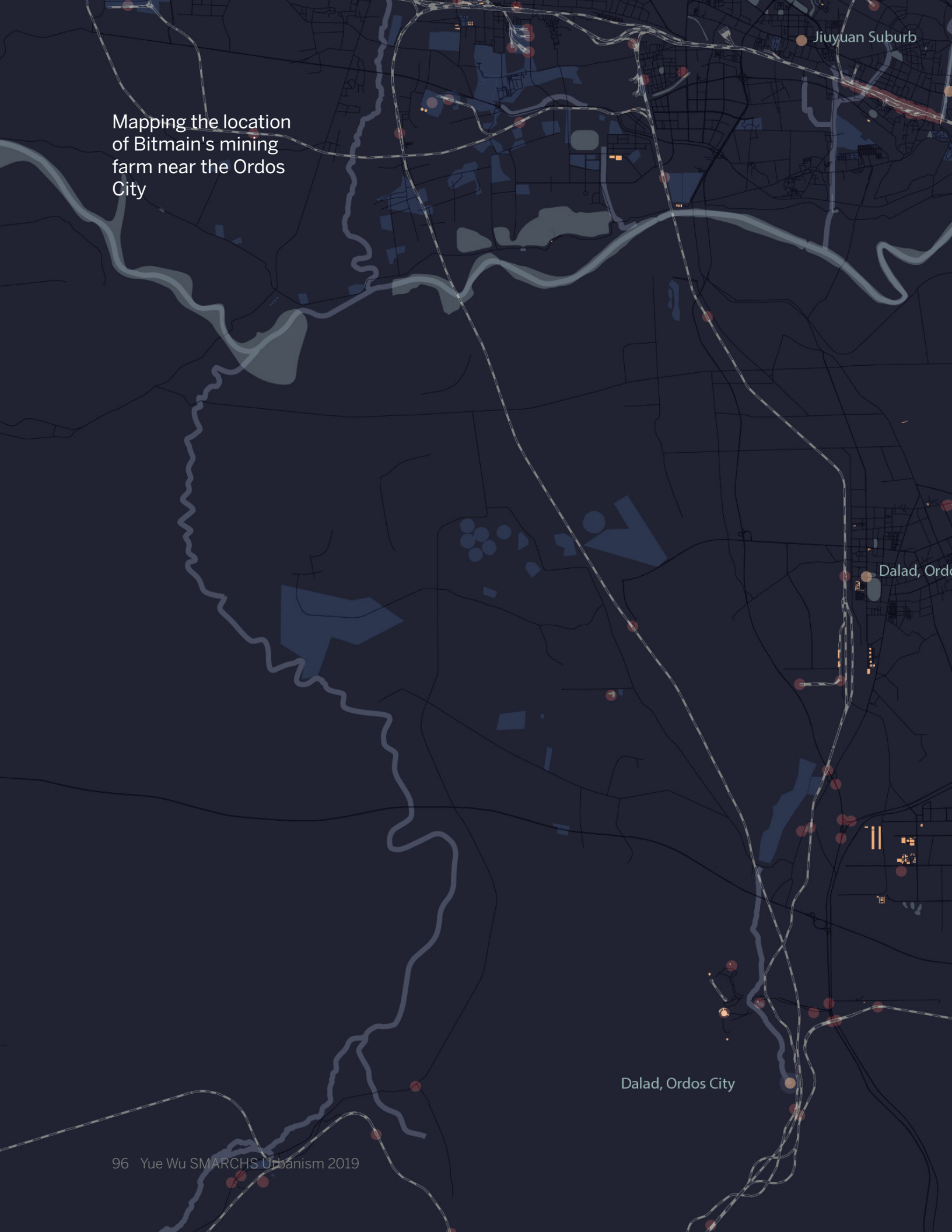
If all the previous three spatial typologies are highly fixed in one place, the **mobile distribution** shows how the centralized bitcoin mining industry is shifted to chase for cheaper electricity resources during different seasons. In this case, the monopolized company Bitmain locates mining center in a place 60 miles to the nearest city-the Ordos, but close to a local thermal power station, which is a Greenfield project. During winter, all the energy depends on this power station. Further typology study reveals that the huge fans for ventilation, the water curtain and, shading for cooling, the squeezed restroom and other service rooms designed are actually for the machines instead of humans. Meanwhile, the other part of the story is that when summer comes and thermal power no longer has the cost advantages, the machines can be put on trucks within nights, and delivered to the places near rivers in Shangri-La. Due to the abundant hydropower in this area in summer, the cost of mining is still cheaper even if we take logistic expense into consideration. This temporary infrastructure is usually built near the river and local small scale

Mapping the location
of Bitmain's mining
farm near the Ordos
City

Jiuyuan Suburb

Dalad, Ordos

Dalad, Ordos City





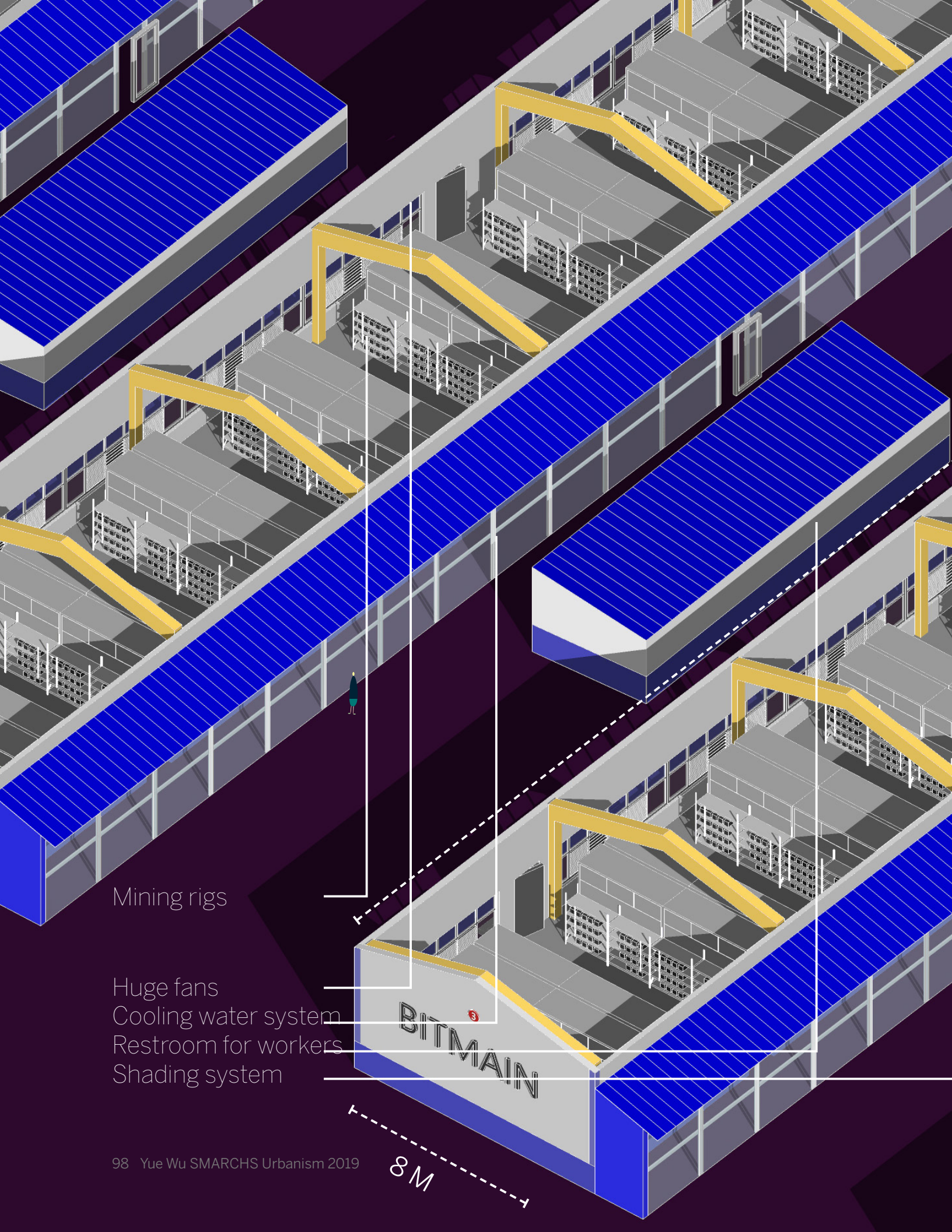
Donghe Suburb
Hedong Town

Sha'erqin Town

Ordos City

Wang'aizhao Town

Bainijing Town

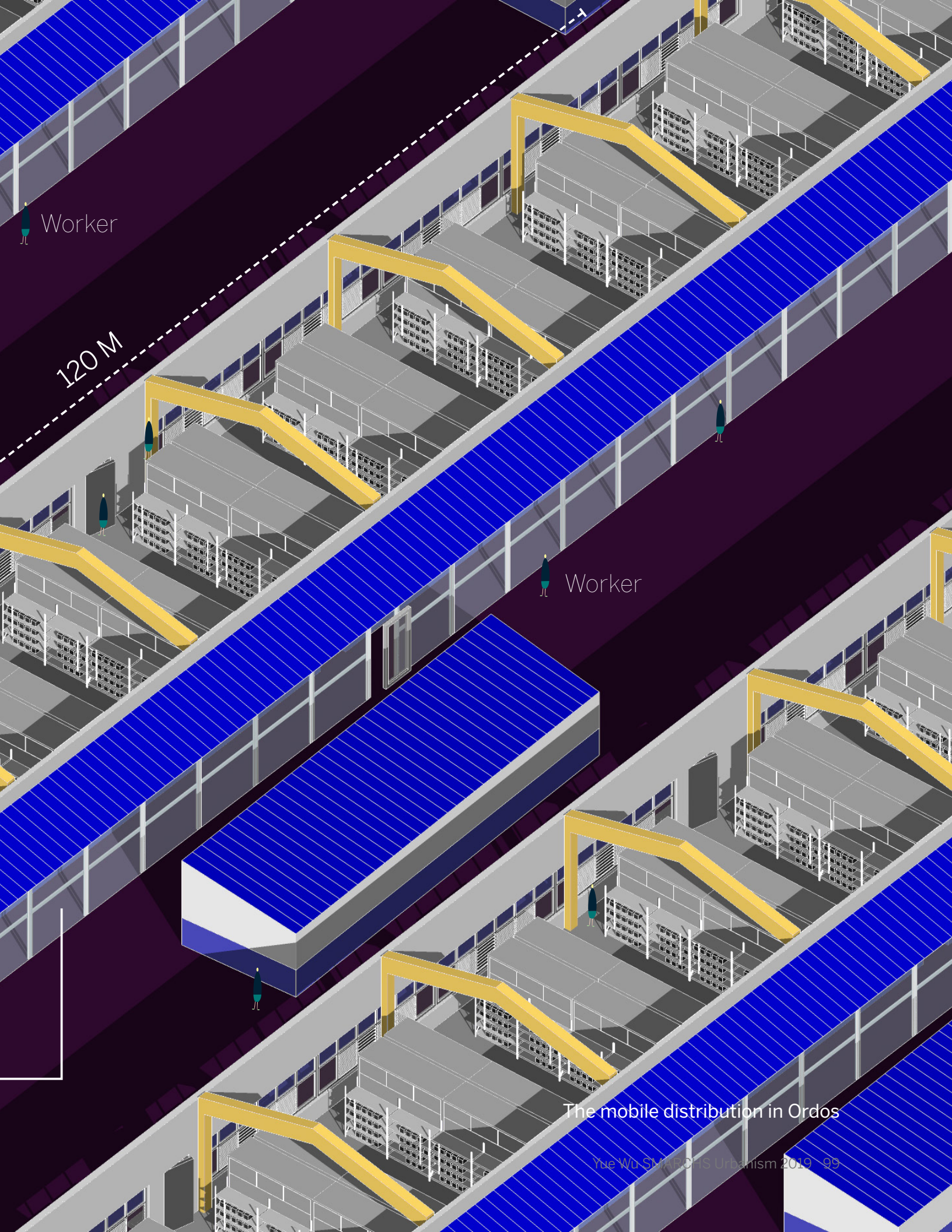


Mining rigs

Huge fans
Cooling water system
Restroom for workers
Shading system

BITMAIN

8 M

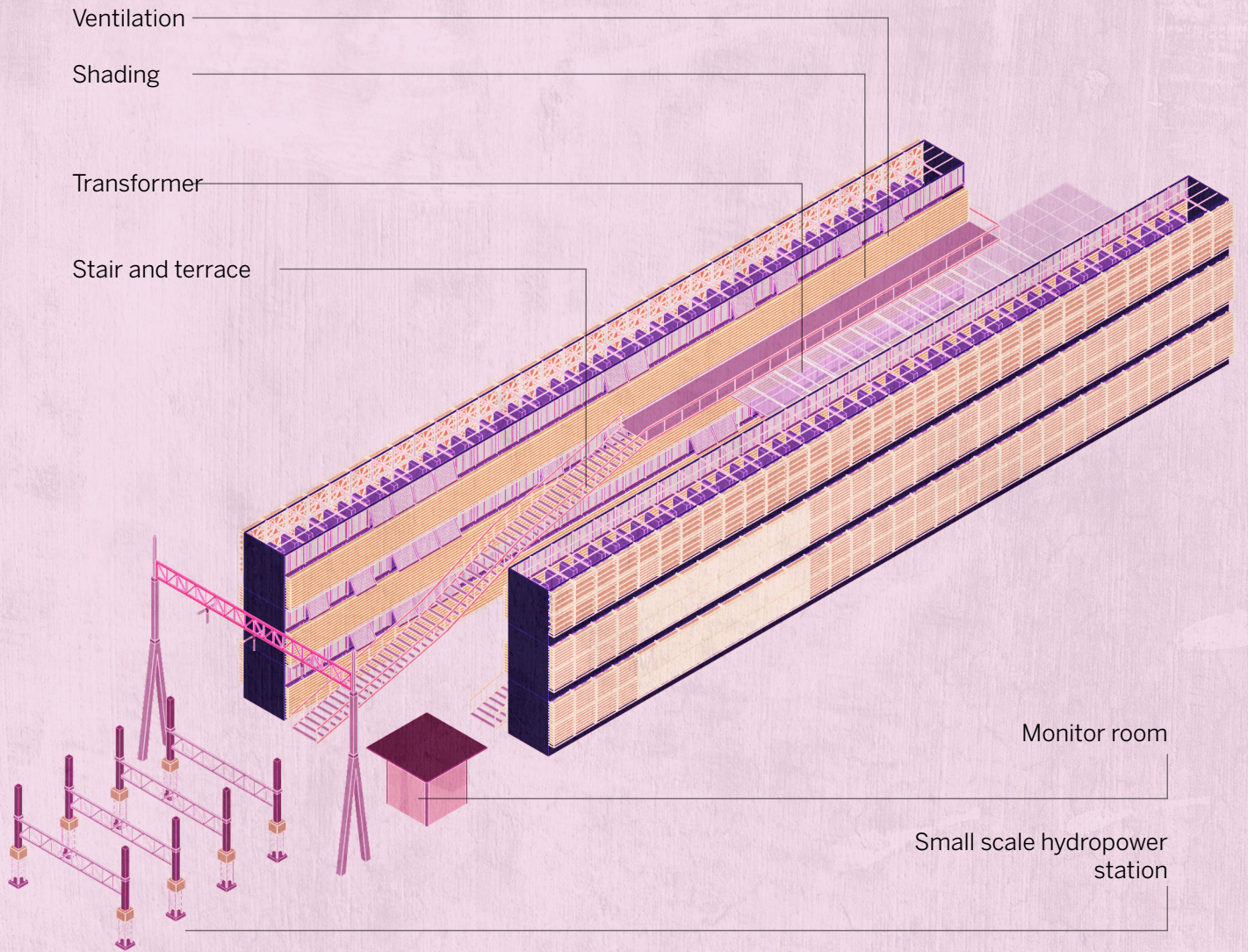


Worker

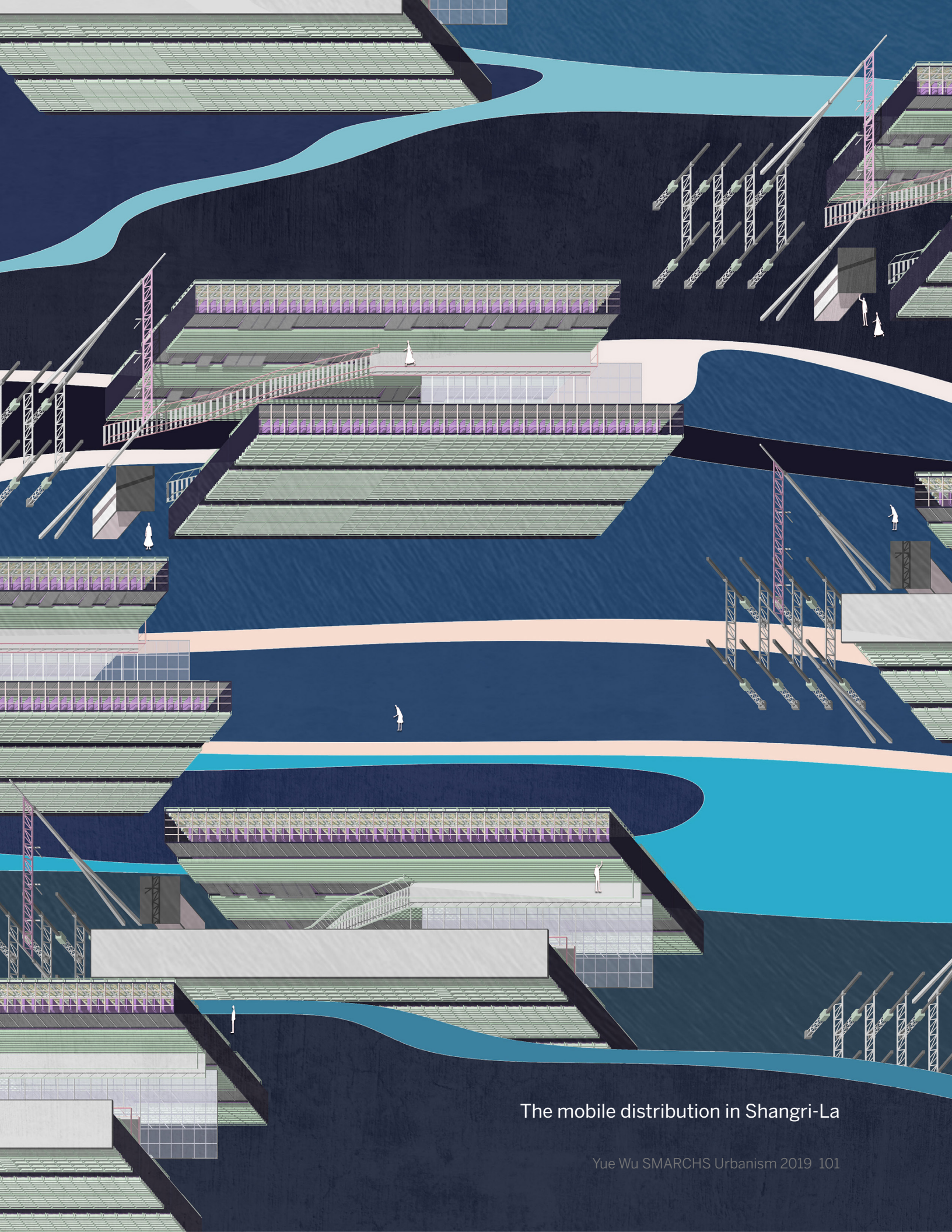
120 M

Worker

The mobile distribution in Ordos



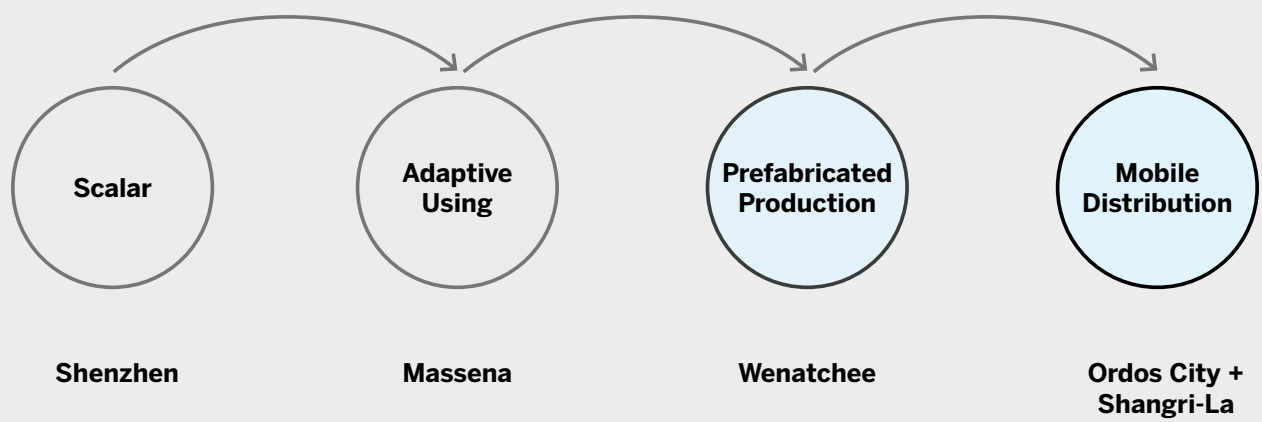
The mobile distribution in Shangri-La



The mobile distribution in Shangri-La

power stations. Due to the space limitation between mountains, they cannot get enough footprint but go vertically. When the dry season comes, the machines will be delivered back to Inner Mongolia. Although migration happens here, the actual mining space is still centralized and fixed in a broader time span.

Therefore, by studying the evolution of Bitcoin mining space, I am showing that the persistent evolution of the spatial typologies are far more dynamic than what the bitcoin is claimed as purely decentralized. It will not lead to urban decentralization, but a more dynamic world contradict to its solely decentralized manifesto, where the mining infrastructure plays the dominant spatial role. In the end, the contemporary manifesto of bitcoinization is essentially a competition for electricity and natural resources extraction, which represents an arc back us to the age of mining.



The evolutionary
landscape of bitcoin
mining

The diagram features three overlapping circles. A yellow circle at the bottom left contains the text 'Bitcoin geopolitics'. A dashed black circle at the top right contains 'Algorithm modeling'. A light green circle at the bottom right contains 'Computational accelerating'. A curved arrow points from the 'Algorithm modeling' circle towards the 'Computational accelerating' circle. The circles are set against a background of several large, thin, grey arcs that sweep across the page.

**Bitcoin
geopolitics**

**Algorithm
modeling**

**Computational
accelerating**

7

TOWARDS POST BITCOINIZATION

A bitcoin mining utopia/
dystopia

**Global
positioning**

Humans

TOWARDS POST BITCOINIZATION

A bitcoin mining utopia/ dystopia

These 4 vignettes of a (dis)utopian scenario describe the development of bitcoinization to its extreme. Playing a fine line between a purely imaginative future and a drafting a prescriptive and practical solution to a better scheme of development, they serve as my last set of critique of the current bitcoin geopolitical landscape. Having revealed the false promises of bitcoinization across four aspects—algorithm modeling, computational accelerating, global positioning and human scaling, I would lastly reemphasize on how current structural inequality may migrate into the future economic system and social structure, and how a regression to traditional farming and mining based on bodily power becomes the only possible solution.

Innovations on energy production continue to be the key to winning in a competitive bitcoin market.

i) Dutch scientists have already developed clothing to extract bio-electricity from one's body. The illusion of endless bio-electricity as an independent energy source is easily broken as one ends up in a vicious circle where one has to continuously use the profits made from body-ming to feed and recharge oneself

for subsequent rounds of extraction. Therefore, energy extraction as such may be limited to only a part of the day, but a routinized event that repeats itself throughout the year. This new working-out-as-profit-making would gather an incredible group of pilgrims and believers, and, thus, becomes a spectacle. Institutional setups will emerge in support of these new social and economic festivals in which thousands and hundreds of people running on treadmills or doing weight lifting together—a newly invented economy of scale.

ii) Alternatively, agricultural fields will be converted to electricity farms as well. The planted bitcoin mining machines are carefully monitored by drones, well irrigated and fertilized, and can be easily managed by whoever is interested in running this farm. The best innovation should be the one that eats up all means of subsistence of lives. What is particularly ironic is that, in a wave of manic efforts to re-appropriate all organic substances to the purpose of electricity generation and bitcoin mining, there is always a collective nostalgia for an agrarian past and a return to a primitive belief in bodily strengths.

iii) At a planetary scale, mining sites become movable. Mining machines are organized into different units for easy transportation. These prepackaged troops of machines are always seeking the most desired sites for mining and constantly calculating a strategic plan to drift to those sites without compromising any mining activities along the way. Imagine them as paramecia.

iv) What is common across this new bitcoin landscape is continued decentralization of production—the

division and subdivision of production units into smaller and smaller ones. The disassembling of all production oligarchies stands in contrast with the unbelievably unified and quasi-militarized movement driven by the same force and attracted by the same goal of securing the most productive sites for electrocution generation. Following the same algorithm of calculating between policy supports, land price, average temperature, etc., atomized units of bitcoin mining are constantly moving, at both urban and planetary scales, towards the same magnetic centers.



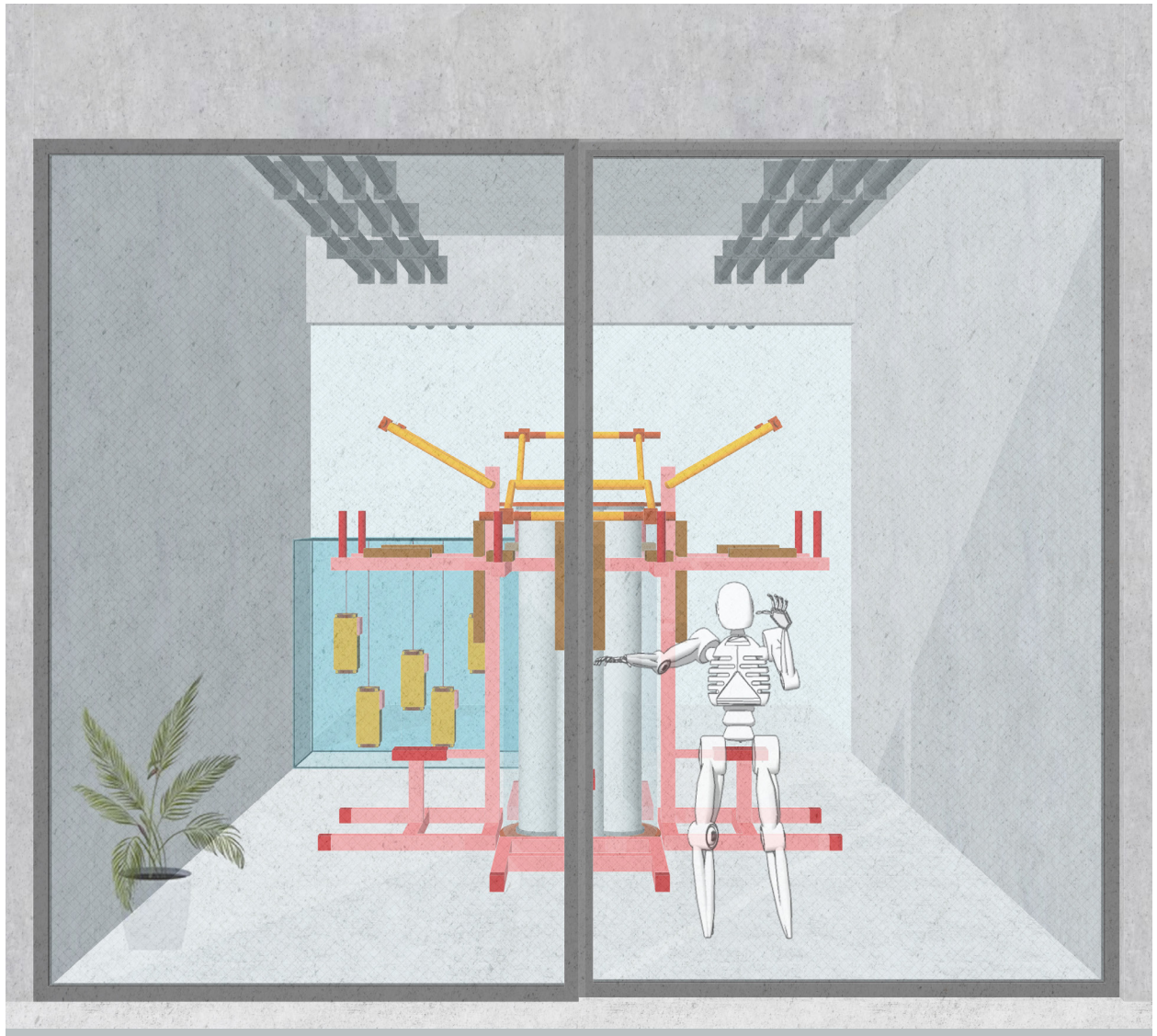
Naming the process of bitcoin production as farming or mining and the associated sites as farms and mines are particularly revealing in how it recognizes the fundamental reliance on planetary-scale resource extraction. The most intelligent financial algorithm ultimately cannot defeat the harnessing of immense human bio-electricity or any other traditional forms of energy. As this reliance of the virtual cryptocurrency on the physical landscape becomes more and more prominent, it is important to understand that, at the other end of the bitcoin lifecycle, it relies on the physical infrastructure of trading and spaces of exchange to convert it into money that can be circulated in the real world. ATMs and banks are not yet outdated. **The most radical imaginations of the blockchain network turn out to be fairly timid and reserved in its spatial and physical visions.**

We look forward to any proposals that seek to challenge the object-to-object exchange that underpins all contemporary commercial activities, including the most abstract and virtualized bitcoin trading. How can bitcoin function in itself without converting to real-life currency? What are the spatial opportunities and implications of bitcoin trading as such? How can we bridge the virtual and the physical in the most smooth and seamless manner? These are the challenges for future bitcoin traders.

I believe that, however, advanced technological development, it is always fettered by the most basic bodily concerns. Furthermore, when all innovations turn to the human bodies as the last opportunities for extraction and exploitation, when this fanaticism for technology develops to its extreme, when, ultimately,

body and machine are seen as one and the same, human control and dictation do not fade away from the picture but grow increasingly important. Someone is always in command of the hysteric working-out-as-profit-making or in the supervision of the paramecia-like mass movement. There is always an invisible but overpowering agent setting up the rules of the game, laying down the infrastructure for the atomized electricity production, prohibiting any eccentric diversions from the unified solidarity navigating towards desired mining sites.

Interestingly, bitcoinization seems to compress an entire evolution of human economy production from framing to mining, building and ultimately to virtual trading. This compression brings with it the acceleration of all innovations' evolution from a world-changing promise to its devolution. Different tracks of the evolution are not necessarily pointing towards progression in a linear fashion. They overlap, divert, fluctuate, and oftentimes circle back, repeating the mistakes of the old systems they intend to correct. Ultimately, we have not gone so far.

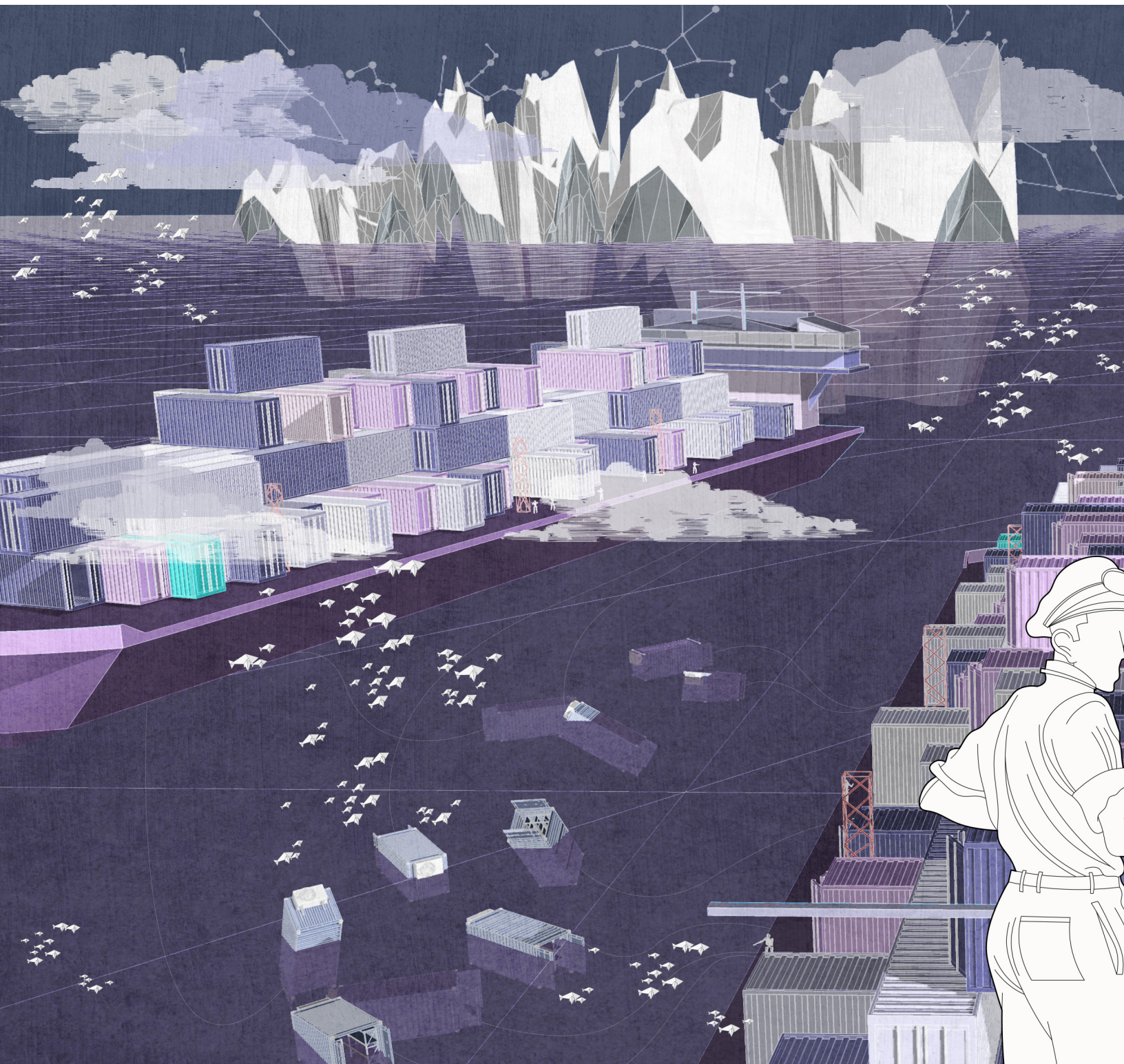


Classic of Mountains and Seas

Narrator: Fu Xi

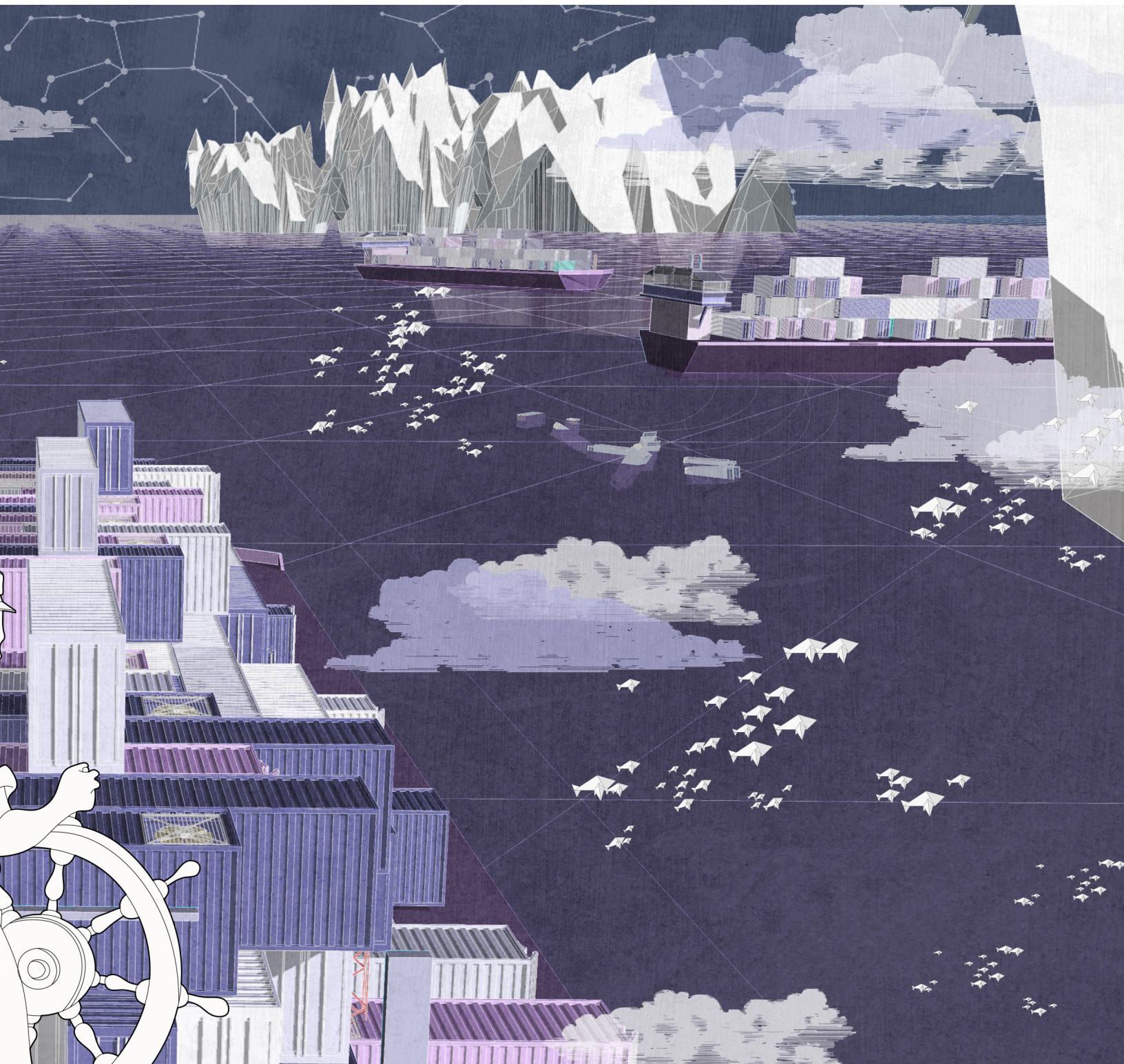
Time: 2,600 BC

In the beginning there was as yet no moral or social order. Men knew their mothers only, not their fathers. When hungry, they searched for food; when satisfied, they threw away the remnants. They devoured their food hide and hair, drank the blood, and clad themselves in



skins and rushes. Then came Fu Xi and looked upward and contemplated the images in the heavens, and looked downward and contemplated the occurrences on earth. He taught his subjects to fish, and to hunt with weapons made of bone. He regulated the five stages of change, and men began to raise herds, drive them, and keep moving with them, following game, water, and available wild forage for them.

— Ban Gu, Baihu tongyi (Richard Wilhelm's and Cary F. Baynes, 1967)

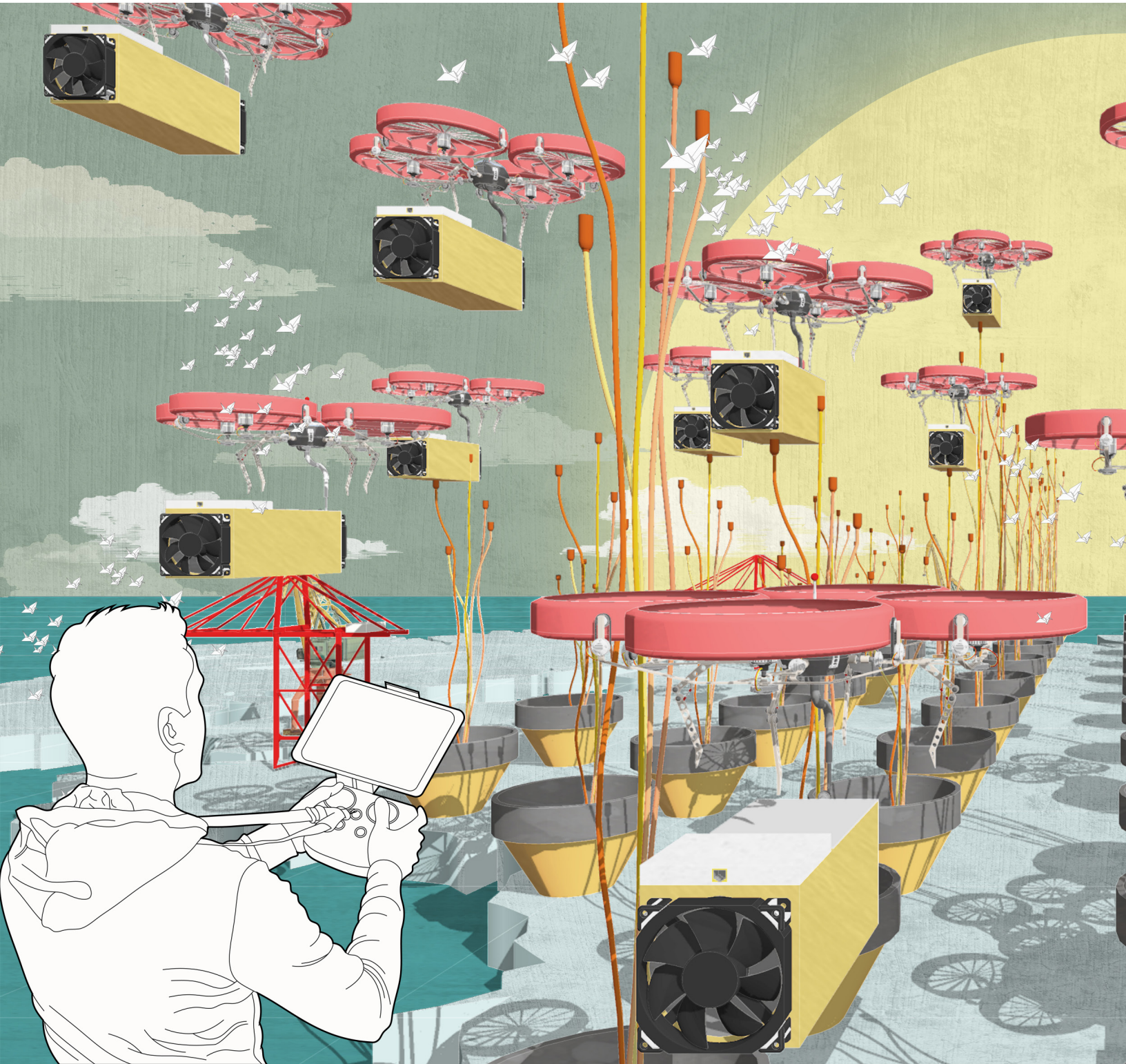


Thesmophoriazusa

Narrator: Demeter

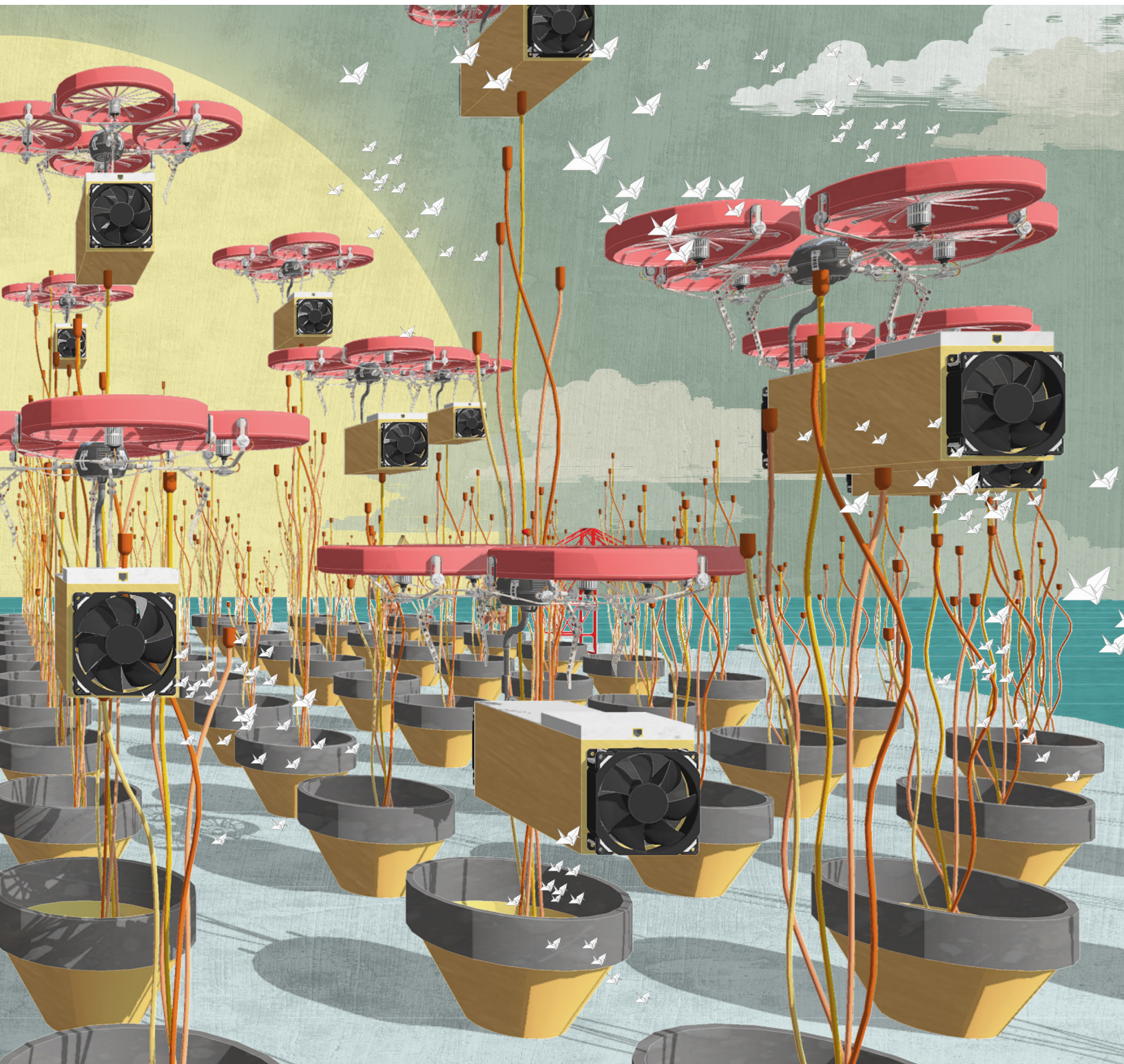
Time: 411 BC

Demeter was the Mother of the Earth. She was the goddess of fertility, protector of farming and crops in general, the goddess of vegetation. She came down to Earth to teach man how to plow, how to harvest, how to water, and how to feed the plants. When Demeter passed



through different lands, the Earth was enriched and filled with seeds, fruits, green pastures, and livestock. In autumn, seeds were buried underground, but in the spring, the Earth's crops came out into the sun once more.

— Aristophanes, *Thesmophoriazousae* (Colin Austin, S. Douglas Olson, 2004)

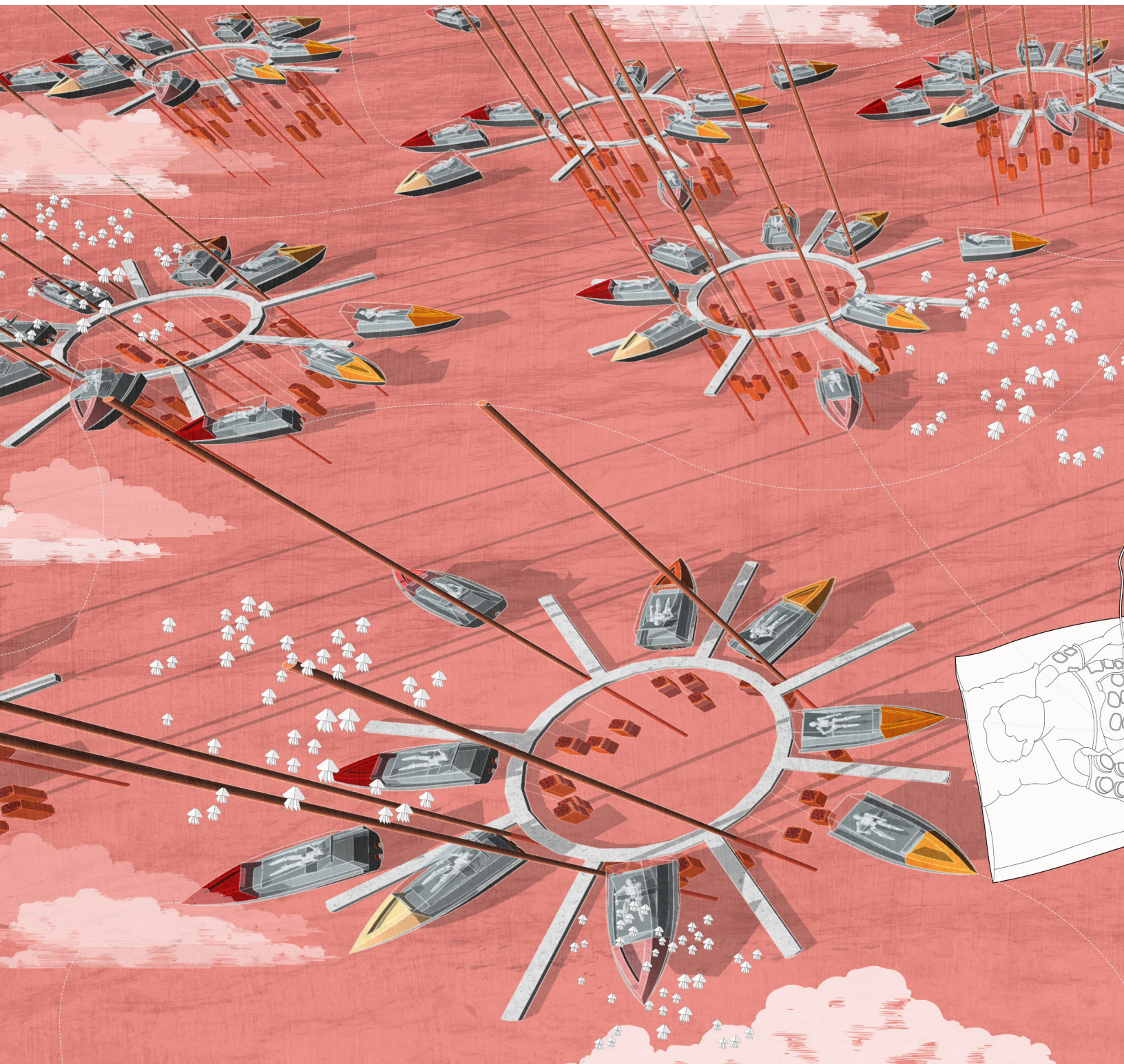


Getting the Gold

Narrator: S. Shufelt

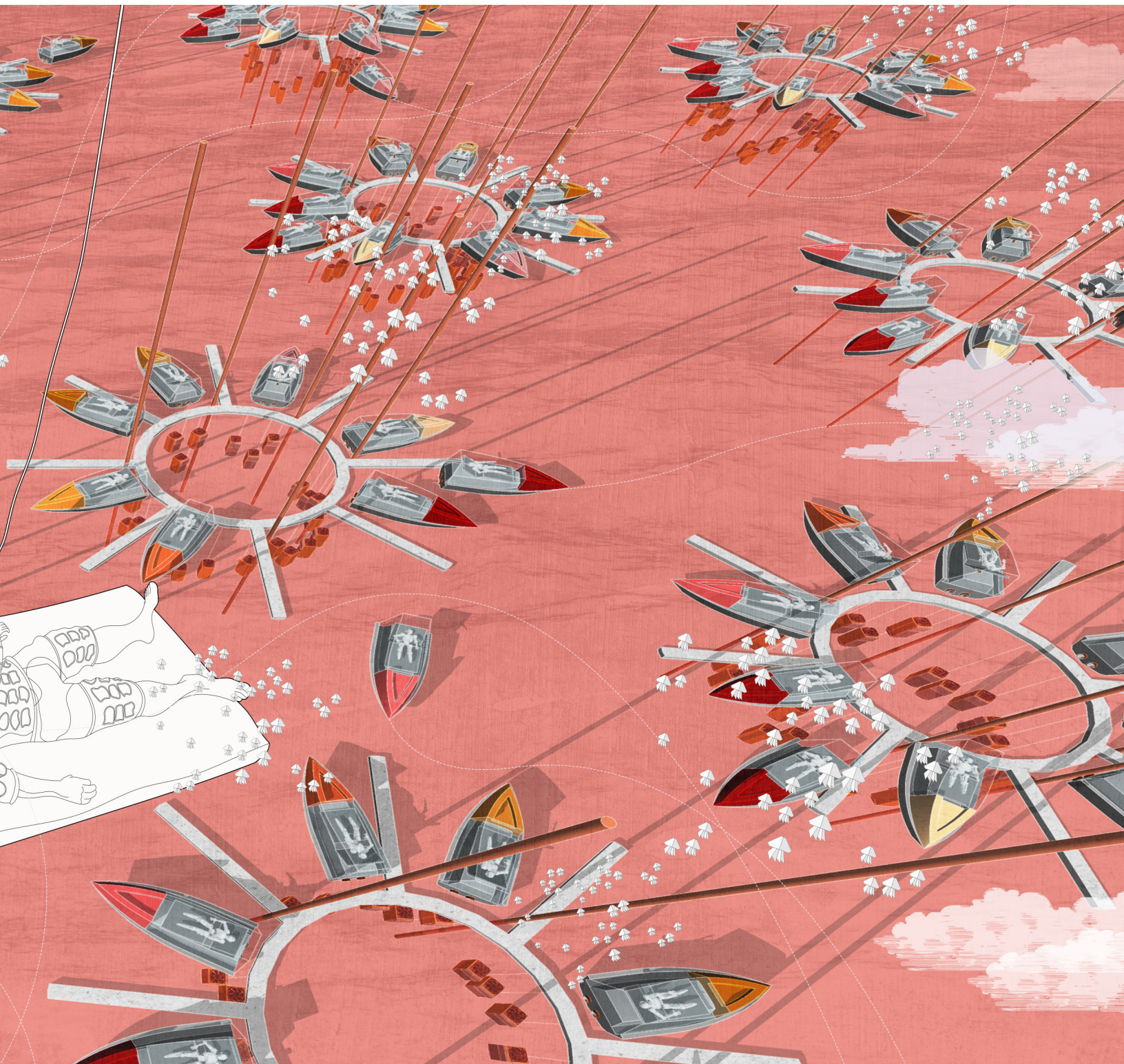
Time: 1850

It is found along the banks of the streams & in the beds of the same, and in almost every little ravine putting into the streams. And often from 10 to 50 ft. from the beds up the bank. We sometimes have to dig several feet deep before we find any, in other places all the dirt and clay



will pay to wash, but generally the clay pays best. If there is no clay, then it is found down on the rock. All the lumps are found on the rock-and most of the fine gold. We tell when it will pay by trying the dirt with a pan. This is called prospecting here...Many, very many, that come here meet with bad success and thousands will leave their bones here. Others will lose their health, contract diseases that they will carry to their graves with them.

— A letter from a gold miner, Placerville, California, March, 1850



996.ICU GitHub campaign

Narrator: X

Time: 2019

On 26 March 2019, the 996.ICU repository and website were created. The repository states that the name "996.icu" refers to how developers who work under the 996 system (9AM–9PM, 6 days per week) would risk poor health and a possible stay in an intensive care unit.



The movement's slogan is "developers' lives matter". Two days later, on 28 March 2019, the repository had already received 50 thousand stars, and 100 thousand stars on 30 March 2019, which made it the top trending repository on GitHub. The repository reached 120 thousand stars on 31 March 2019, and 200 thousand stars on 9 April 2019, making it the second most starred repository on GitHub. The flurry of activity led to the "issue" page of the repository to be flooded with spam and shut down, which was hotly discussed on Weibo and WeChat.

— 996 working hour system, from Wikipedia



**Bitcoin
geopolitics**

**Algorithm
modeling**

**Computational
accelerating**



8

APPENDIX

The promise of bitcoin



APPENDIX

The promise of bitcoin

8

[48] Nakamoto, Satoshi. 2008. Bitcoin: A Peer-to-Peer Electronic Cash System

[49] Aron, Jacob. n.d. "Bitcoin: How Its Core Technology Will Change the World." *New Scientist*. Accessed November 19, 2018. <https://www.newscientist.com/article/mg22129553-700-bitcoin-how-its-core-technology-will-change-the-world/>

[50] Manski, S. & Manski, "No Gods, No Masters, No Coders? The Future of Sovereignty in a Blockchain World." *B. Law Critique* (2018) 29: 151. <https://doi.org/10.1007/s10978-018-9225-z>

[10] Ulm, Bogdan. 2014. "Ireland Central Bank Official Admits Bitcoin's Disruptive Potential." n.d. Accessed October 9, 2018. <https://cointelegraph.com/news/ireland-central-bank-official-admits-bitcoins-disruptive-potential>

Based on Nakamoto's manifesto⁴⁸, Jacob Aron, the journalist of *New Scientist*, remarked that virtual currency is about "more than money" – the real innovation is what people are doing with the technology based on decentralized blockchain technology⁴⁹. Ben Manski, an American sociologist and democracy advocate has suggested that "Since technologies in general have tendencies that are materially inherent and not simply produced by social context, it is comparatively easier for them to achieve specific structure, because a technology is itself 'a structured set of relations that enables or constrains different sets of possibilities'. Therefore, bitcoin and the blockchain technology become promising carriers of decentralization. Popular claims predict the blockchain to 'harken the end of the contemporary sovereign order' due to its decentralized structure. As he argued in his paper, *The Future of Sovereignty in a Blockchain*, "the blockchain, as well as the application of such technology, is ... widely treated and expected as the revolutionary technology, or at least as one that has such potential, which can change the rule of the centralized sovereignty into decentralized self-management"⁵⁰. Gareth Murphy, the senior Central Bank of Ireland official, noted that "Virtual and digital

[51] Manski, S. & Manski, “No Gods, No Masters, No Coders? The Future of Sovereignty in a Blockchain World.” *B. Law Critique* (2018) 29: 151. <https://doi.org/10.1007/s10978-018-9225-z>

[10] Ulm, Bogdan. 2014. “Ireland Central Bank Official Admits Bitcoin’s Disruptive Potential.” n.d. Accessed October 9, 2018. <https://cointelegraph.com/news/ireland-central-bank-official-admits-bitcoins-disruptive-potential>

[52] Higgins, Stan. 2016. “‘Sovereign’ Blockchains Will Change Monetary Policy, Bank Paper Argues - CoinDesk.” n.d. Accessed November 19, 2018. <https://www.coindesk.com/sovereign-blockchains-will-change-monetary-policy-bank-paper-argues>

[53] Miller, Ron. 2017. “The Promise of Managing Identity on the Blockchain | TechCrunch.” n.d. Accessed November 19, 2018. <https://techcrunch.com/2017/09/10/the-promise-of-managing-identity-on-the-blockchain/>

[54] Susanne Tempelhof, S., Teissonniere, E., Fennell, J., & Edwards, D. 2017. *The Internet of Sovereignty*

currencies can challenge the sovereignty of states”. By comparing bitcoin with central banks, which have monopolized finances, virtual currencies pose new challenges to the central banks control over these important functions, and have “disruptive potential”. In Gareth’s opinion, blockchain is able to claim power from centralized third parties and distribute it through a decentralized network ⁵¹.

Similar ideas can be found in a research paper by South Africa's FirstRand Bank - the report examined the question of central bank-issued digital currencies, and examines what cryptocurrencies might look like. The paper’s conclusion noted that with a beneficent sovereign blockchain, the world will be able to change “at the threshold of the new epoch in financial services” ⁵². IBM technologist Jerry Cuomo also suggested that blockchain technology allows individuals to regain power from centralized information transaction companies ⁵³. In addition, Susanne Tempelhof and Elliott Teissonniere proposed the concept of “the internet of sovereignty”. Contradicting the current world order, which is interpreted as the force that, due to citizens’ competition with each other in order to receive the desired governance outcomes (which often leads to violence and conflict), they imagined a world with global free market for governance service. Namely, they outlined a decentralized, borderless voluntary nation: “Bitnation”. They thus imagined a world where sovereignty shifts decisively from the state to the citizen, and humanity reclaims freedom of choice when accessing such services ⁵⁴. Promising to solve current cities’ redundant exchange services, complicated information connectivity, and heavily governed central entities, blockchain is expected

[55] Gerard, David. 2017. Attack of the 50 Foot Blockchain: Bitcoin, Blockchain, Ethereum & Smart Contracts. createspace Independent Publishing Platform

to change the structure of the centralized financial system, governance and sovereignty.

Despite the positive claims that are widespread and welcomed, blockchain-related technology is still in the early stage, which means there are gaps between imagination and practical application⁵⁵. Not only has blockchain and cryptocurrency's technical maturity been doubted, but people also question cryptocurrency's decentralization and further claim that it promotes capitalism. For example, Erik Voorhees, the co-founder of the bitcoin company Coinapult, indicated that there is a "growing dichotomy" which questions whether bitcoin as well as other cryptocurrencies are truly decentralized and outside of the surveillance of the sovereign governments and global markets. He argued that although bitcoin has no central control, which equates to "no central repository of information, management and no central point of failure", most of the actual services and businesses built within the Bitcoin ecosystem are centralized: they are run by specific people who are actually operating the system; the transaction can only be accessed in specific locations; the system can only be accessed with specific computation system; and the ecosystem is susceptible to specific legal entanglements. This reveals an irony: cryptocurrency is a seeming decentralized technology while most of its instruments are centralized⁵⁶.

[56] Voorhees, Erik. n.d. "Is Bitcoin Truly Decentralized? Yes – and Here Is Why It's Important." Bitcoin Magazine. Accessed October 8, 2018. <https://bitcoinmagazine.com/articles/bitcoin-truly-decentralized-yes-important-1421967133/>

Meanwhile, as proposed by Ken Schortgen – a finance and economic columnist, when compared to the amount of the trading that takes place on the centralized platforms, the amount of actual peer-to-peer transactions in bitcoin are next to

[57] Schortgen, Ken. 2017. "If Bitcoin Is Truly Decentralized Then Why Does It Gain or Lose Value on News Regarding Banks and Global Markets?" The Daily Coin. September 15, 2017. <https://thedailycoin.org/2017/09/14/bitcoin-truly-decentralized-gain-lose-value-news-regarding-banks-global-markets/>

[58] Oyedele, Akin. 2017. "Bitcoin Is a Fraud That's 'worse than Tulip Bulbs,' Jamie Dimon Says - Business Insider." n.d. Accessed October 8, 2018. <https://www.businessinsider.com/bitcoin-price-worse-than-tulip-bulbs-2017-9>

[59] Oyedele, Akin. 2017. "Robert Shiller Says Bitcoin Is the Best Example of a Bubble - Business Insider." n.d. Accessed October 8, 2018. <https://www.businessinsider.com/bitcoin-price-bubble-shiller-best-example-2017-9>

nothing. More than 90% of bitcoin transactions are finished through online platforms, where the "buyers are not interested in using it as the currency but as a speculative investment"⁵⁷. Jamie Dimon, the CEO of the JPMorgan, argued that "bitcoin is a fraud" that's worse than 'tulip bulbs', considering the bitcoin's market value fluctuation. According to his prediction, bitcoin has over 350% rocket-like market volatility and the digital currency will eventually end in a panic selling. Based on this market observation, people questioned whether the value of the bitcoin is manipulated. In other words, if the bitcoin ecosystem is truly outside the purview of the sovereign governments and financial markets, the cryptocurrency should have none influence to the price or to investors trading in the assets, which is not the actual case⁵⁸. Robert Shiller, an economist from Yale, shares a similar skeptical attitude toward bitcoin. He suggested that the bitcoin is the best example of a bubble, in terms of manipulating people's investment mentality, regardless of its decentralization. He explained that bitcoin takes advantages of people's anxieties towards the future in the digital era – a fear of digitization and computers, of not knowing what our place should be in the new world, and thus offers people "the confidence of knowing the future and can actually earn profit from it"⁵⁹. Clearly, there is a general controversy and skepticism about the decentralized nature of cryptocurrency as defended by its promoters.

**Bitcoin
geopolitics**

**Algorithm
modeling**

**Computational
accelerating**

9

FIELDWORK DOCUMENTATION

Monitors

Planetary bitcoinization

Global
positioning

Humans

NO SIGNAL

01 TOILET-2

NO SIGNAL

02 FARM-1300-ACRES

NO SIGNAL

05 CABLE-???

NO SIGNAL

<https://youtu.be>

06 LIGHT-???-LEX

09 VOLTAGE-435-MEGAWATT

10 FAN-???

NO SIGNAL

NO SIGNAL

44°55'49"N, 74°53'33"W
03-12-2019

NO SIGNAL

03 CONTAINER-39

NO SIGNAL

04 MINER-290,000

NO SIGNAL

e/CxuR8TcSiWg

07 AIR-800-°F

NO SIGNAL

08 FILTER-???

11 STORAGE-???

12 MASSENA-380-MILES

NO SIGNAL

NO SIGNAL

00:07:13:11

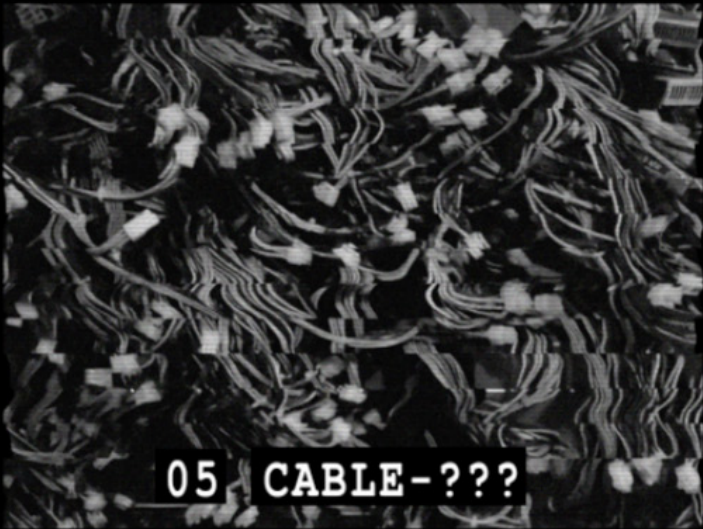
Monitors



01 TOILET-2



02 FARM-1300-ACRES



05 CABLE-???



06 LIGHT-???-LEX



09 VOLTAGE-435-MEGAWATT

44°55'49"N, 74°53'33"W
03-12-2019



10 FAN-???



03 CONTAINER-39



04 MINER-290,000



07 AIR-800-°F



08 FILTER-???



11 STORAGE-???



12 MASSENA-380-MILES

00:07:26:23

Monitors



"BITCOIN GEOPOLITICS"

<https://youtu.be>



e/5Eys0uGkpvs

Planetary Bitcoinization-from Micro Scale to Macro Scale

**Bitcoin
geopolitics**

**Algorithm
modeling**

**Computational
accelerating**

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