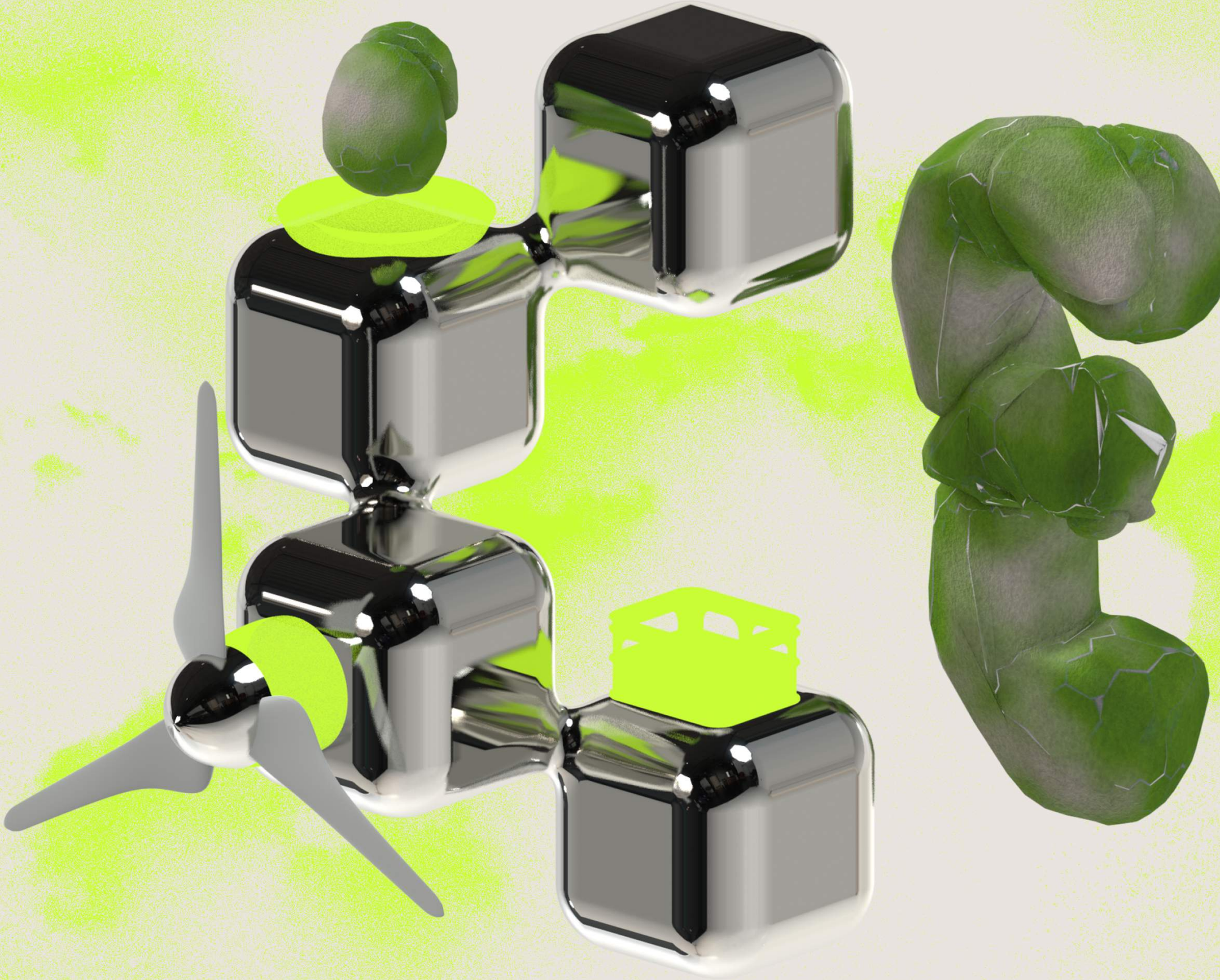
Sustainability and Cryptocurrencies: An Analysis



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beINcrypto

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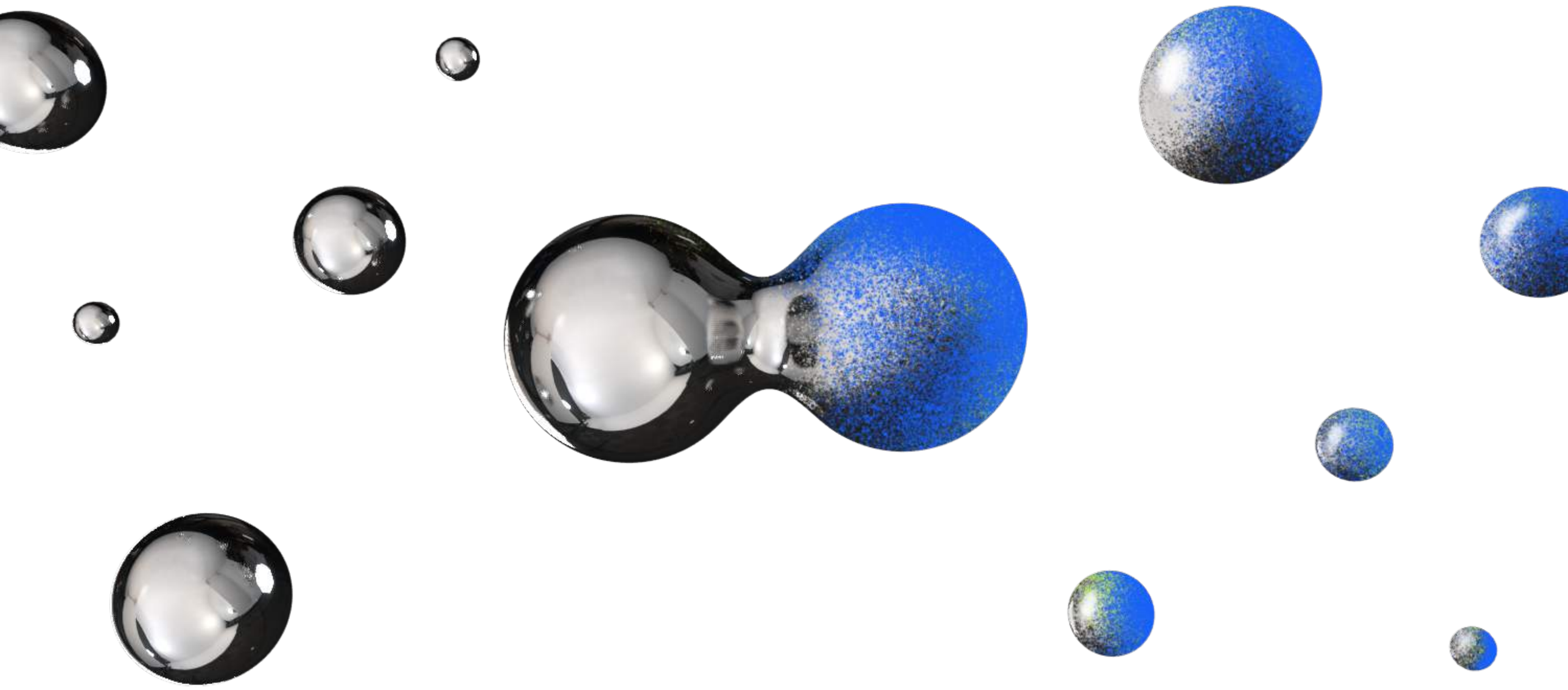
CHAPTER I

— BLOCKCHAIN TECHNOLOGY: MERGER OF CRYPTOGRAPHY AND SMART CONTRACTS

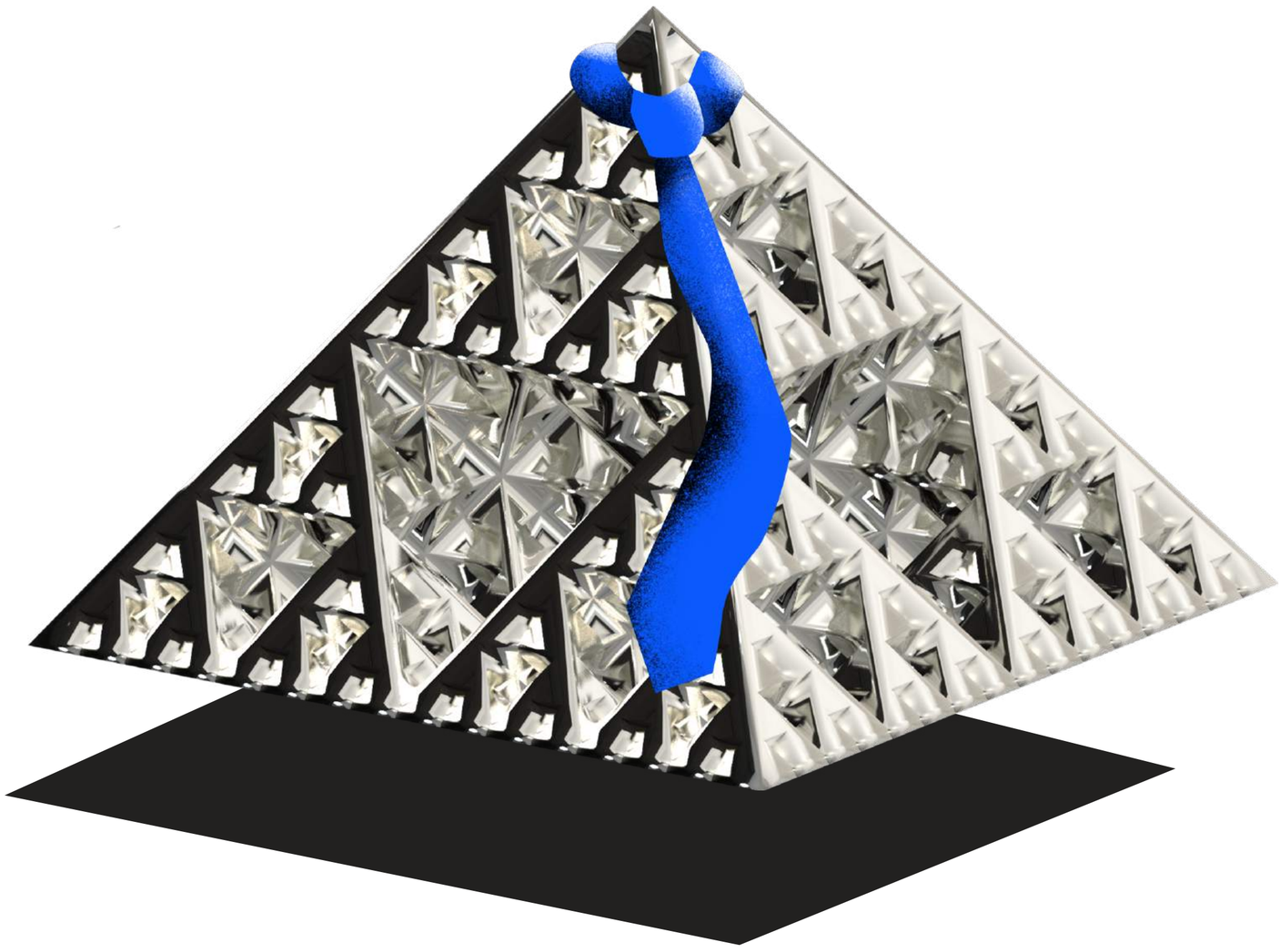
Blockchain Technology: Merger of Cryptography and Smart Contracts

All technology is built on previous layers and percolating concepts. When the conditions are ripe, an assortment of existing elements and needs coalesces into a new, game-changing solution. This is the story of blockchain technology in a nutshell.



Even before the first city states came into existence and established regular trading routes, the question of trust was the underpinning element of all economic activity. How can two parties come to an agreement that is satisfactory for both sides? Who enforces the agreement? What are the penalties in the case it is breached? Are third-party arbiters trustworthy?

To adequately provide solutions for these civilizational concerns, a vast edifice of law, specialists, institutions and hierarchical reputational systems has been erected. There were tweaks here and there, but nothing significantly changed for the bulk of human history. That is, until 1991 when the blockchain concept was proposed as a research project.



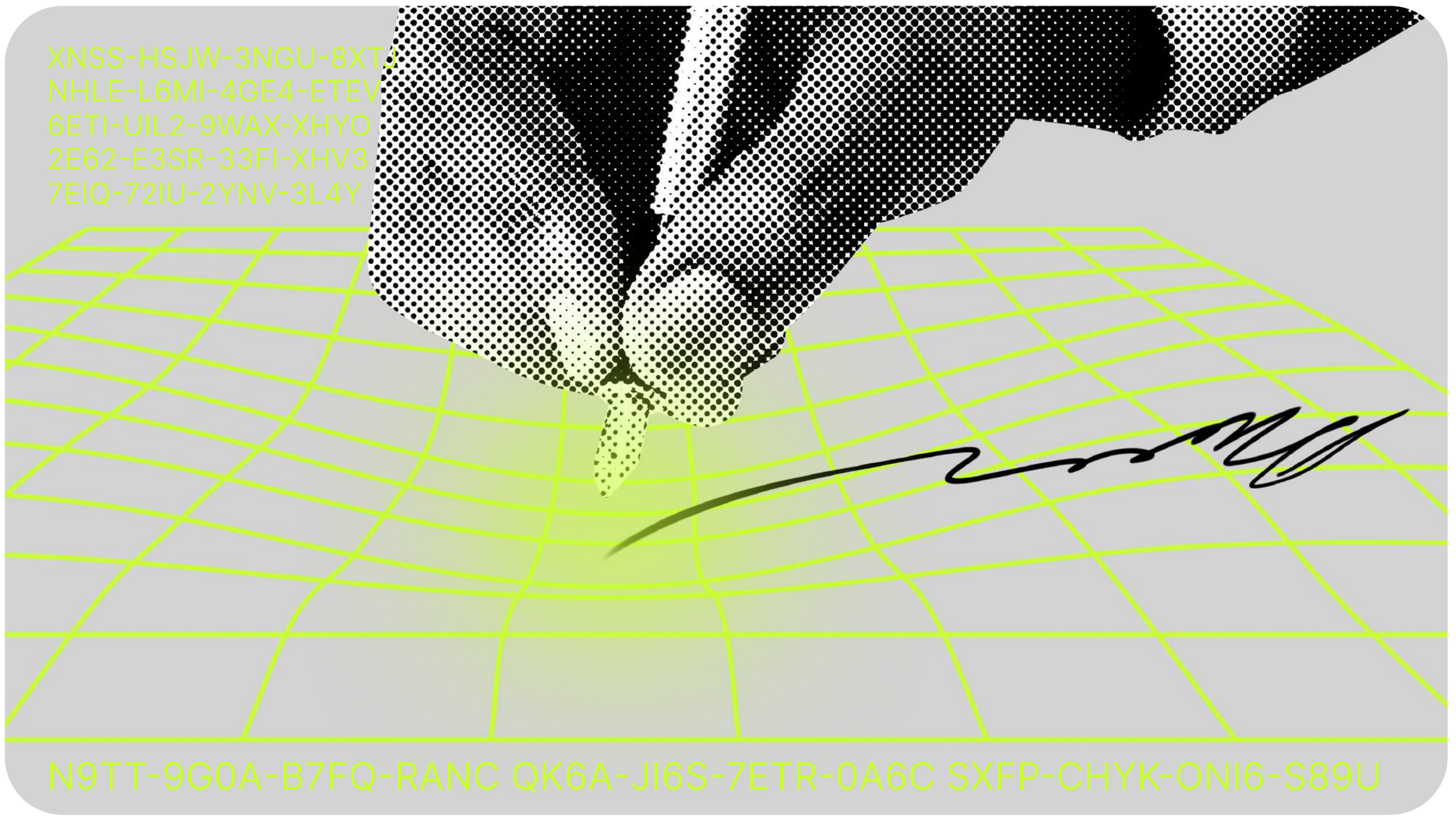
Owing its existence to previous decades of digital technology development, blockchain is a game-changing technology for one simple reason. It distributes the power to access and modify data, hence why it is also called distributed ledger technology (DLT). It chronologically and cryptographically orders data blocks into a time-stamped data chain. Therefore, unlike in traditional databases, such chains cannot be altered without creating a new one — a hard fork.

However, this is just the first step in the blockchain revolution. Five years later, in 1996, cryptographer Nick Szabo came up with the concept of "smart contracts." For the first time in history, they've made it possible to codify and enforce agreements without hierarchical oversight. As Szabo himself put it, the impact of smart contracts cannot be overstated:

> “New institutions, and new ways to formalize the relationships that make up these institutions, are now made possible by the digital revolution. I call these new contracts ‘smart,’ because they are far more functional than their inanimate paper-based ancestors. No use of artificial intelligence is implied. A smart contract is a set of promises, specified in digital form, including protocols within which the parties perform on these promises.”

Therefore, three technological layers had to combine and coalesce into a unified product to represent blockchain technology as we know it today:

- Digital revolution
- Blockchain revolution
- Smart contract revolution

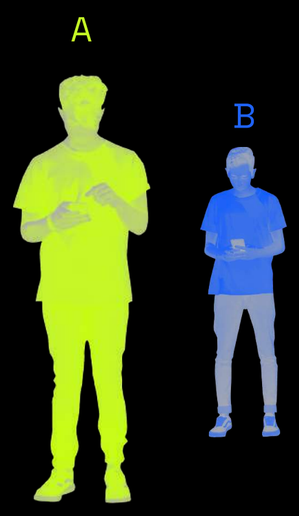


That unified product turned out to be Bitcoin (BTC), created by pseudonymous Satoshi Nakamoto. Utilizing both blockchain and smart contracts, Satoshi harnessed them for a singular purpose — to create a deflationary cryptocurrency as a counter to the inflationary central banking system.

This peer-to-peer electronic cash solves three key problems:

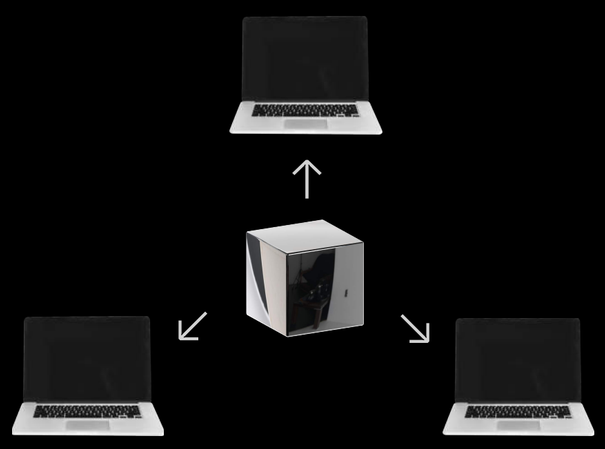
- Authenticity verification
- Digital cash's double spending
- Money supply centralization

Because of its inherent digital nature, in which files can be duplicated ad infinitum, so too can smart contract primitives representing each Bitcoin. Normally, the solution would be to entrust a third-party as a check on this potential double-spending problem. However, this would defeat the purpose of having a pure P2P electronic cash.

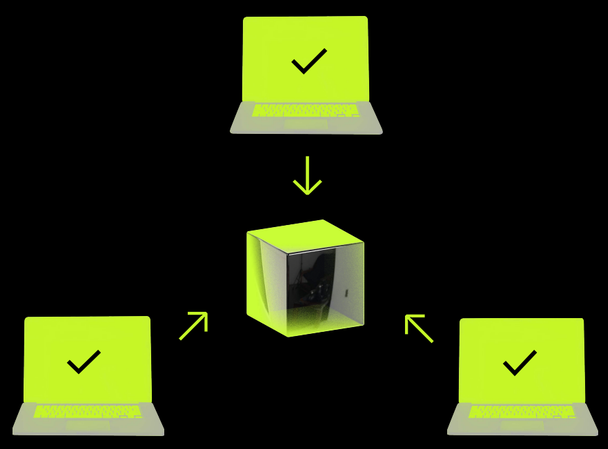


A wants to trasfer
money to B

Transaction is
represented as a Block



Block is broadcasted to
everyone in the network



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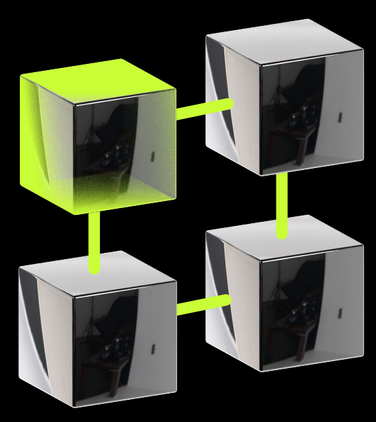
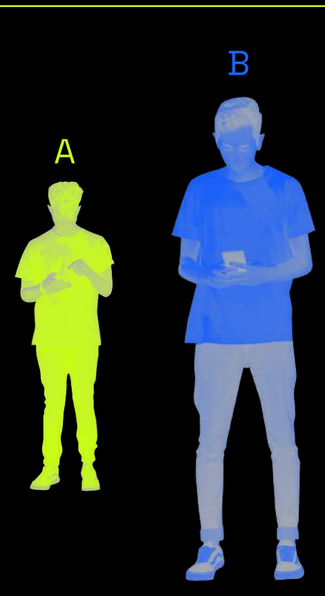


Block is then added to the hcain,
providing and indelible and
transprentrecord of transaction.

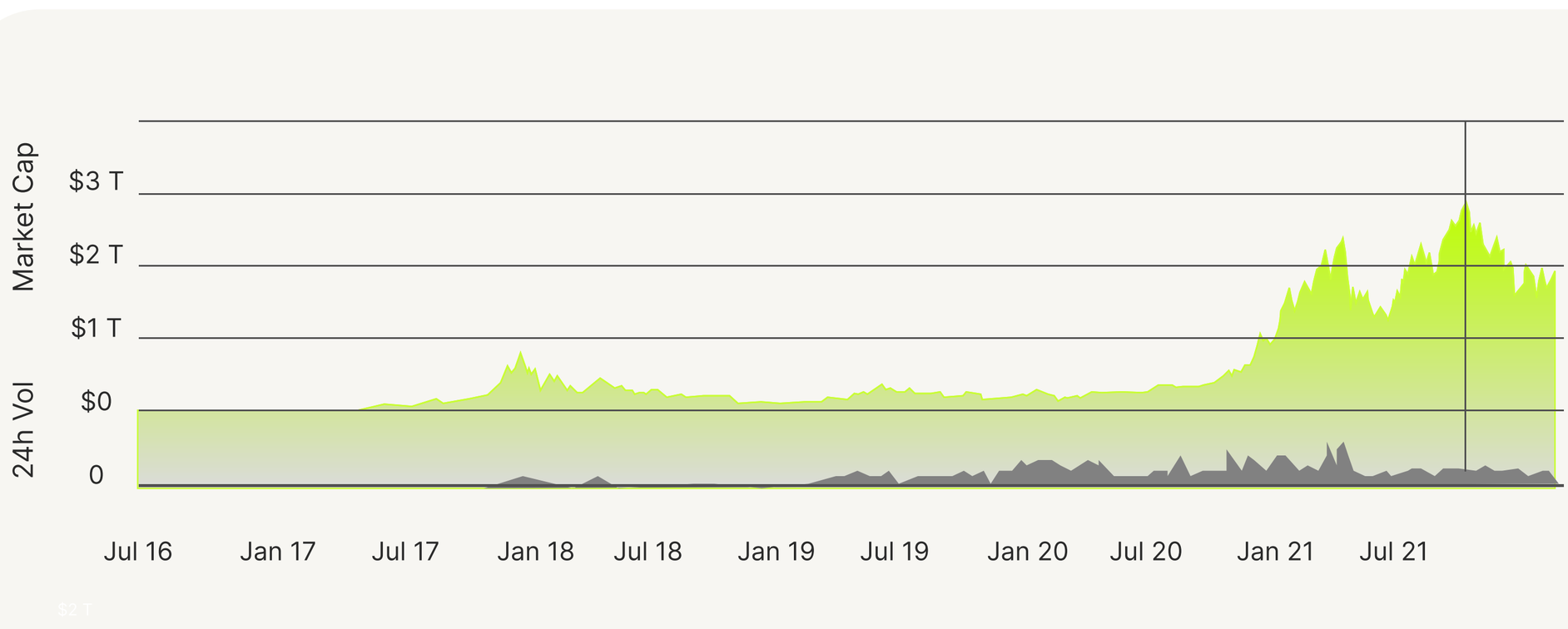


A wants to trasfer
money to B

In turn, Satoshi established a proof-of-work blockchain network to tackle the double-spending obstacle, while also eliminating the need for any institutions. Satoshi did this by imposing a cost on executing transactions (adding new data blocks to the chain), coming from the CPU power as the proof of work.

Combined into such a CPU (hash rate) pool across the network, each node holding the entire ledger maintains the integrity of the Bitcoin chain. As a consequence, the network could only be attacked if the majority of nodes (51%) are compromised.

Fast forward from 2008 to 2022, and Bitcoin served as a vanguard for mainstreaming cryptocurrencies, blockchain as a concept, and smart contracts. At one point, in November 2021, the total crypto market spearheaded by Bitcoin grew to nearly $3 trillion.

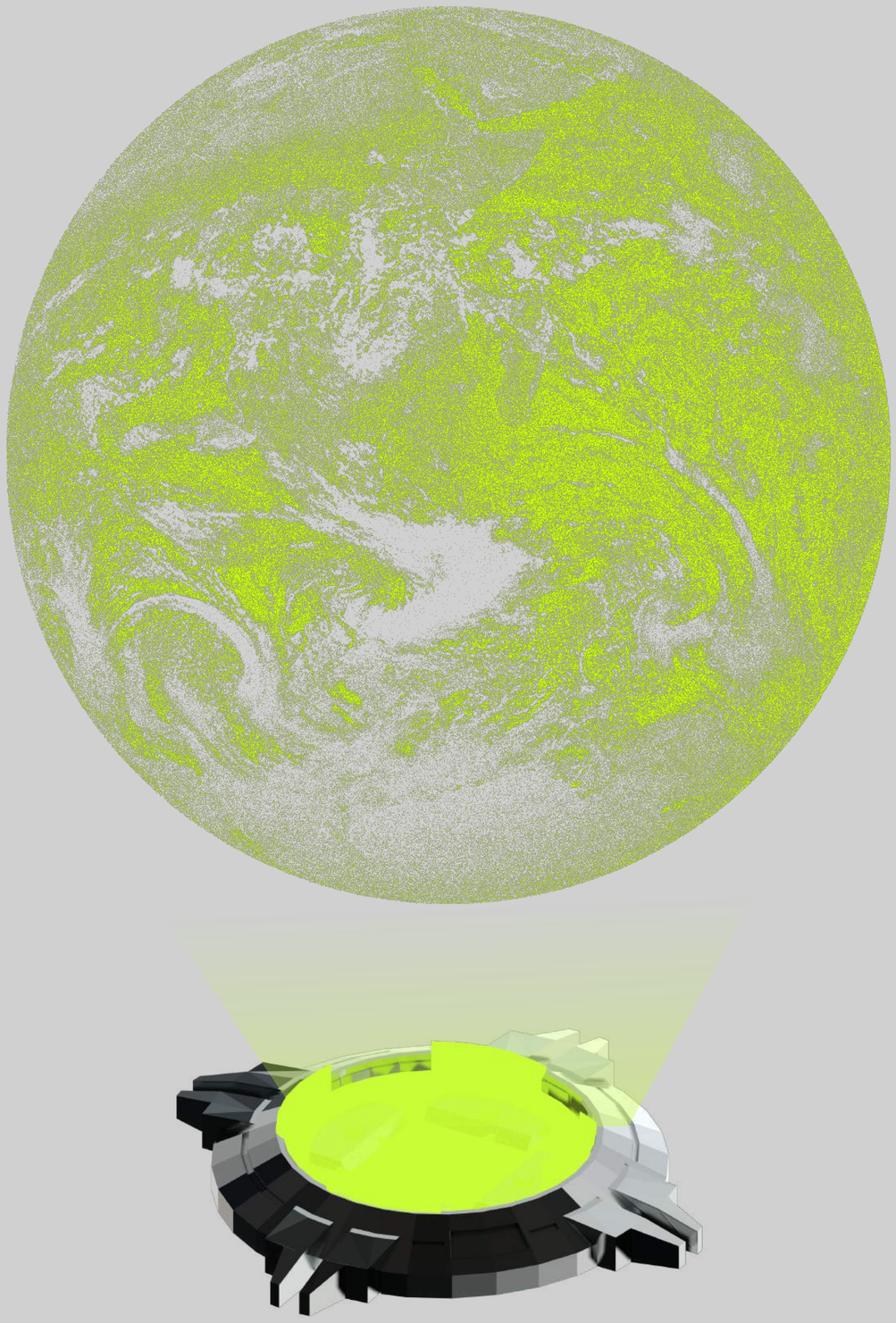


Total cryptocurrency market cap as of March 22th 2022 is holding at $1.93 trillion, a 51% decrease from last November's high point. Source: CoinMarketCap

This 1,327x growth within four years is remarkable for a decentralized industry, native to the internet. Without a doubt, Bitcoin kickstarted a new online economy that spilled over across all sectors of society.

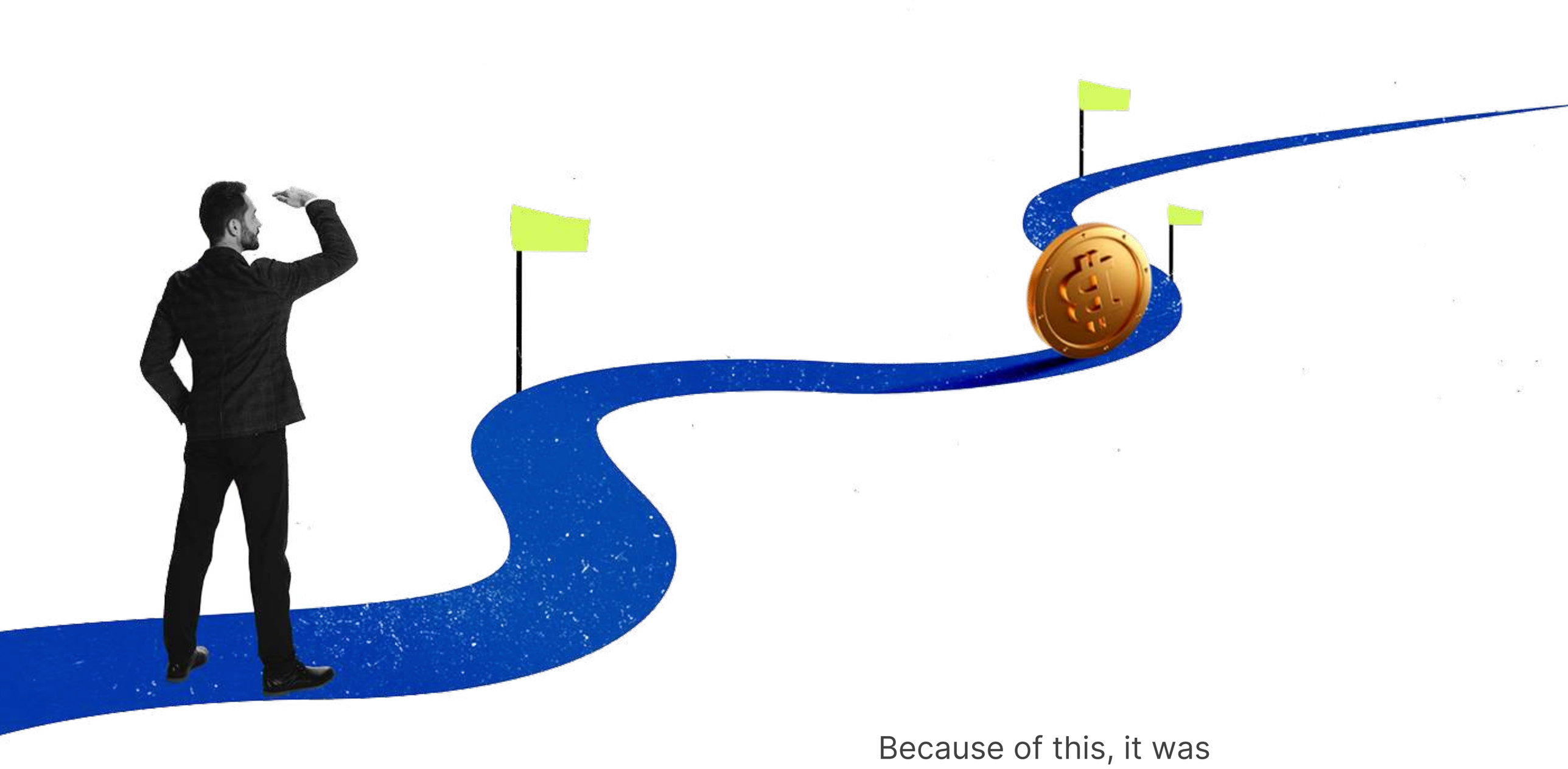
Real-World Use Cases of Blockchain Technology

It is now common to diversify the world of blockchain into Bitcoin and altcoins, or Bitcoin and smart contract platforms such as Ethereum (ETH), Cardano (ADA), Terra (LUNA), Avalanche (AVAX), Solana (SOL), Fantom (FTM) and others. In this diversification, it is often forgotten that Bitcoin's network is also a smart contract platform.



The difference being, Bitcoin's network is solely devoted to deflationary cryptocurrency as its main product. In contrast, other blockchains are generalist smart contract platforms for dApp development and deployment. Yet, through this singular purpose, Bitcoin opened the door for a wide range of blockchain applications.

Bitcoin showcased that record immutability, traceability, security and transparency can be achieved on a global scale at a relatively low cost.



Because of this, it was inevitable that Bitcoin's two foundational blocks — blockchain and smart contract — would spread to all human activity that deals with the transfer of value, regardless of its form.

Semiconductor

- Support supply chain traceability for products
- Provide system of record for capital equipment lifecycle manageemtn
- Enable trasnparency on intercompany transactions

Software

- Support supply chain traceability for products
- Provide system of record for capital equipment lifecycle manageemtn
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Hardware

- Support supply chain traceability for products
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IT Services

- Support supply chain traceability for products
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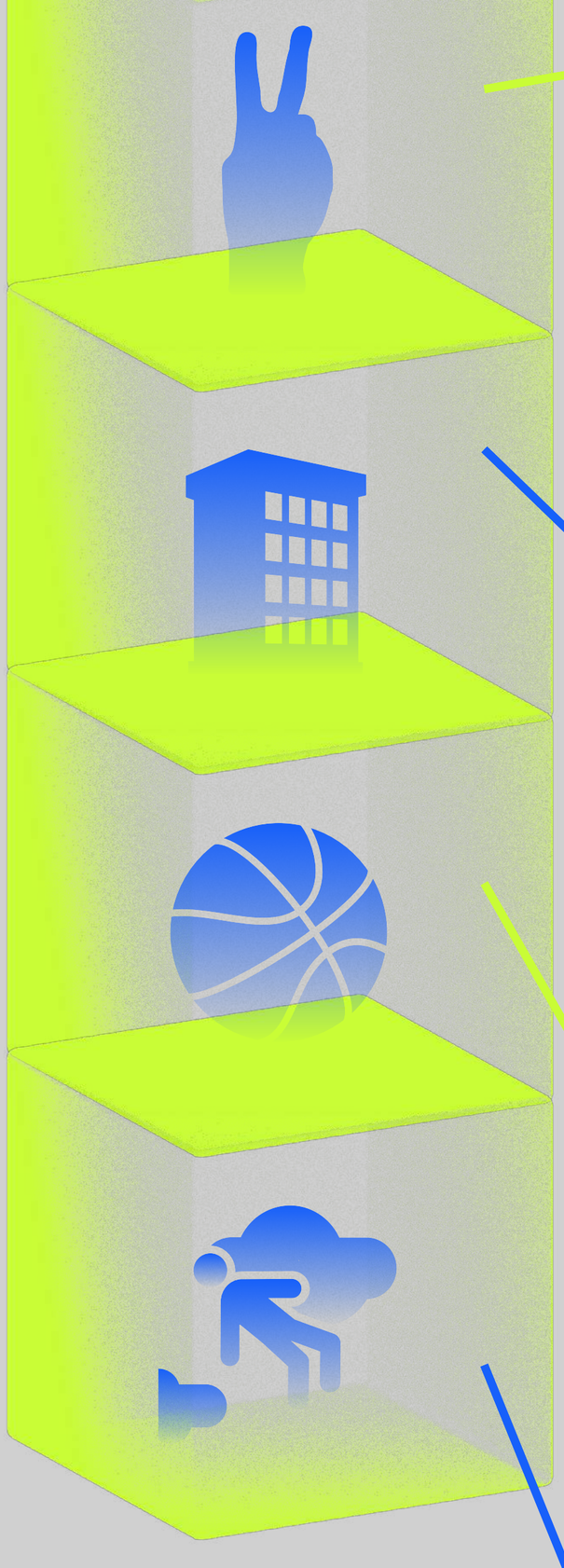

Communication

- Support supply chain traceability for products
- Provide system of record for capital equipment lifecycle manageemtn
- Enable trasnparency on intercompany transactions

Infrastructure

- Support supply chain traceability for products
- Provide system of record for capital equipment lifecycle manageemtn
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Entartainment

- Support supply chain traceability for products
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Social, Digital Advertising

- Support supply chain traceability for products
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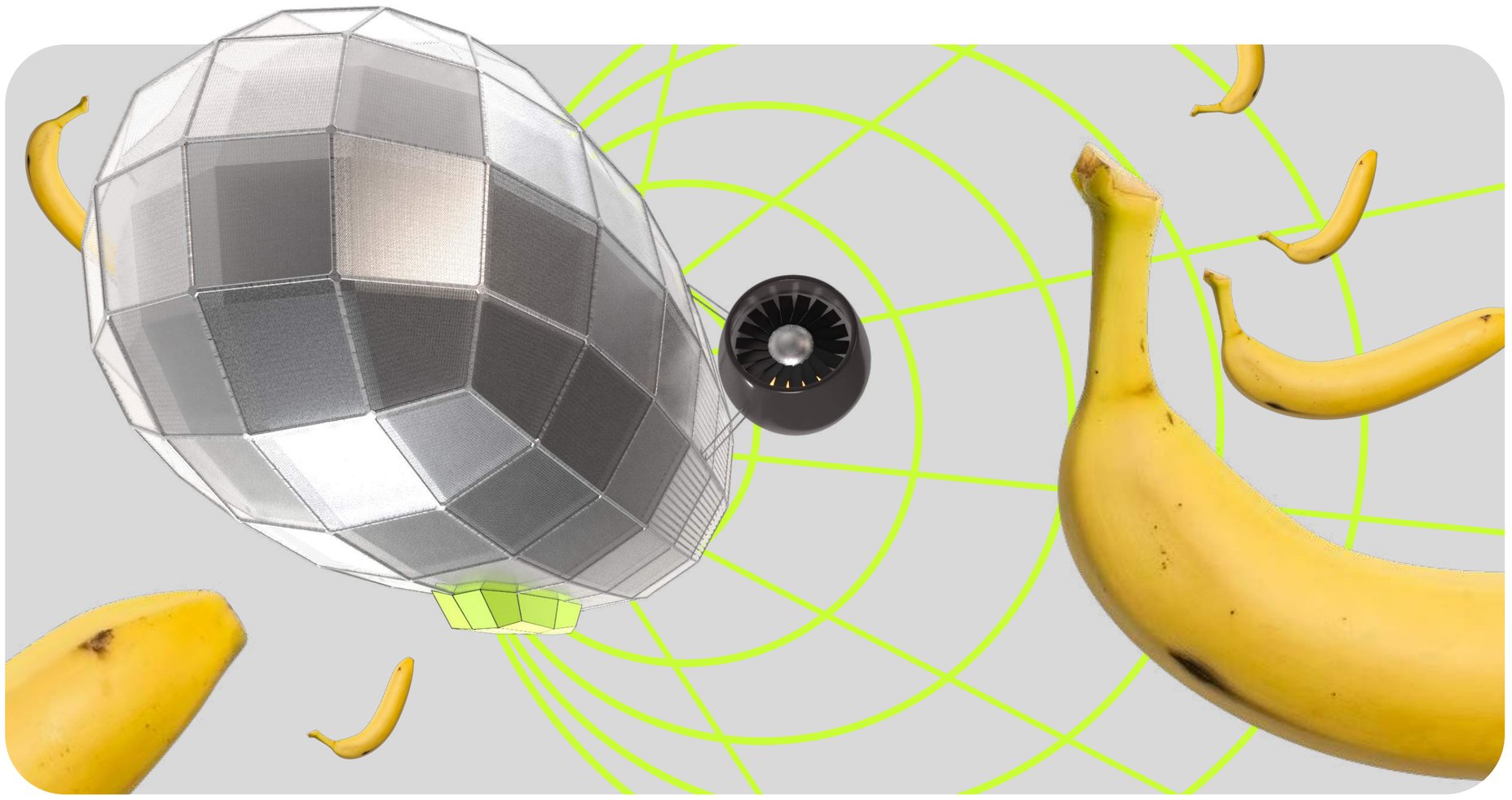
- Enable trasnparency on intercompany transactions

Blockchain In Food Supply Chain/Logistics



Trust and verification is paramount in many industries but not as much as in the food industry. Not only is it vital for sustenance and health of the population, but its complexity is daunting when one takes into account every cog of the operation, from planting and harvesting to end-point store delivery.

The iconic IBM knows this well, which is why the international conglomerate launched IBM Food Trust, a permissioned blockchain platform that aims to:

- Minimize food waste and fraud.
- Increase food freshness when delivered.

- Increase food safety.
- Increase food supply chain efficiency by facilitating better coordination through a shared digital record.

When plugged into the IBM Food Trust network, all participants gain access to real-time data on location and status of food products. This way, the system can detect inefficiencies and develop a better business model, and account for the costs associated with product transfer.

More importantly, a blockchain network eliminates traceability of food supply done on paper. Needless to say, such a legacy system is prone to economically motivated adulteration (EMA), commonly referred to as food fraud. The Food & Drug Agency (FDA) regularly encounters diluted products such as olive oil, honey, maple syrup, juice, seafood, and spices, all prone to mislabeling.

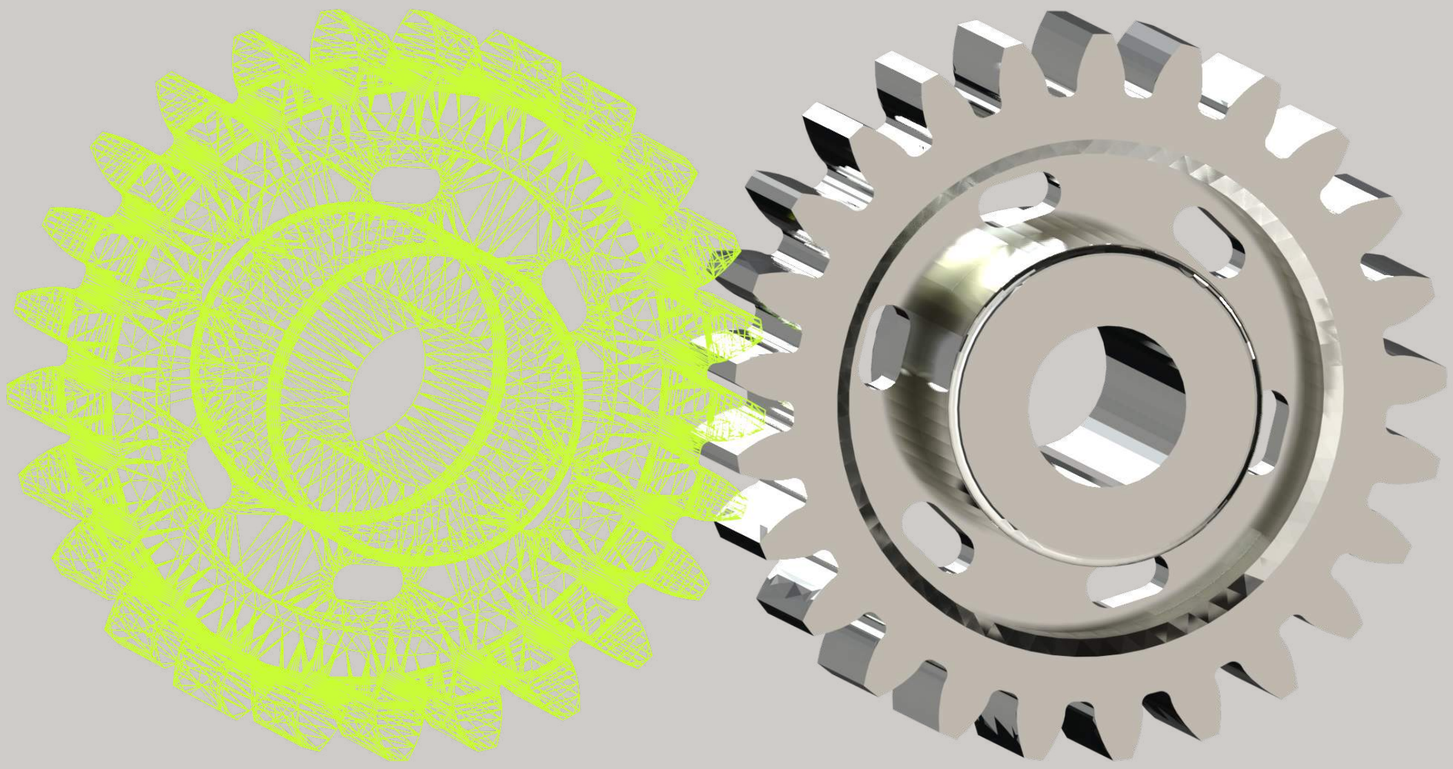
With an immutable record like IBM Food Trust employed, all cogs of the food supply chain are accounted for in real-time, so it becomes exceedingly difficult to commit EMA without being detected. By the same token, such transparency can have an adverse economic effect as well. For instance, if there is a breakout of a plant disease during food production, which is quashed with a pesticide, such a product might receive market rejection.

For this reason, IBM Food Trust is a permissioned blockchain instead of public. Bext360 is a similar blockchain platform, providing scalable, configurable software-as-a-service (SaaS) solutions to bring greater accountability to food production. In practice, major corporations have been using blockchain solutions to trace product origin, helping in recall and ensuring quality:

Walmart switched to blockchain traceability following an E.coli outbreak of leafy greens encompassing 19 states in 2020. Now, Walmart's suppliers are required to enter immutable data, so every product can be traced right back to the farm of origin. The difference is reaction time measured in minutes instead of weeks to manually trace contaminants.

Likewise, Nestle tracks its Rainforest Alliance coffee brand, so that both providence and sustainability of coffee beans can be verified. On the consumer end, when a customer scans a QR code from such a plugged-in product, they receive the entire data chain involved in the production: who grew the coffee beans, harvesting period, roasting period, and shipment data.

Blockchain In Energy And Sustainability

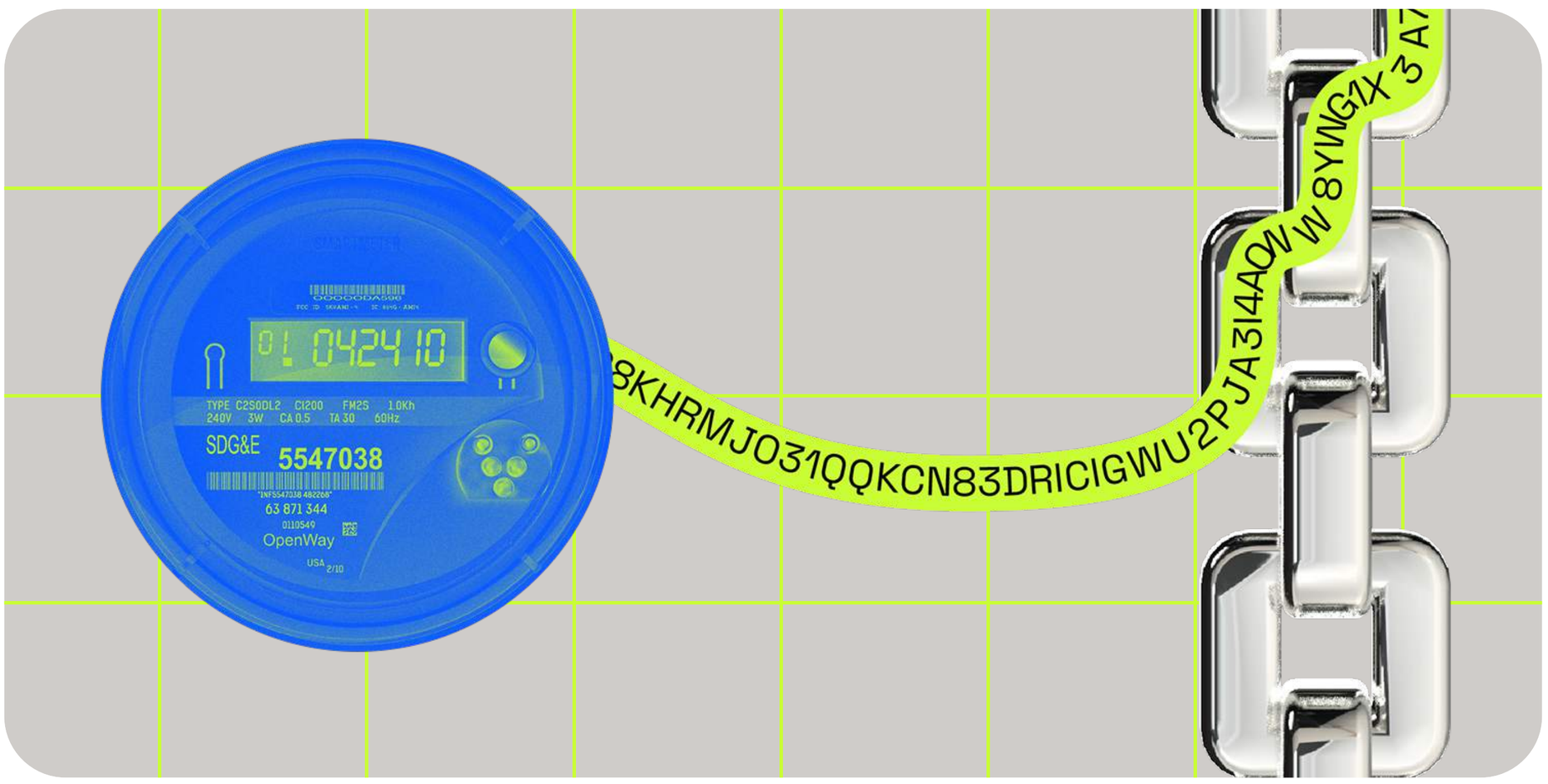


As the Ukraine-Russia conflict bifurcates both financial and commodity markets, it is more important than ever to streamline how we use energy sources. Specifically, how to develop "smart energy" or "smart grid". The European Commission defined smart grid as:

> *“an electricity network that can intelligently integrate the actions of all users connected to it generators, consumers and those that do both in order to efficiently deliver sustainable, economical and secure electricity supplies”*

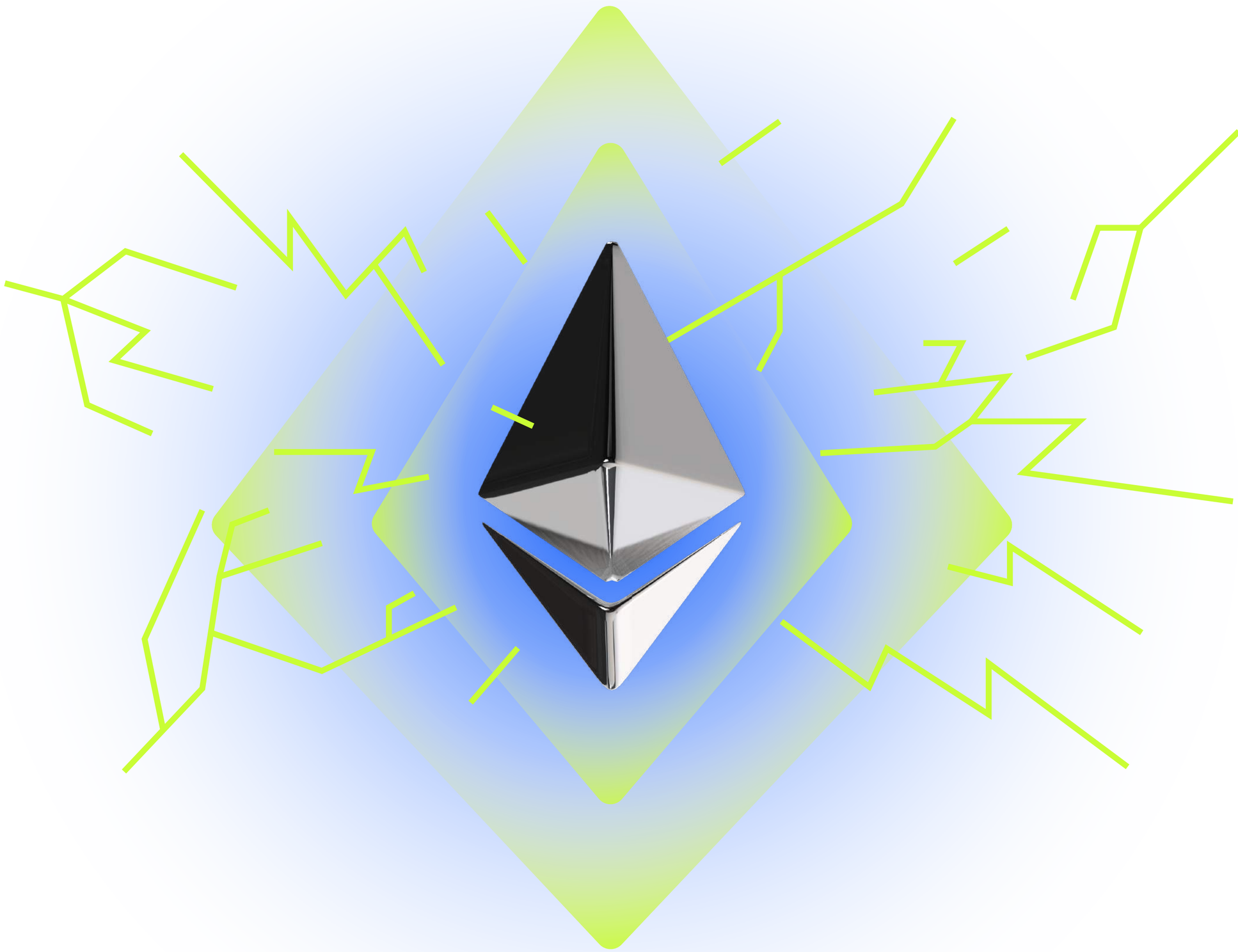
In practice, this translates to following features facilitated by blockchain networks:

- Meter transparency
- P2P energy trading
- Data security
- Compliance with energy laws
- Real-time energy price updates, fed to the blockchain network by oracles



This is made possible by IoT (Internet of Things) devices in the form of smart meters. Through oracles, this data is then fed to the immutable blockchain. On top of which is a software platform that makes it easy to access data and enable energy trading between a wider type of energy infrastructure participants.

Case in point, when Chile launched its version of smart grid in 2018, it opted for Ethereum to store and track energy usage. This was not done by accident. As a public blockchain, Ethereum lends itself to public scrutiny, as metered data is often prone to manipulation or administrative error. Having an immutable record of energy usage makes it easy to detect such discrepancies.



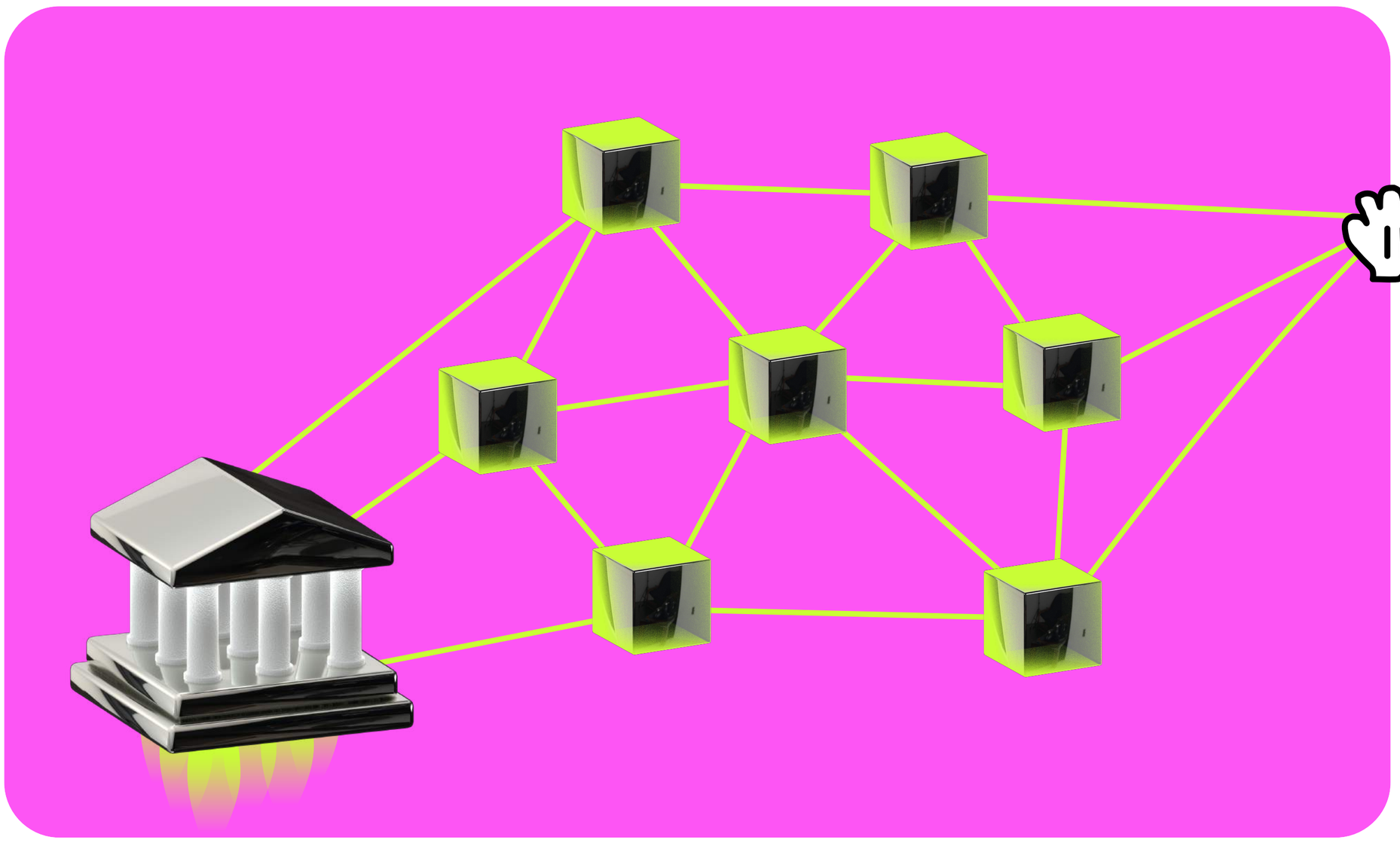
However, the biggest benefit of blockchain-enabled systems in energy infrastructure is P2P trading. This is best exemplified by Australian company Power Ledger, having spread out in 11 countries since its launch in 2018. Power Ledger has been creating micro-grids with the help of smart meters, as networks on top of national grids.

With energy accountable down to every kilowatt, residents can trade them between each other, thus creating an agile and distributed energy market. So far, Power Ledger has supplied its blockchain solution to French ekWateur, Thailand's TDED, and Australia's CUB energy retailers.

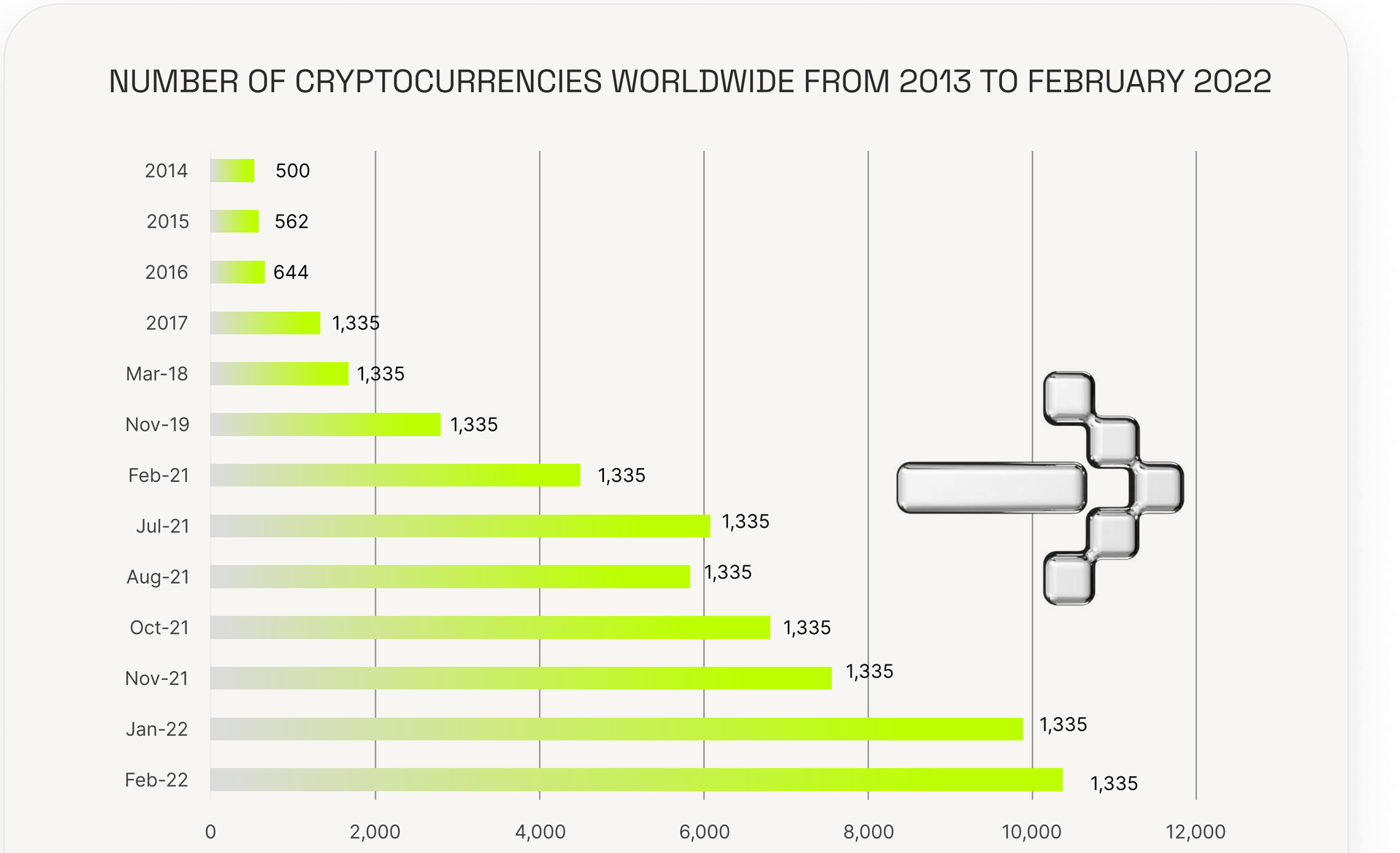
Dr. Michael Gebert, Chairman of the European Blockchain Association e.V., believes that the technology can actually help us, saying,

> *“I think Green Climate Funds and the use of Blockchain, and Distributed Ledger Technologies (DLT) could actually help us face the climate crises since new financial technologies have the potential to boost international climate funding. DLT could support climate action in two ways. One, by making transactions more transparent and standardized, two, by making monitoring and accrediting processes more efficient. If we take for example the Green Climate Fund, DLT could help the fund's work in areas like multi-stakeholder coordination and effect evaluation.”*

Blockchain In Crypto and DeFi



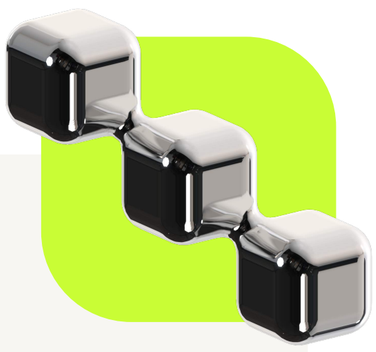
Since Bitcoin launched on January 3rd, 2009, to February 2022, over 10,000 cryptocurrencies have been launched. However, digital assets are easy to create, as demonstrated by Jackson Palmer and Billy Markus. By their own account, they created Dogecoin (DOGE) over a single weekend by tweaking Litecoin code.

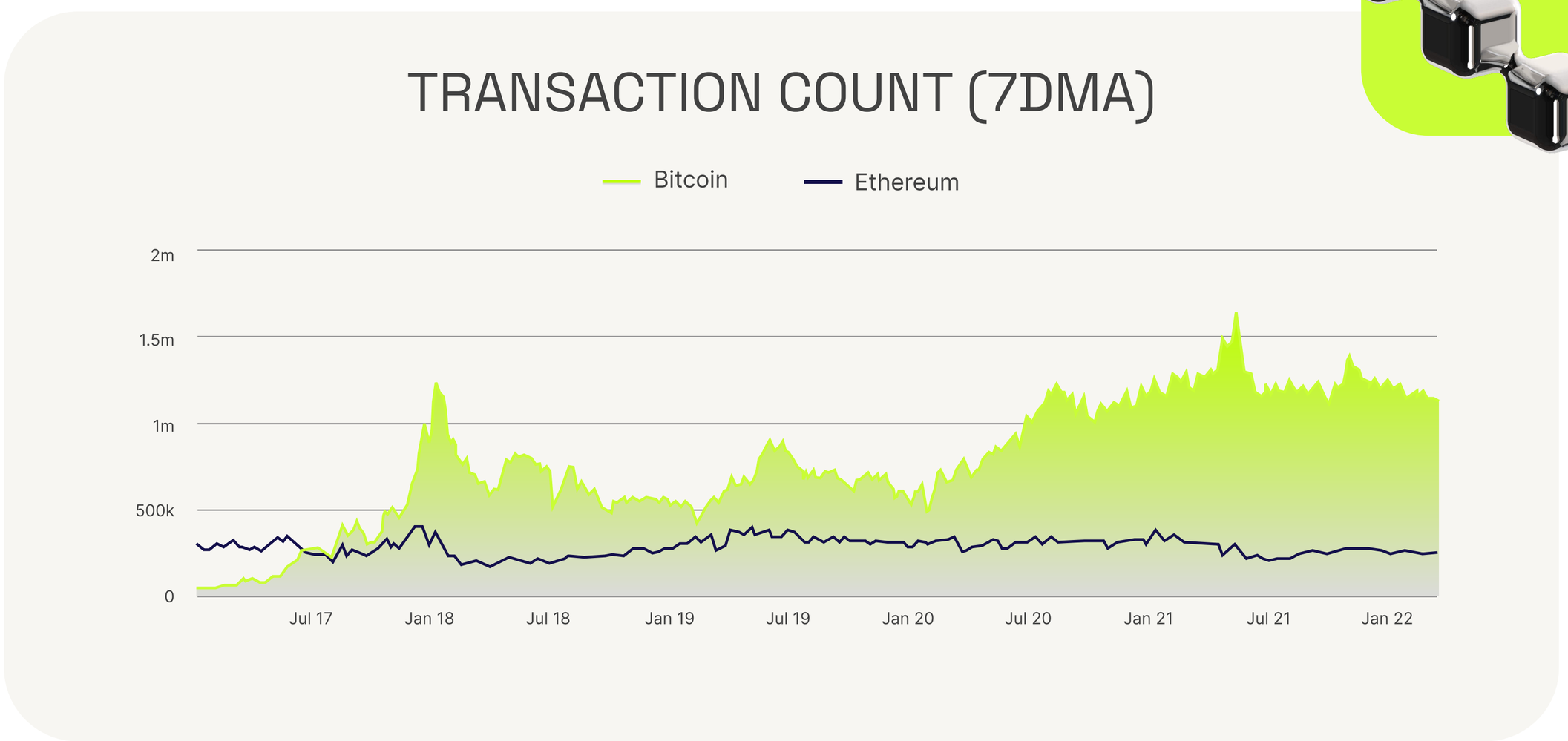


That is to say, out of those 10k altcoins, only a tiny fraction has significant market share and practical use. In numbers, the top 20 cryptocurrencies make up almost 90% of the total crypto market cap. Bitcoin (BTC) alone holds a 42% market share.

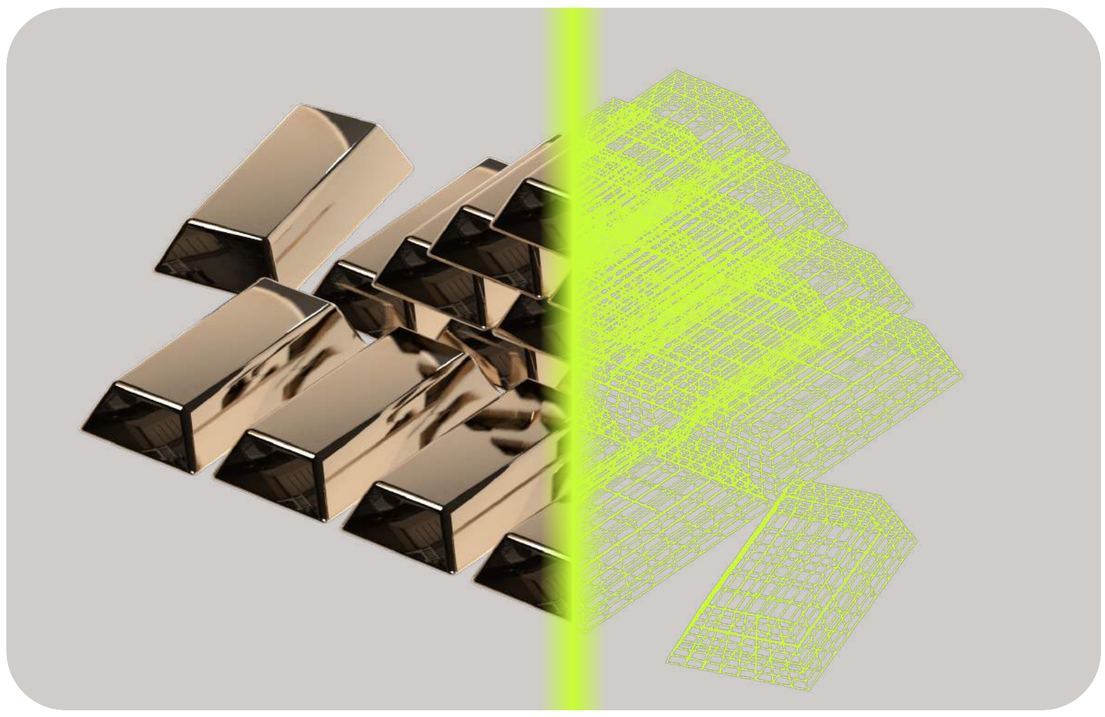
At second place is Ethereum (ETH) with a $413 billion market cap, which is 54% lower than Bitcoin. However, as a generalist smart contract network, Ethereum has a much more dynamic ecosystem consisting of 2,945 dApps — decentralized applications ranging from blockchain games and NFT marketplaces to lending protocols and DAOs (Decentralized Autonomous Organizations).

dApps should not be confused with smart contracts. Rather, they serve as a web interface to blockchain's smart contracts. Given its more dynamic nature, Ethereum has 357% more transactions than Bitcoin, at 1.17 million vs. 256k respectively.

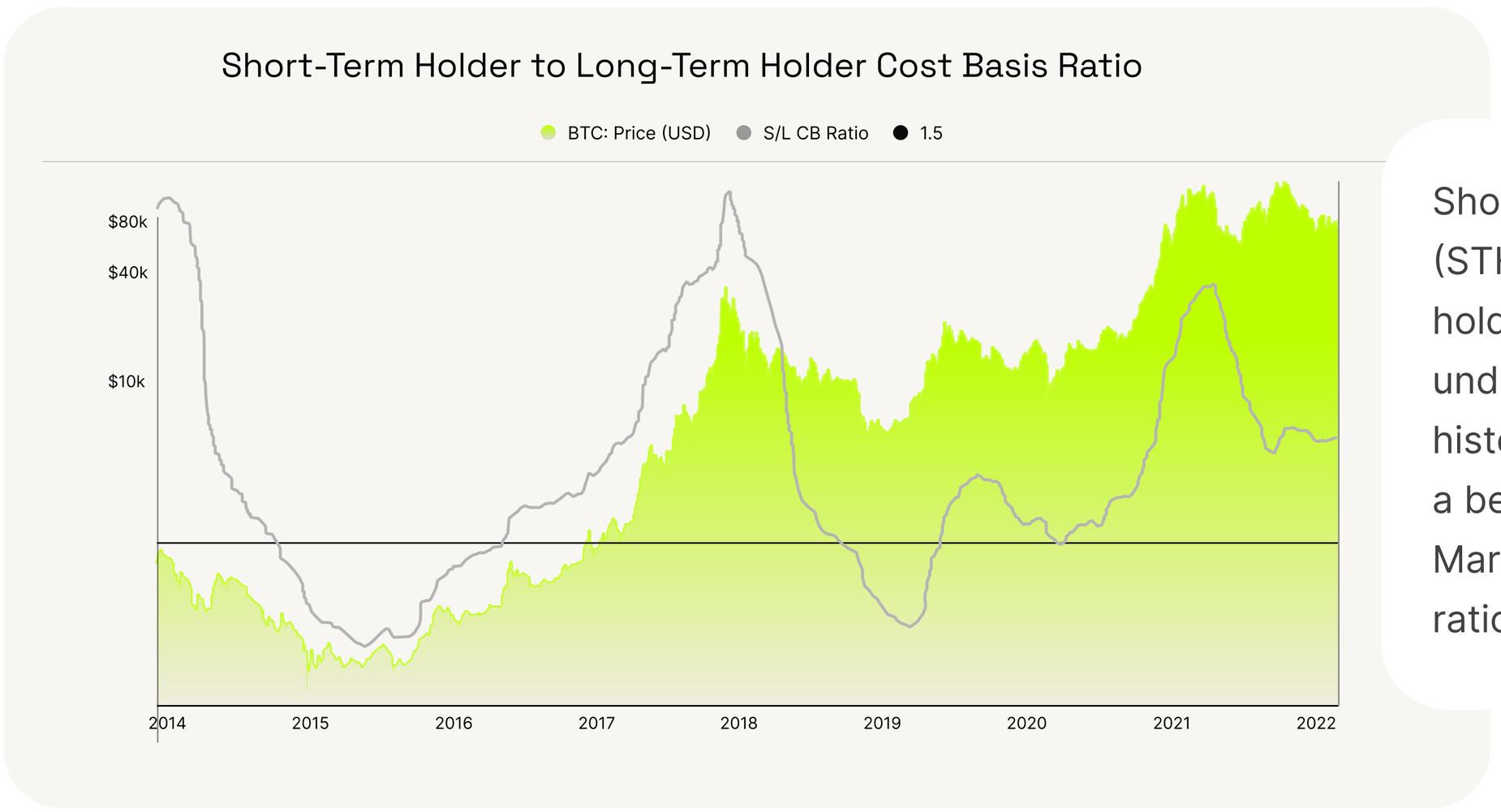




In turn, Bitcoin has moved on from Satoshi's original vision as electronic P2P cash and become more of a store of value, effectively becoming a digital representation of gold. This is exemplified by the fact that long-term-holders (holding BTC over 155 days) make up 71% of Bitcoin's total circulating supply.

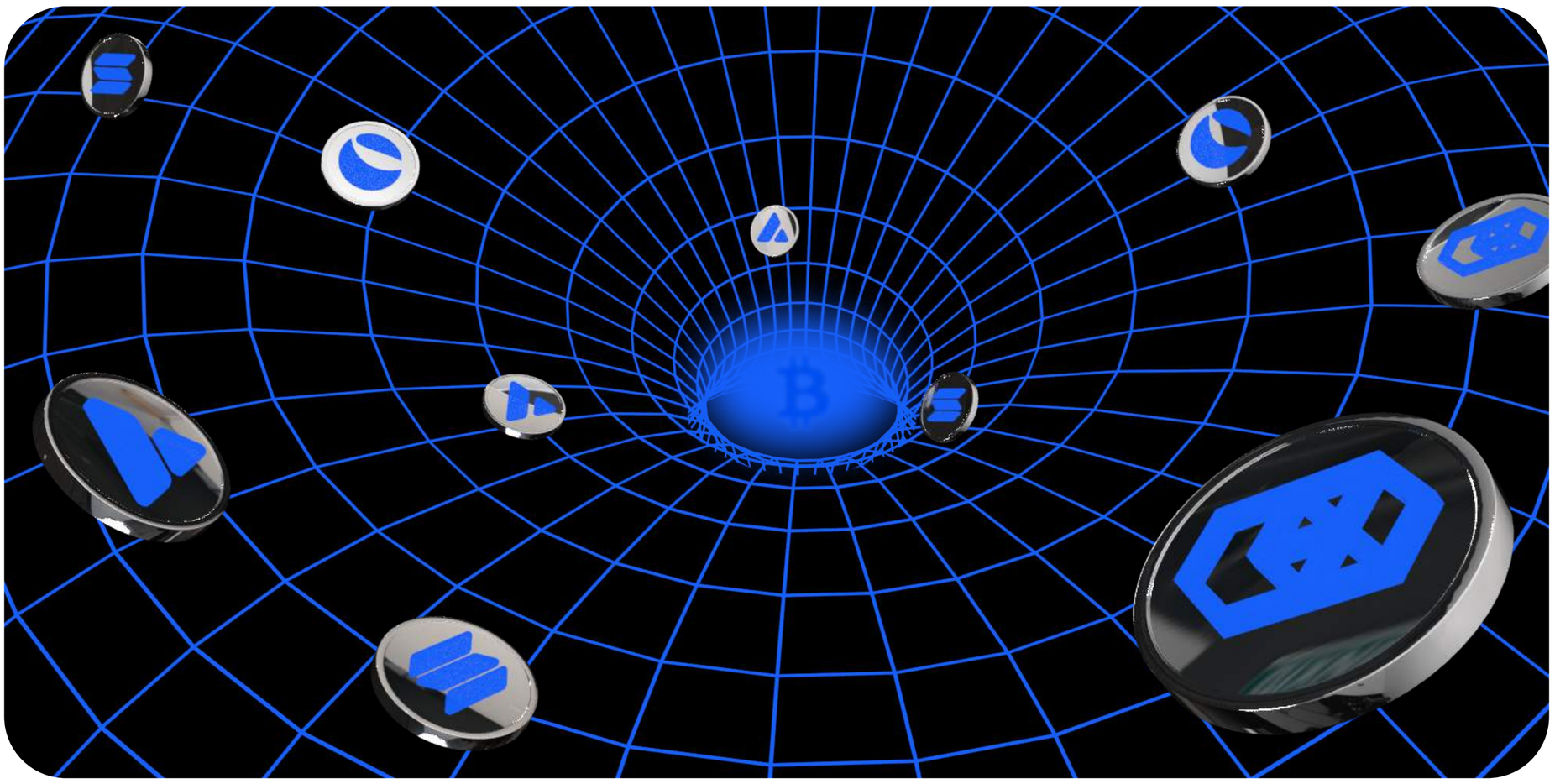


With a high STH to LTH ratio, this means that Bitcoin's health as a digital asset is very strong.



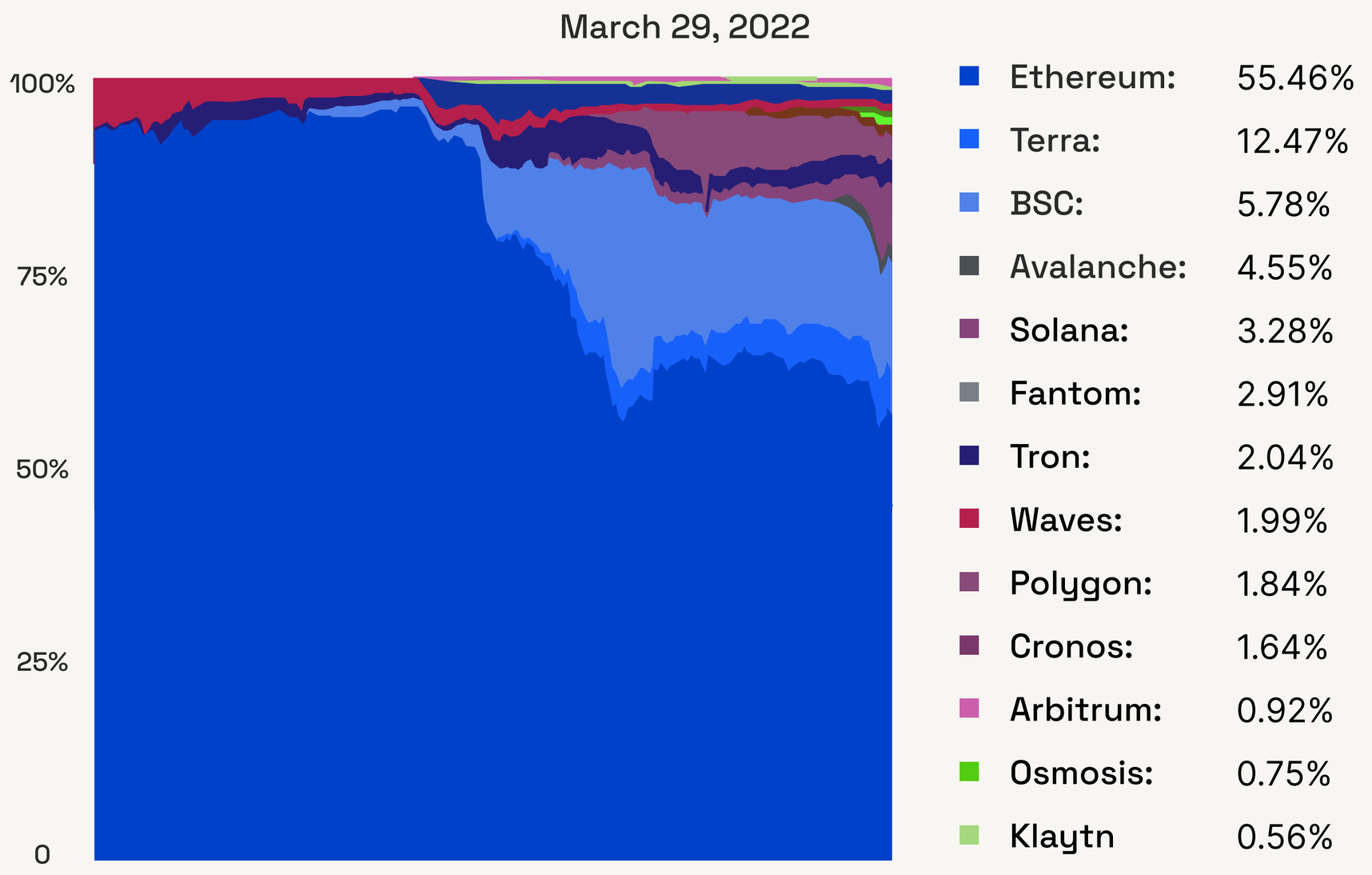
Short-term holder (STH) to long-term holder (LTH) ratio under 1.5 has historically signaled a bear market. As of March 22th, this ratio is at 2.8.

This is important to note as Bitcoin is still the dominant gravitic force in the crypto market. As it falls or rises, it pulls or pushes other altcoins with it. When it comes to altcoins beyond Ethereum, there has been a major diversification of smart contract alternatives.



While Ethereum holds dApp dominance at 73% of all dApps, this is not reflected by its market share. During the last year, Terra (LUNA) gained a large DeFi foothold at 12.47%, which is $28.41 billion total value locked (TVL) compared to Ethereum's 55.46% ($126.32 billion).

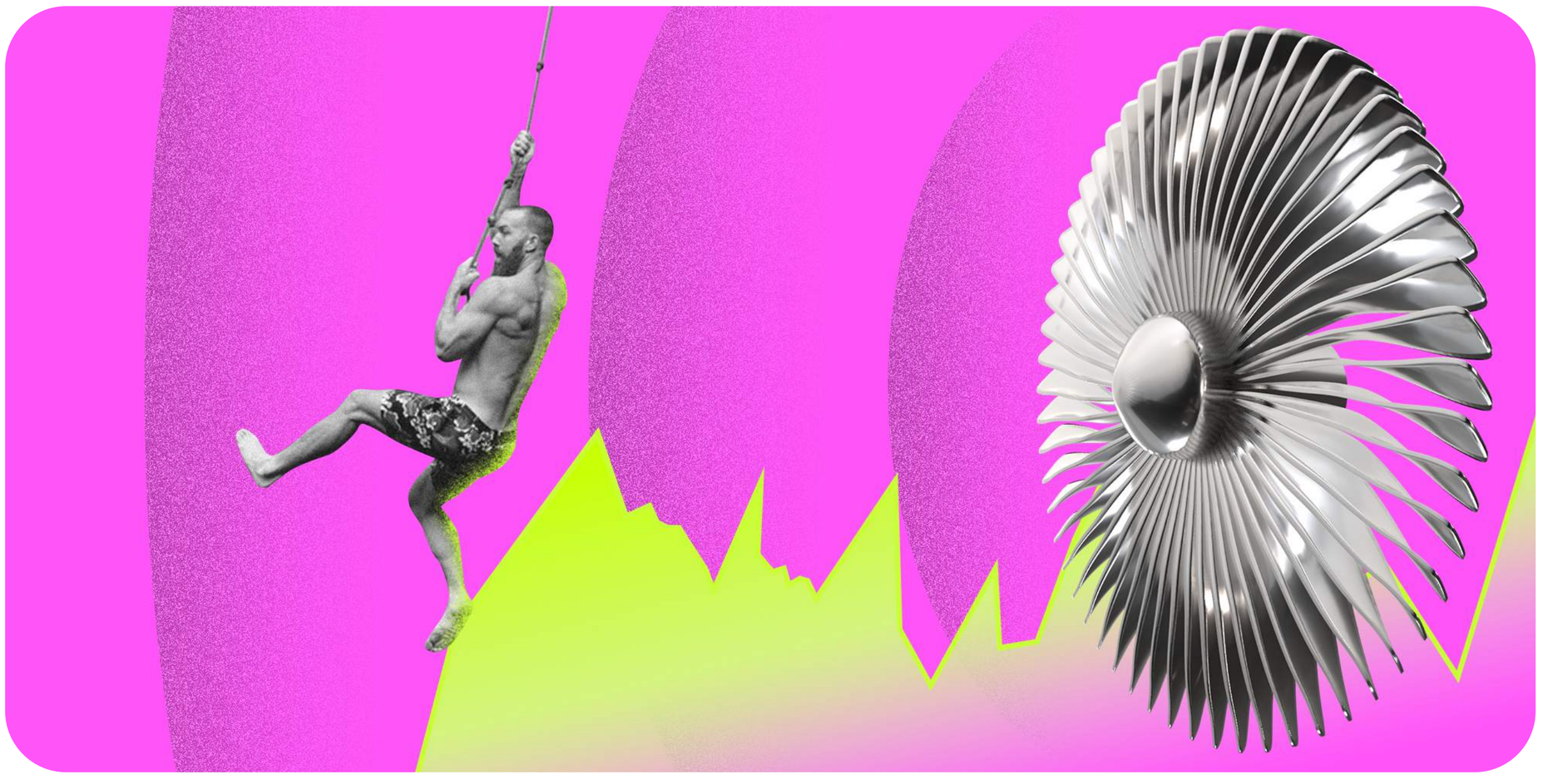
In this way, Ethereum is losing DeFi dominance just as Bitcoin is losing overall crypto dominance. To the surprise of many investors, Terra (LUNA) surged ahead of previously dubbed "Ethereum killers," such as Solana (SOL), Avalanche (AVAX), and Fantom (FTM).



The main reason for Terra's surge lies in its wide adoption in South Korea serving as a fast and cheap payment network. Specifically, the payment app CHAI which has over 25 million users, running on Terra's blockchain. Furthermore, Terra's algorithmic blockchain TerraUSD (UST) is an elegant solution to solving stablecoin collateralization.

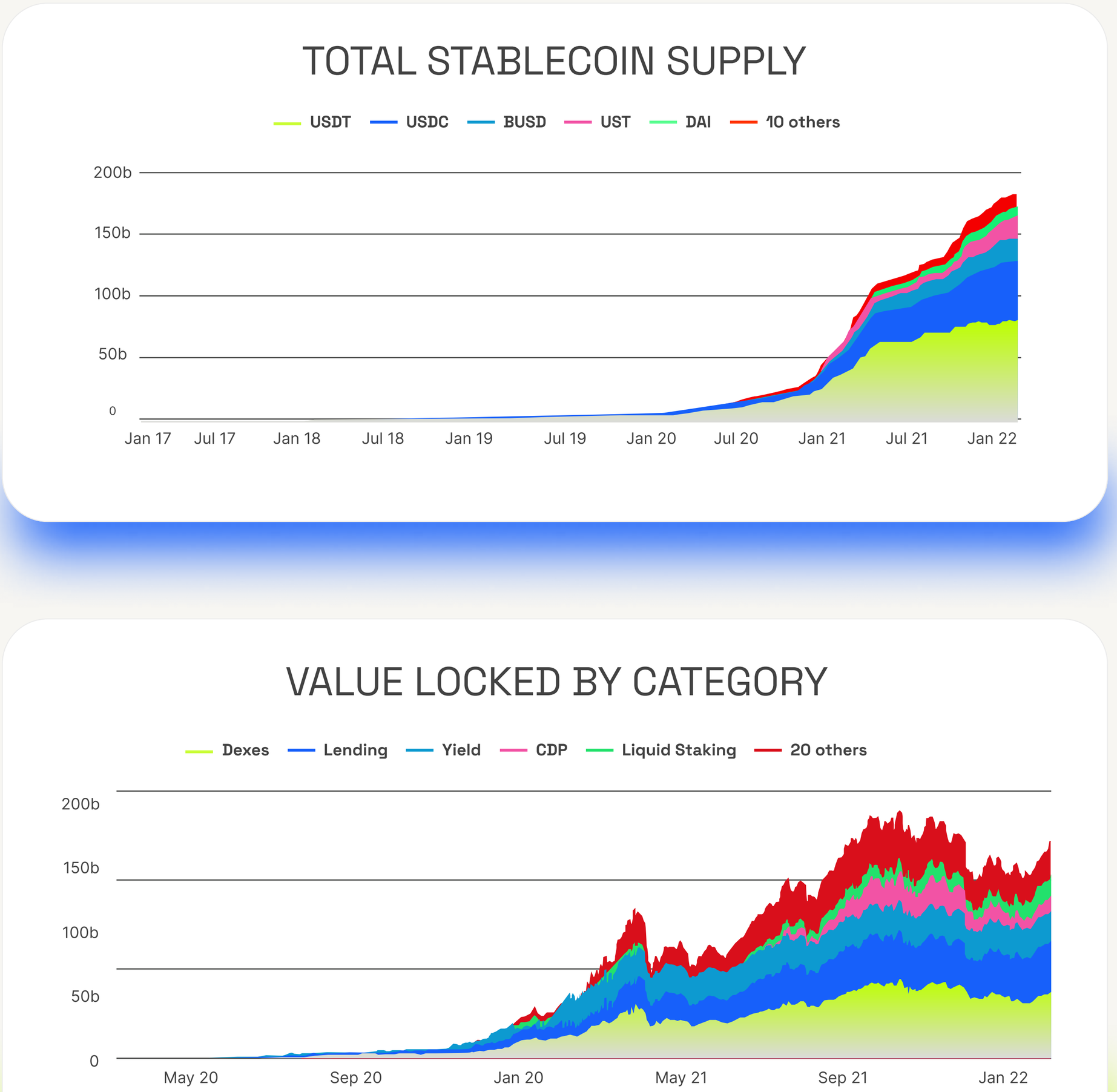
While stablecoins such as USD Coin (USDC) or Tether (USDT) rely on institutional collateralization, Terra uses a decentralized solution. By contracting and expanding its supply in conjunction with Terra's LUNA native token, UST maintains its peg to the dollar. In turn, traders earn rewards from selling or buying LUNA, regardless if its supply contracts or expands.

By the same token, Terra's Anchor protocol serves as a viable replacement for a traditional savings banking account, offering a drastically higher interest rate for depositing idle stablecoins. Overall, the stablecoin market has grown alongside Ethereum's dApps, providing a haven from crypto volatility.



Unfortunately, algorithmic stablecoins have a long road ahead of them to gain mainstream acceptance. Due to extreme market stress, LUNA price collapsed, bringing down UST stablecoin with it. This caused a complete Terra ecosystem meltdown, wiping out at least $45 billion in crypto wealth.

In addition, stablecoins offer drastically higher interest rates compared to traditional banking savings accounts due to their higher demand. With a skewed demand/supply for stablecoins, it is common to see up to 9% APY (annual percentage yield) compared to banks' average of 0.06%. In short, stablecoins and DeFi go hand-in-hand.



Between March 2020 and March 2022, stablecoins grew from $7.5 billion to $186 billion. This was in lockstep with the growth of Ethereum's dApps for lending and token-swapping. Source: The Block

Outside of nullifying volatility and offering higher interest rates, stablecoins offer more efficient borderless payments, with 24/7 near-zero fee transfer service. Gnosis Chain (former xDAI), Terra, and TRON are just some of the DeFi blockchains aiming to replace the likes of Visa and Mastercard.

CHAPTER II

— NOT ALL CRYPTO CURRENCIES ARE CREATED EQUAL

Not All Cryptocurrencies Are Created Equal

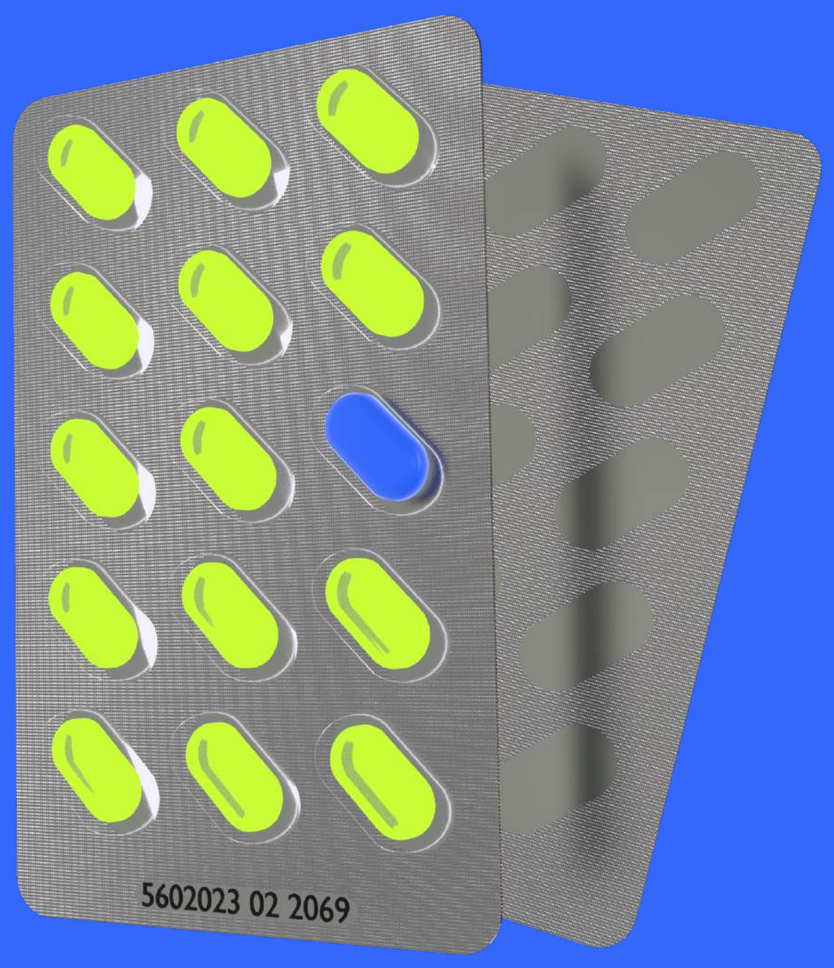
We have already skimmed the surface of how Bitcoin works, therefore, how cryptocurrencies work. Because blockchain cannot be altered without creating a new chain, this provides a baseline for a secure peer-to-peer (P2P) payment system. The discrete units we commonly recognize as BTC or ETH are simply smart contract records on their respective decentralized networks.

In other words, what it means to hold these cryptocurrencies, is to hold an updated and immutable blockchain record — a public ledger. In turn, crypto wallets are not containers as one would traditionally think of them. Instead, a digital wallet is software that gives access to the blockchain network via private keys.

The crypto part in cryptocurrency is an additional layer of security on top of blockchain, as the interaction between the public ledger and wallets is encrypted. However, beyond encryption itself, there is a divergence in how blockchain ledgers are secured. These are the consensus algorithms.

Consensus Algorithms

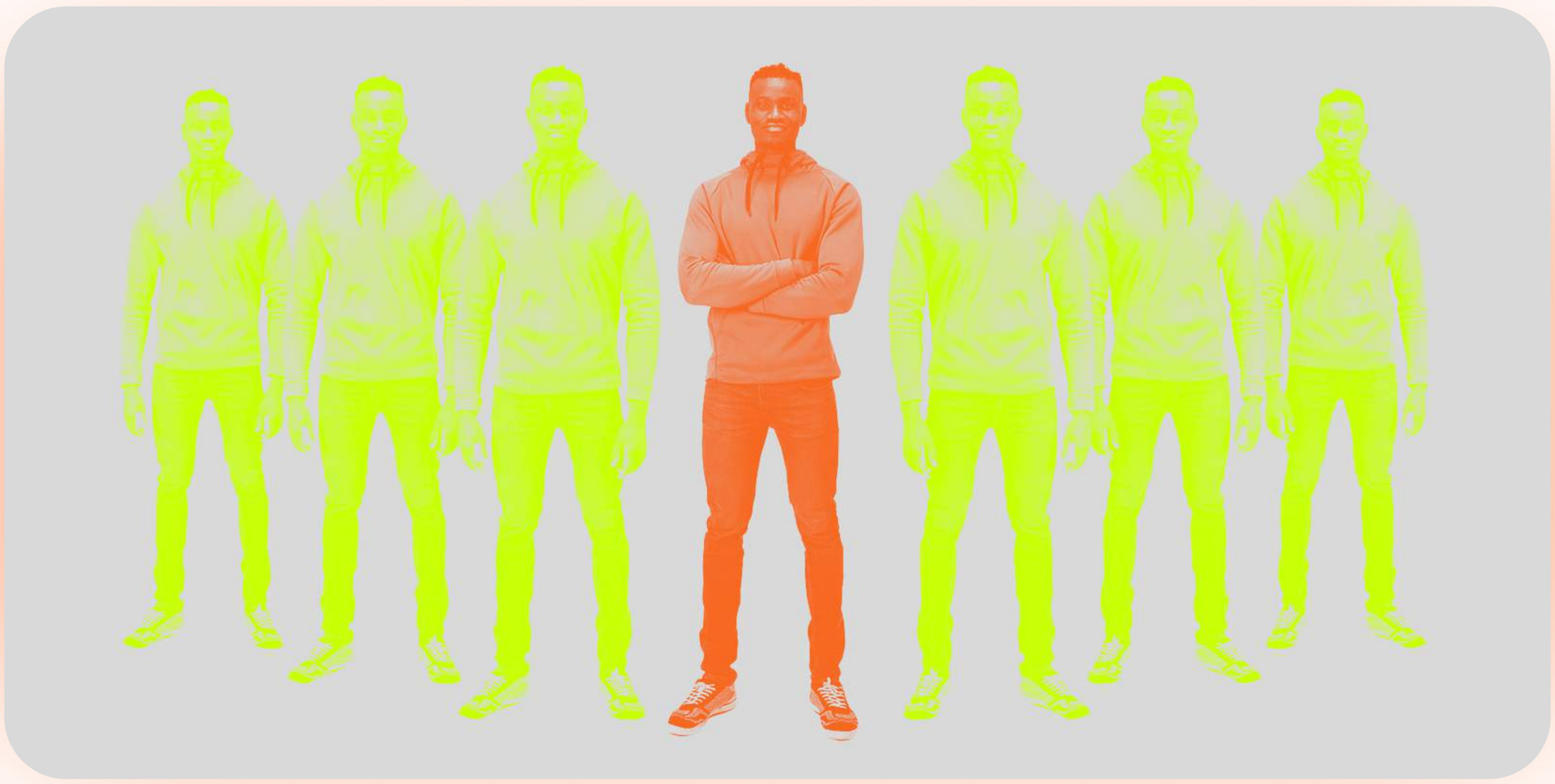
For cryptocurrencies to safely run on a distributed digital ledger (DLT), each cog of the network holds an entire record of all transactions, thus avoiding the potential for a single point of failure (SPOF). These cogs, as network computers, are called full nodes. When a transaction happens, such as person A sending person B 1 BTC, this new data block is added to the ledger across the nodes.



The key question then is, how do nodes reach an agreement to determine that this exact new data block is the updated state of the entire blockchain network? This is the job for consensus algorithms, as they establish trust between unknown network nodes.

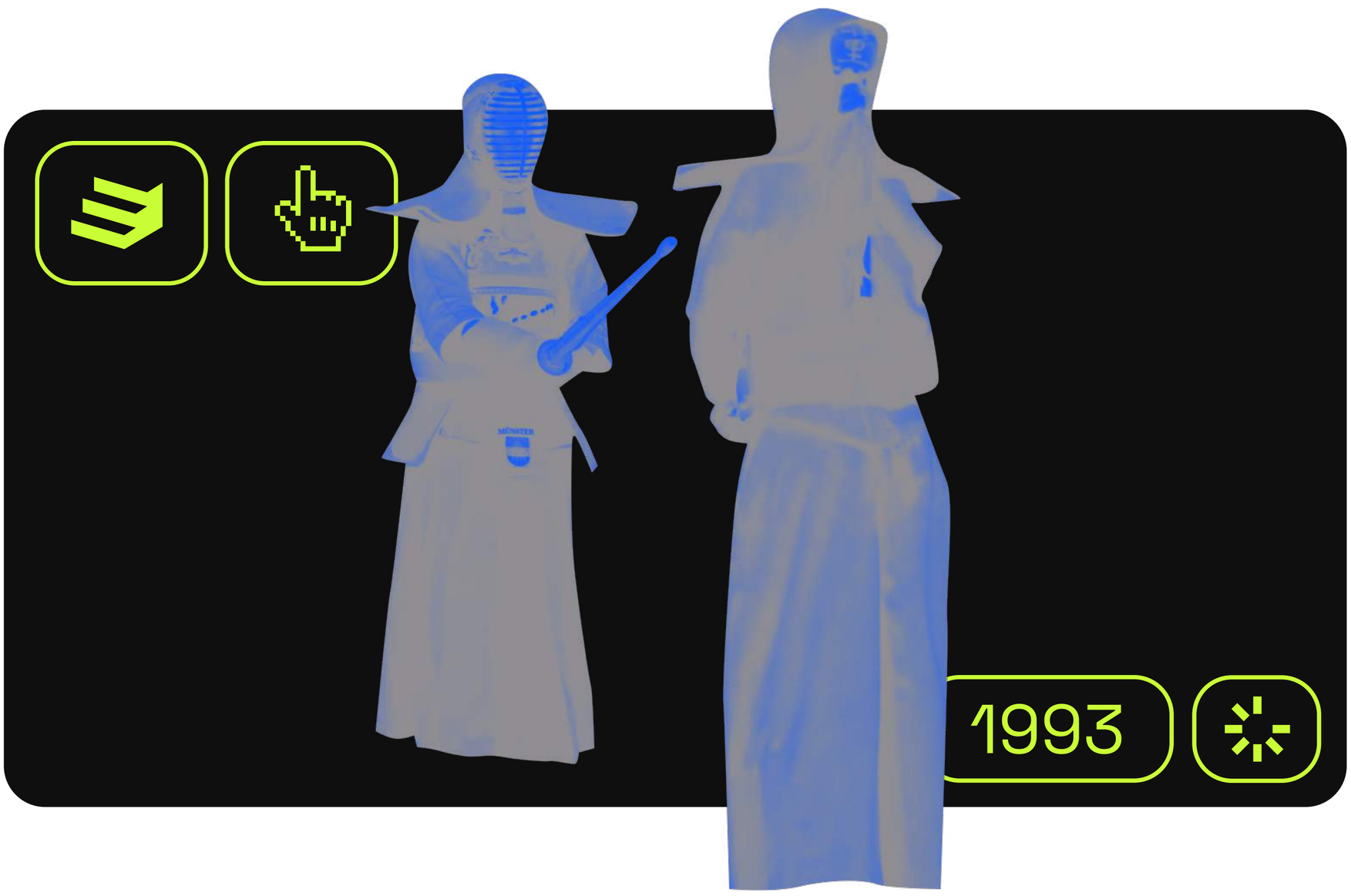
As such, blockchain consensus protocols consist of multiple layers by which agreement on the new blockchain state is achieved:

- Equal rights and mandatory participation of every node.
- Collaboration between the nodes.
- Fault-tolerance, i.e., the network doesn't require full participation and response of all nodes. Instead, if some fail, a consensus is reached with a minimum response of 51% of all nodes.
- Incentives for securing the network.



In short, blockchain's consensus algorithm ensures that new entries into the distributed database are valid. The end result is a trustless network that makes it possible to have P2P money without any gatekeepers and institutions. However, there are different ways to set up consensus algorithms while achieving the same result.

Proof-of-Work vs. Proof-of-Stake



Although Cynthia Dwork and Moni Naor introduced the proof-of-work concept in 1993, it was Satoshi Nakamoto that re-introduced and implemented it in his Bitcoin whitepaper 15 years later. Satoshi's proof-of-work consensus introduced a mechanism to stamp out double spending and other malicious behavior that can potentially appear in a P2P network.

At the same time, an incentive to secure the network must be present as well. After all, when there is no central organization, running nodes necessitates an inherent incentive structure. Consensus algorithms not only coordinate nodes but provide that incentive structure.

Therefore, the binding feature of all consensus algorithms is they all require nodes to have a stake in order to be penalized if acting maliciously. In the case of proof-of-work, that stake comes from the computing power provided by transaction validators called miners. For their service, miners receive rewards.

It is then in the interest of miners to be honest, as only the miners verifying the longest chain recieve rewards. Satoshi explained this in his Bitcoin whitepaper as follows:

> *“as long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they’ll generate the longest chain and outpace attackers”.*

In technical terms, miners within a proof-of-work network use their hardware to process incoming data (transactions) by running them through cryptographic hash function. This simply means that they convert this data into a string of letters. However, when it is run through the function again, it delivers the same output.

In other words, an input cannot be derived from looking at the output. This is important to note because miners introduce an arbitrary number called nonce to establish valid data blocks. This way, they can prove before-hand knowledge, establishing their honest network status.

This hashing processing requires heavy electricity usage and specialized ASIC hardware. Nonetheless, Bitcoin's miners have a substantial stake in securing the network, by paying for both the electricity and the ASIC mining machines themselves. Both of these elements constitute the 'work' in proof-of-work.

Proof-of-stake is based on the same principles of staking, developed in 2011. The difference is that validators don't put forward a computing stake but an economic one. Instead of running cryptographic hash functions, validators in a proof-of-stake blockchain lock up their cryptocurrency funds in a wallet.

The same wallet can then be either penalized or rewarded. Validator software randomly picks which transactions will form the next data block. If the validator's block gets added, the network recipient receives a reward in the blockchain's native currency. The chance increases if there are more funds staked.

If there is something iffy going on with block validation, the validator's staked funds get slashed, Meaning, their locked-in tokens staked in the associated wallet are reduced. For instance, this might happen if the validator signs two different blocks to be added to the same slot, which constitutes proposal offense.

EPOCH	SLOT	AGE	SLASHED VALIDATOR	SLASHED BY	REASON
105025	3360802	17 days 7 hrs ago	66065	37126	Attestation rule offense
104362	3339591	20 days 6 hrs ago	19299	42958	Attestation rule offense
95785	3065150	58 days 8 hrs ago	270651	95482	Attestation rule offense
89764	2872461	85 days 3 hrs ago	62830	73684	Attestation rule offense
88569	2834210	90 days 10 hrs ago	39710	14871	Attestation rule offense
87951	2814433	93 days 4 hrs ago	88657	51775	Attestation rule offense
87842	2813961	93 days 5 hrs ago	88632	95067	Attestation rule offense
87936	2813961	93 days 6 hrs ago	88655	27904	Attestation rule offense

In the Ethereum ecosystem, the slashing mechanic is commonly divided between attestation and proposer offenses.Source: beaconscan.com

By the same token, a validator can be slashed for attestation offense if they vote on adding a new block, this attestation passes with an agreement by 2/3 of the network, but the attested validator doesn't meet the 12-second timeframe from the proposal to the attestation of every new block.

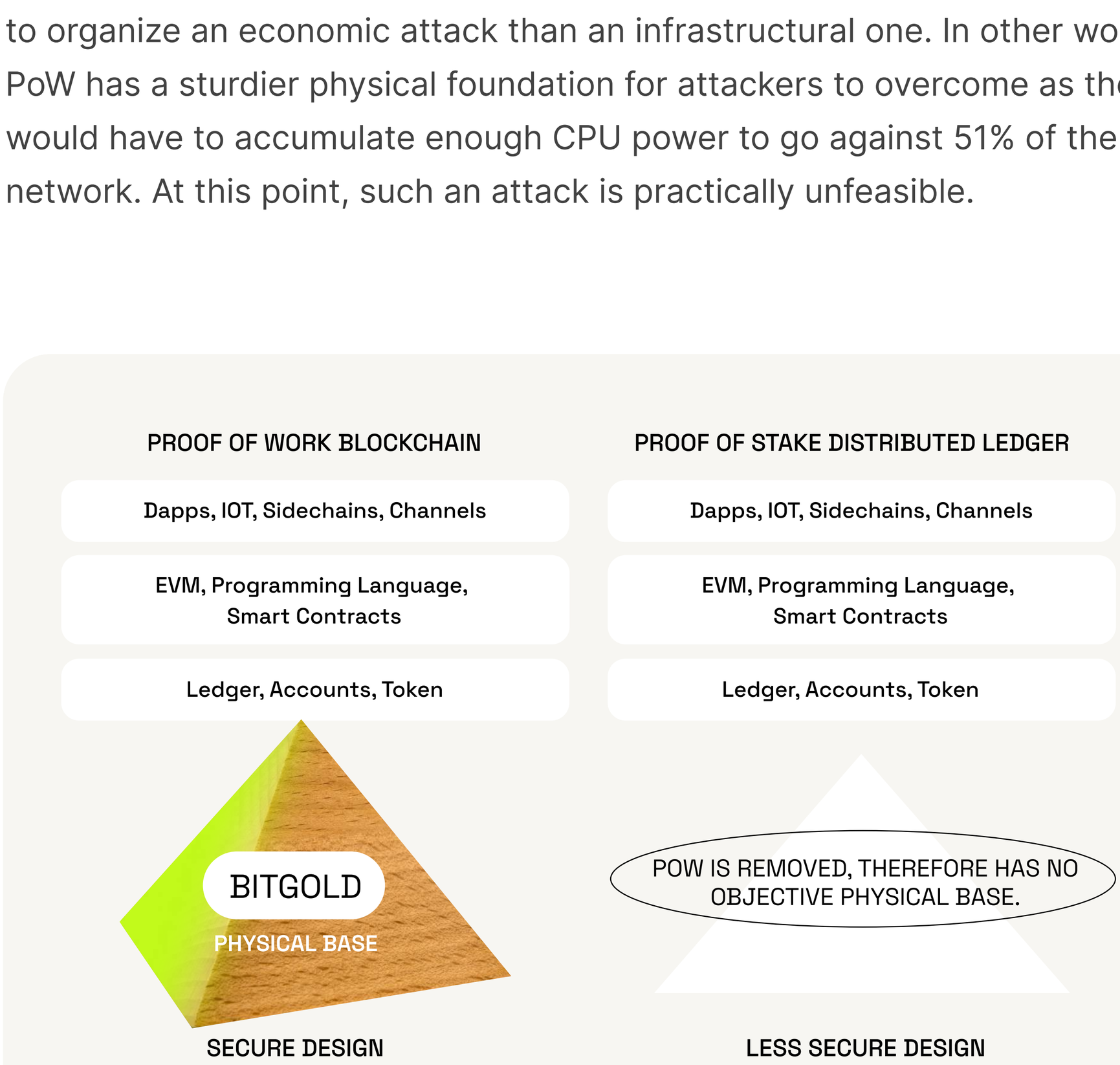
When accounting for pros and cons of proof-of-work vs. proof-of-stake, we arrive at three key conclusions:

1. PoW relies on electricity-intensive computational power while PoS relies on economic staking to secure the network.

2. PoW miners receive block rewards while PoS validators receive transaction fees.

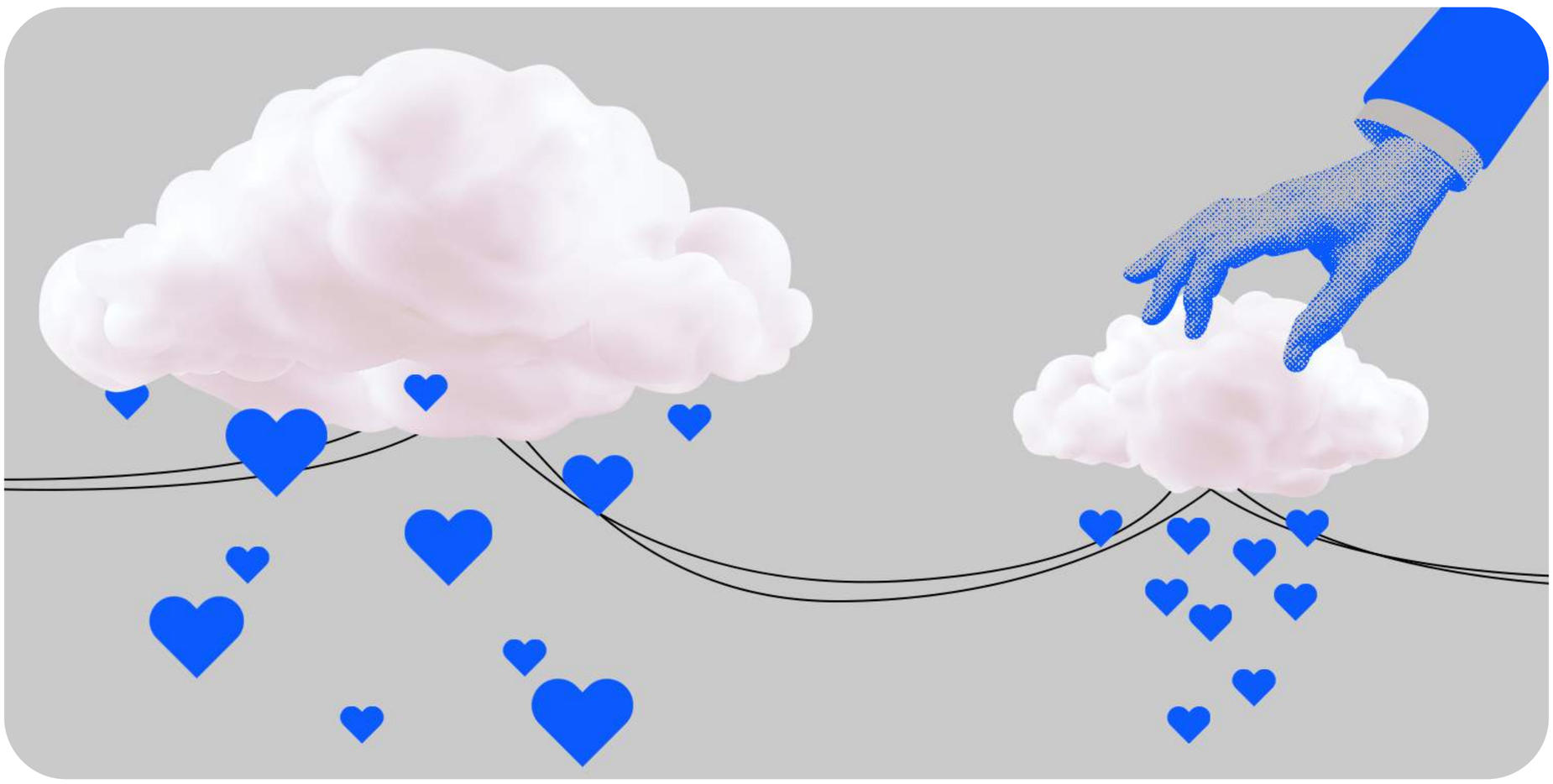
3. PoW attackers would have to have computational power greater than 51% of the network to succeed, while PoS attackers would have to own more than 51% of the network.

The first and third points are cause for much controversy because it is more likely that a PoS attack would succeed. After all, it is far more feasible to organize an economic attack than an infrastructural one. In other words, PoW has a sturdier physical foundation for attackers to overcome as they would have to accumulate enough CPU power to go against 51% of the network. At this point, such an attack is practically unfeasible.

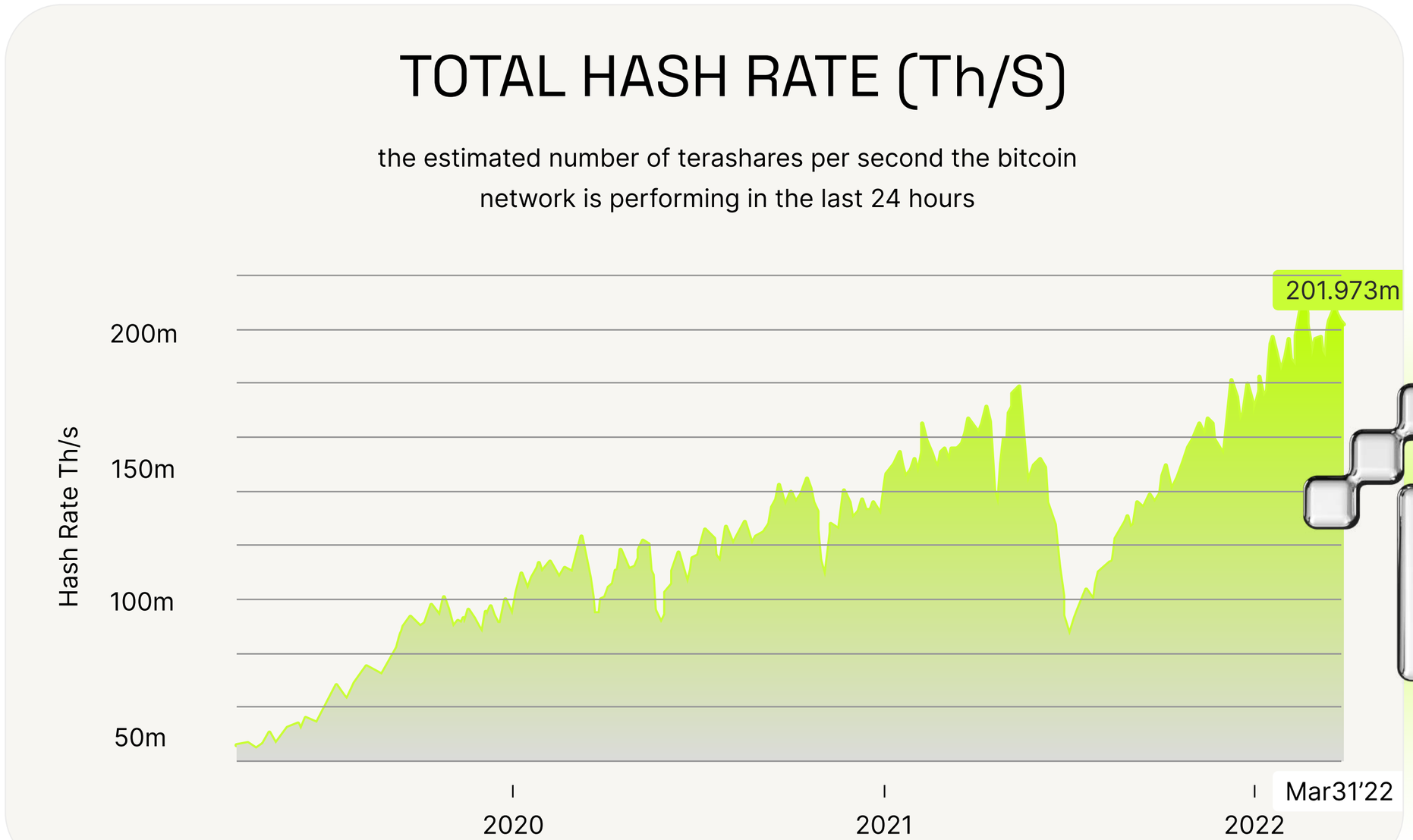


Yet, it is PoW's physical stake that is also the subject of mediatic attack. The formula for Bitcoin's energy usage has been well-established among mainstream media outlets — ‘Bitcoin uses as much electricity as country X’. However, what does the data show when put into proper context with other technological, financial, and consumption sectors?

The Impact of PoW/PoS Algorithms on the Environment



Proof-of-work, specifically for Bitcoin, has created an ecosystem of mining companies and mining hardware manufacturers. They deploy ASIC farms that tend to conglomerate and centralize, as they streamline every bit of electricity into Bitcoin's hashrate power, delivering optimal cost to BTC reward ratio. The aforementioned cryptographic hash function is measured by the network's total hash rate (TH/s), holding at 201.9m TH/s as of March 31.

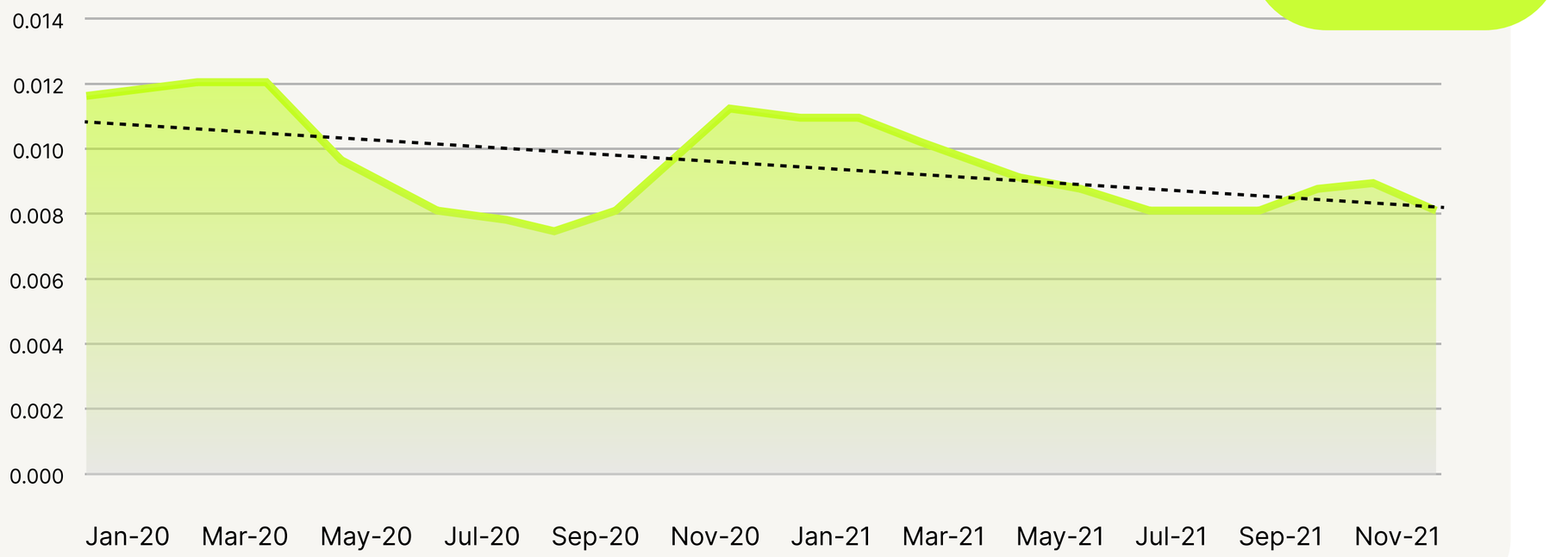


In mid-2021, Elon Musk' tweet about withdrawing Bitcoin payment from Tesla, and China mining ban, triggered a market crash, mirrored by the Bitcoin network's loss of hash rate.

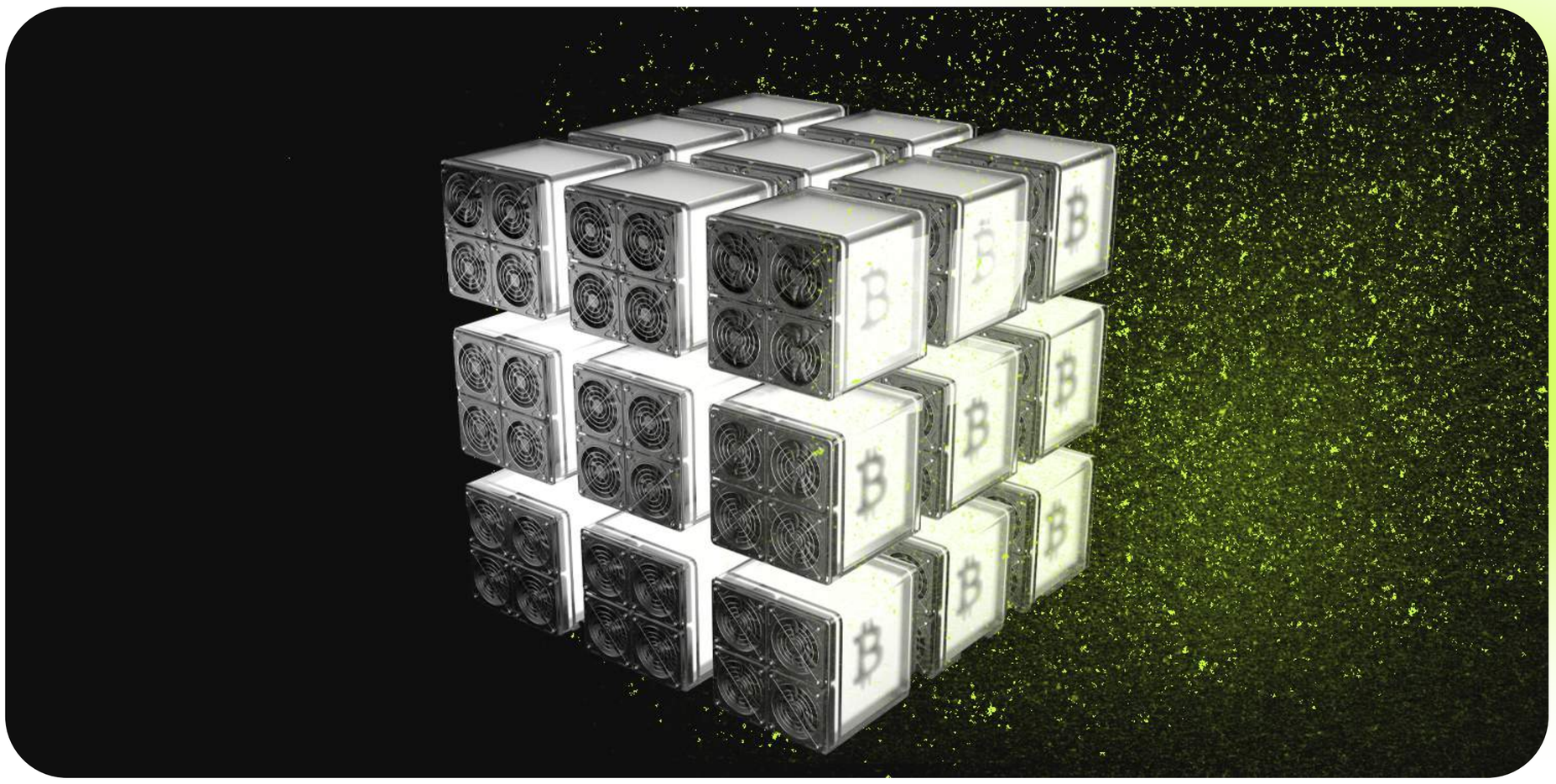
In turn, Bitcoin's hashing carbon intensity, measured as a gram of carbon dioxide per tera (1^{12}) hash (gCO_2/TH), is under 0.008 according to CoinShares January 2022 report.

FIGURE 1: CARBON INTENSITY OF HASHING (gCO_2/TH)

Source: CoinShares Research (Jan 2022)



Put into global context, Bitcoin's network by the end of 2021 generated 41 megatonnes (Mt) of carbon dioxide (CO2) for that year. This represents less than 0.08% of global emissions for the same year, which was 49,360 Mt of CO2. Although this percentage may seem minor, it still showcases its impact, the need to reduce its carbon footprint and employ offsetting measures whilst on that reduction journey.

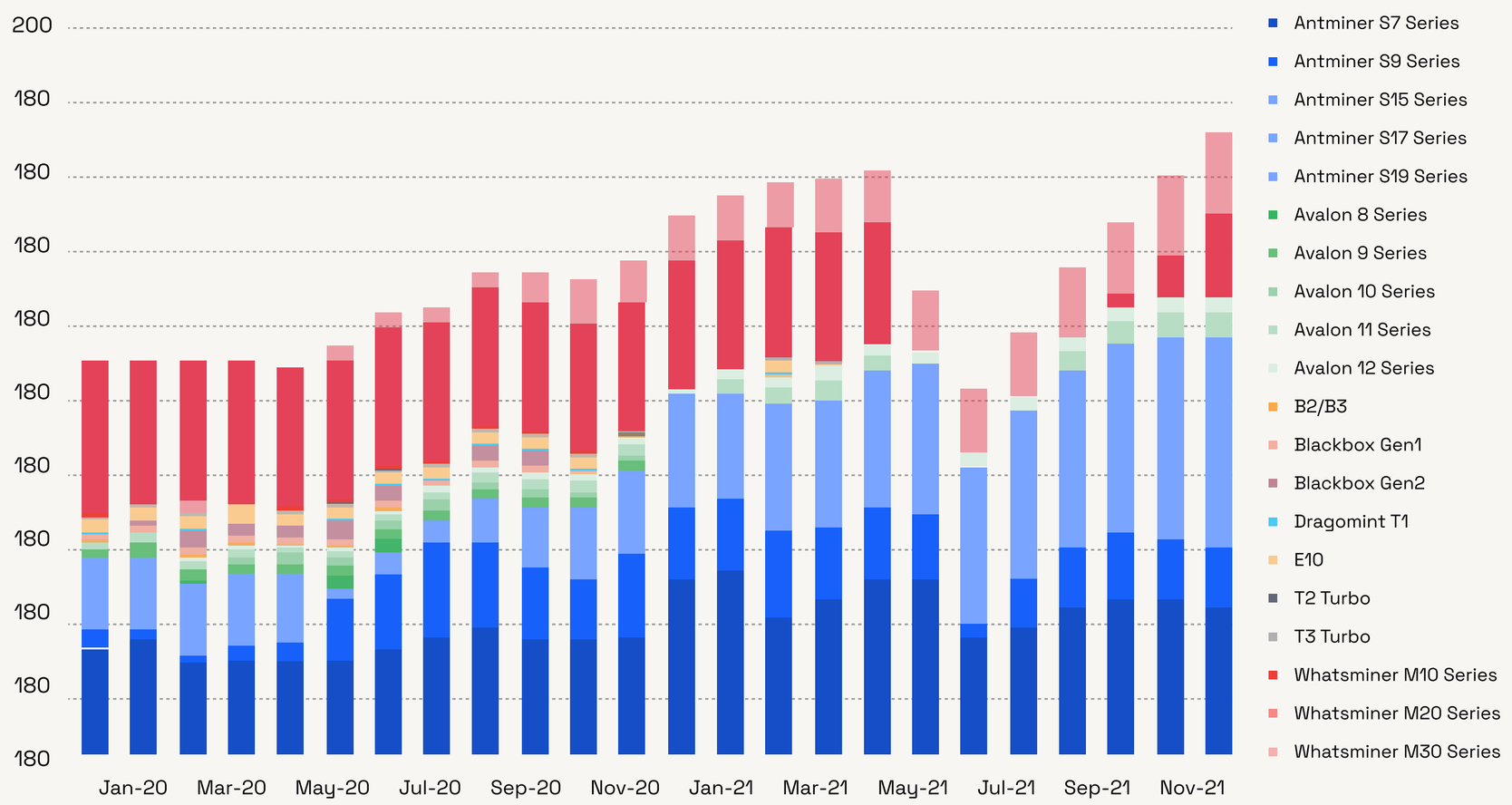


Overall, the cryptocurrency mining market size has grown to $2.28b, according to Brandessence Research published on March 2022. With a compound annual growth rate (CAGR) of 28.5%, this market is poised to grow to $5.2b by the end of 2028. Some of the more notable cryptocurrency mining companies are the following:

- BitMain Technologies
- Canaan Creative
- HIVE Blockchain Technologies
- Hut 8 Mining Corp
- Riot Blockchain
- Marathon Digital Holdings
- Cleanspark
- Bitfarms
- Ironmountain
- F2Pool
- Genesis Mining
- ASICMiner

Bitmain, with its Antminer S series, covers the bulk of global cryptocurrency mining, while Whatsminer M series, manufactured by MicroBT, tags along at close second place.

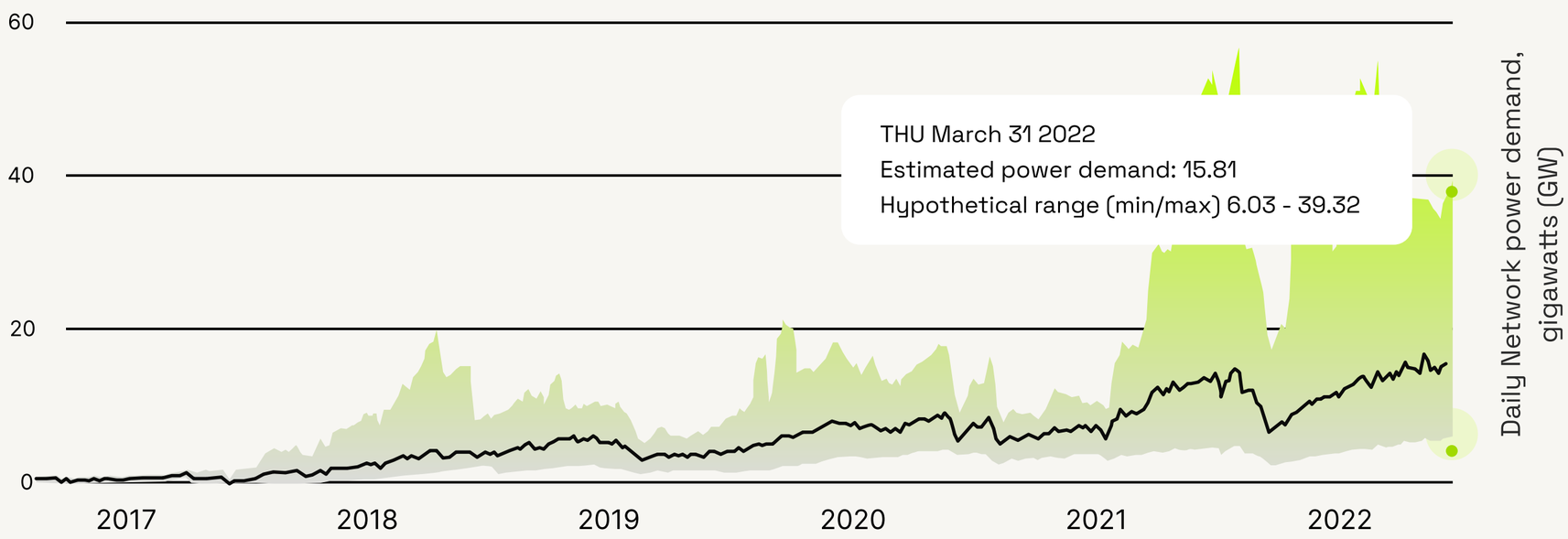
FIGURE 3: TOTAL HASHRATE BY HARDWARE UNIT (EH/S)



Source: CoinShares Research (Jan 2022)

Altogether, cryptocurrency mining companies are responsible for often making such news headlines as 'Bitcoin uses as much electricity as country x'. This framing stems from the estimates done by the Cambridge Centre for Alternative Finance, presently estimating Bitcoin's annualized energy consumption at 138.57 TWh.

BITCOIN NETWORK'S DAILY POWER DEMAND IN GIGAWATTS (GW).

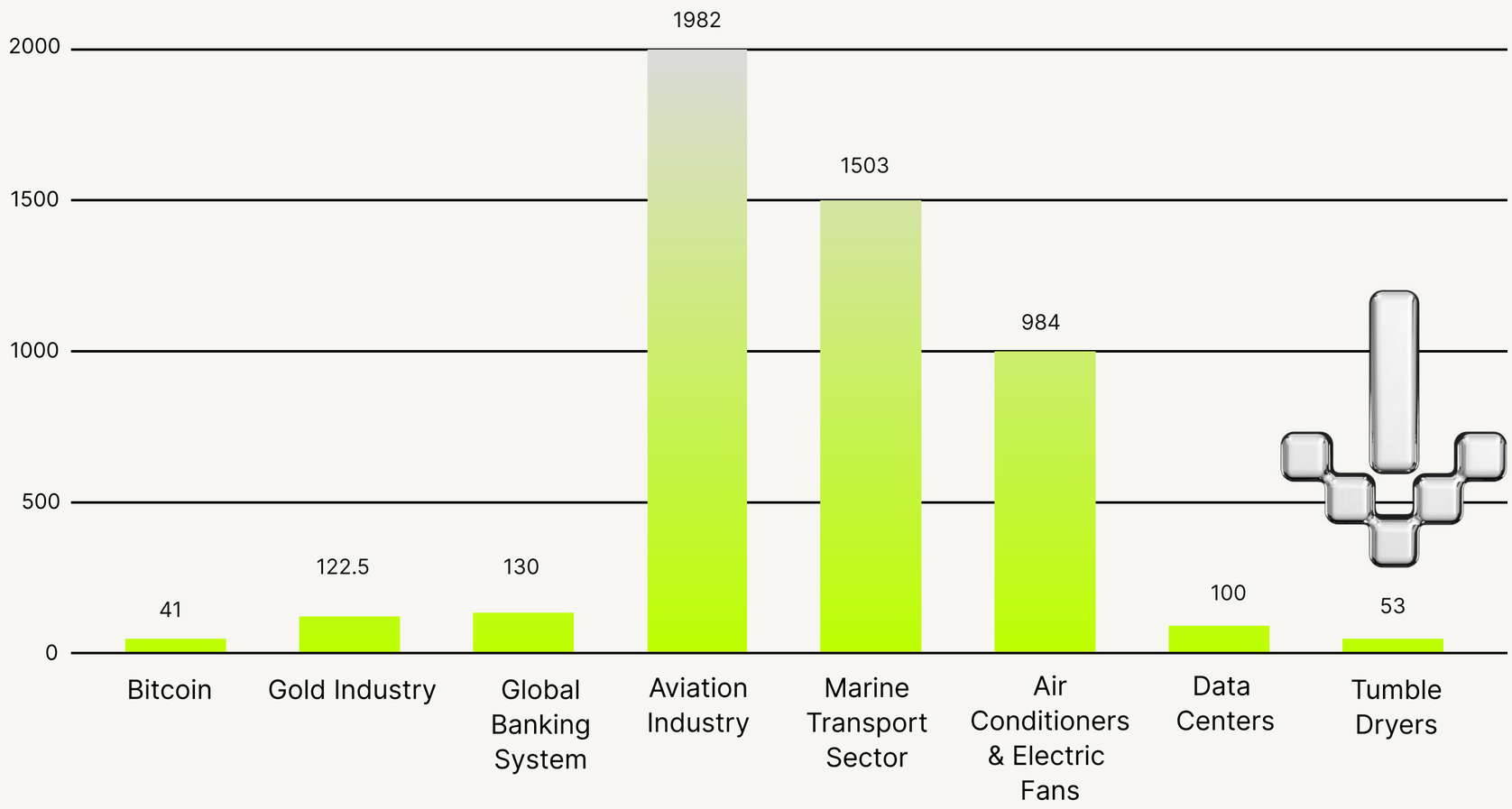


Compared to nation-states, this places Bitcoin's network energy consumption between Sweden (123TWh) and Malaysia (150 TW/h), according to the U.S. Energy Information Administration (EIA). However, when zoomed out further on a global scale, and compared to industries as a whole, Bitcoin uses less energy than tumble dryers.

CO2

CARBON EMISSIOONS OF BITCOIN COMPARED TO OTHER INDUSTRIES

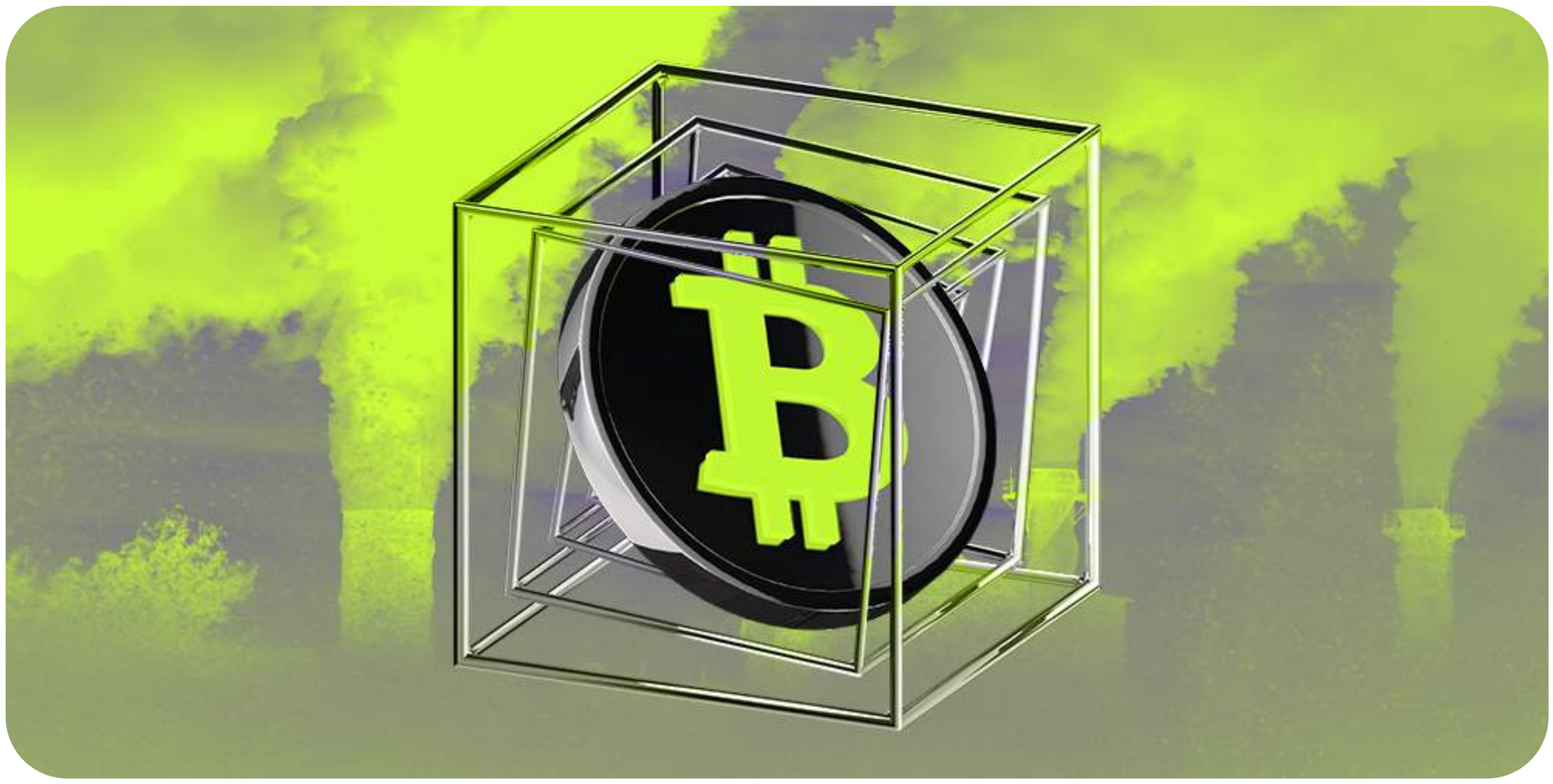
Jan 2022



Such a perspective shines a different light on Bitcoin's energy consumption. It then becomes a subjective matter of deciding what is more important in a contrast between a decentralized, deflationary monetary system, or:

- Waiting for a bit longer for clothing to dry out.
- Using social media platforms (data centers) to pass the time.
- Using the global banking system, despite that the same functionality can be achieved with blockchain dApps for a fraction of the cost.

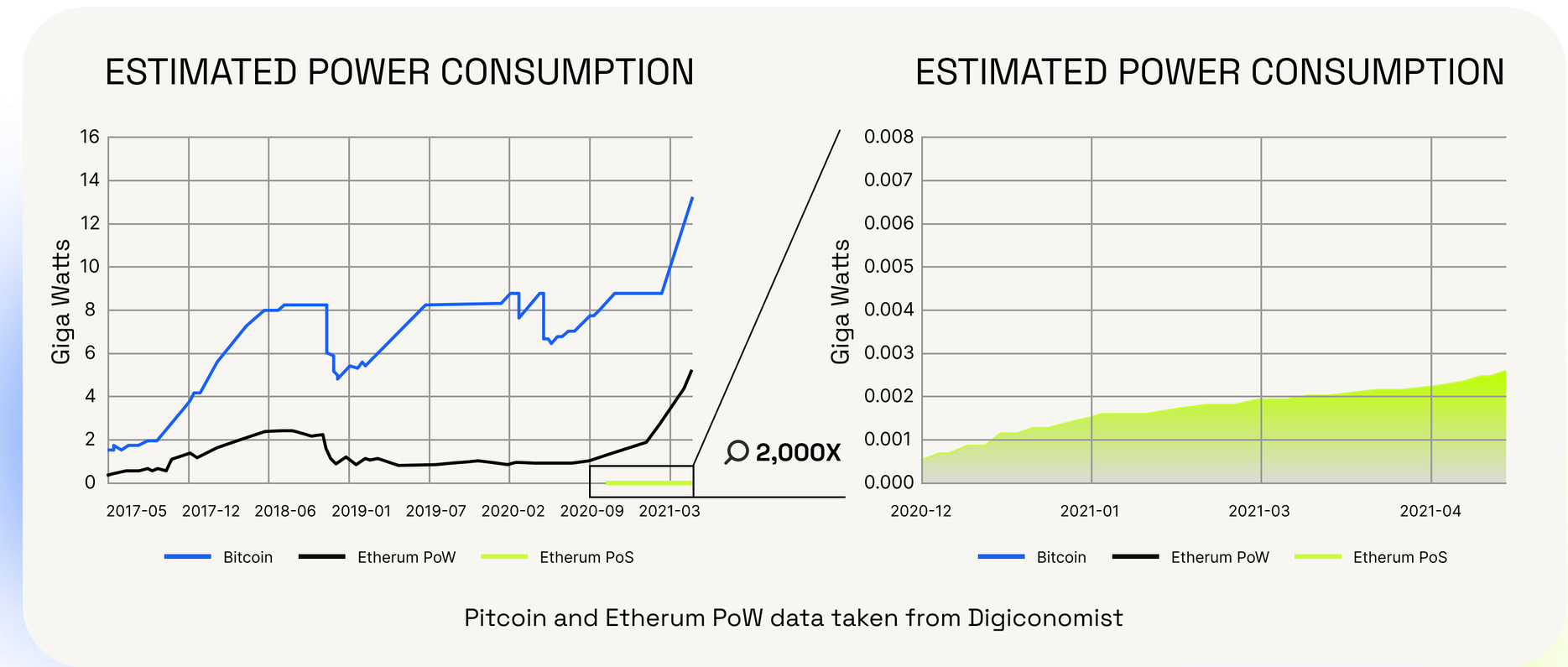
Nonetheless, environmental activists continue to target Bitcoin and other PoW cryptocurrencies. On March 29th, Greenpeace, a global campaigning eco-network founded in 1971, launched the CleanUpBitcoin campaign. The demand is for Bitcoin to change its consensus from PoW to PoS, as the latter network consensus mechanism coordinates blockchain nodes for a tiny energy consumption cost compared to PoW.



One of Bitcoin's Lightning Network developers, Rene Pickhardt, responded by asking Greenpeace to hire developers to institute Bitcoin's hard fork that runs on a proof-of-stake consensus mechanism. After all, Bitcoin code has always been open source. Therefore, it would be easy for Greenpeace to divert its substantial marketing money into developer work itself. The market demand for the new chain would then decide which type of network security is more popular.

Interestingly, the former Greenpeace president, Dr. Patrick Moore, diverged with the organization on the basis of its foundational claims filing today's media space: climate change, carbon footprint, greenhouse emissions, coral reefs, warming, etc. In his book *Fake Invisible Catastrophes and Threats of Doom*, Dr. Moore offers a data-based approach to cover these common themes.

Whatever the case may be, it is factual that PoW is far more energy-intensive than PoS. Case in point, the Ethereum Foundation estimated that, when Ethereum blockchain fully transitions from PoW to PoS via the Merge, its energy consumption will be reduced by a factor of 2,000x.



Pitcoin and Etherum PoW data taken from Digiconomist

Combined with Ethereum's scalability solutions that also use PoS, such as Arbitrum, Polygon, Loopring, Immutable X, Optimism, and others, Ethereum is poised for a ~99.95% energy reduction this year. Such a move brings the largest smart contract platform from the level of nation-states at continuing 5.13 gigawatt usage to the level of a tiny town using about 2.62 megawatt.

This places PoW cryptocurrencies like Bitcoin in an awkward position, as Ethereum creates a mediatic fallback position. The headlines will then likely transition from 'Bitcoin uses as much energy as country x' to 'Ethereum uses that much less energy than Bitcoin'.

However, without changing Bitcoin's code, a strong case can be made that Bitcoin's environmental impact is reducing as the tech and renewable energy sources improve.

How Is Crypto Mining Going Green?

Just as Greenpeace launched a campaign to "clean up Bitcoin," so did mining companies gather data on the type of electricity they use for securing Bitcoin's network. After all, there is a difference if it comes from a coal plant or a hydroelectric power plant, as the latter reduces greenhouse gas emission by 97.7%.

According to the Cambridge Bitcoin Electricity Consumption Index, Bitcoin network uses 138.44 TWh of annualized consumption as of March 2022. The entire world uses approximately 23,900 TWh, making Bitcoin's energy drain at 0.57%.

However, how much of that 0.57% comes from renewable sources? The Bitcoin Mining Council is an organization that gathers most of the mining companies previously listed. Consisting of 29 mining companies and DeFi platforms, the Bitcoin Mining Council (BMC) makes up one-third of Bitcoin's mining network.

For Q3 2021, BMC issued a report which states that Bitcoin uses only 0.12% of the world's energy production. The reason for this reduction is that 0.38% of global Bitcoin mining uses energy that would have been otherwise wasted.

154,620 TWh

Total energy geenrated worldwide

50,000 TWh

Energy lost due to ineficiencies

188 TWh

Energy consumed by bitcoin mining on the worlds electric grid

GLOBAL BITCOIN MINING CONSUMES 1.12%

of the wrolds energy production

GLOBAL BITCOIN MINING CONSUMES 0.38%

of the worlds energy wasted

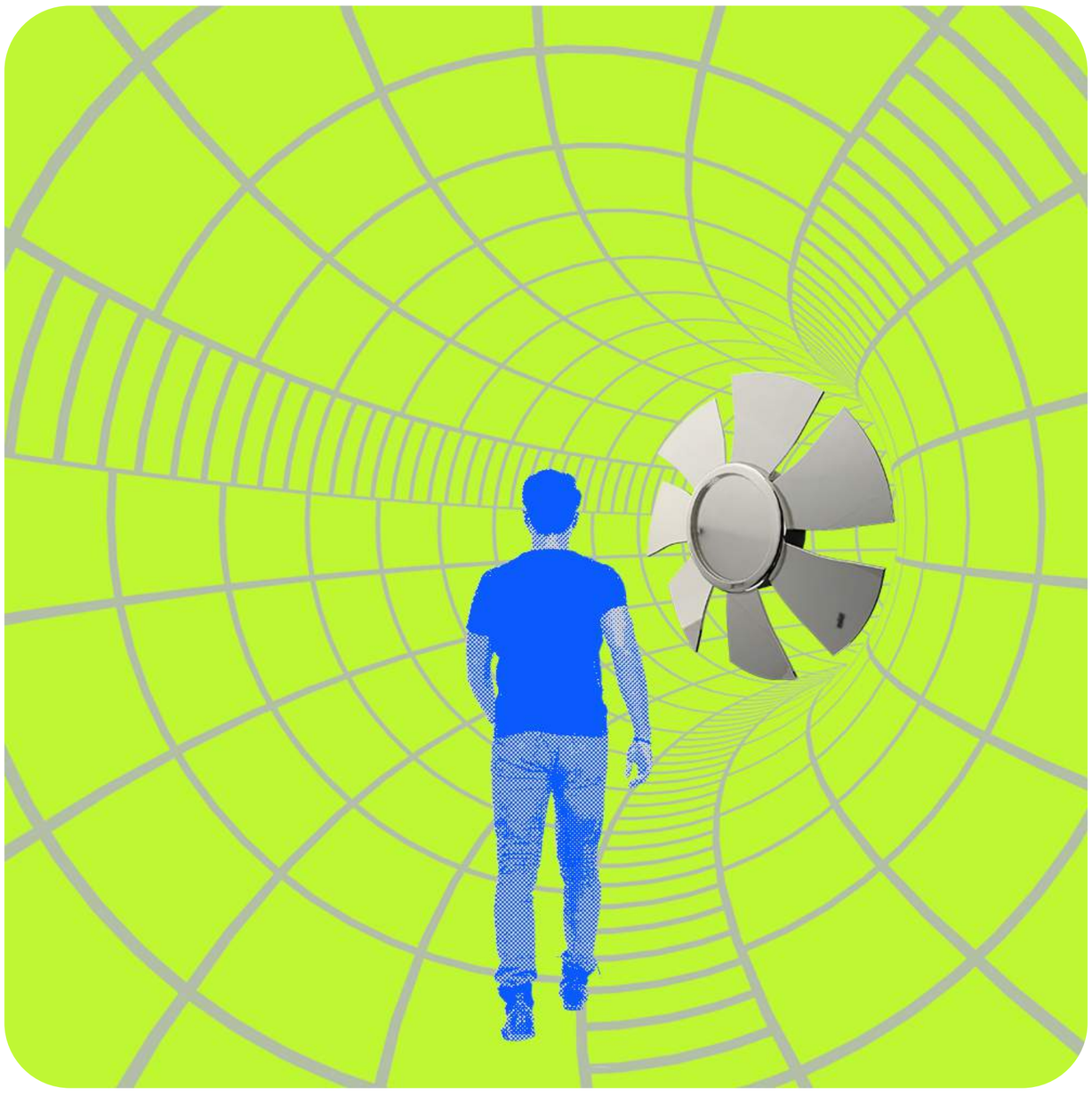
The BMC report aligns with the previous report from CoinShares in 2019, stating that 74% of Bitcoin mining comes from renewable sources. Likewise, there is also the matter of computing efficiency itself.

The BMC report estimated that the computing-to-energy cost ratio will increase dramatically in the next 8 years. Case in point, Bitman mining company announced 'Antminer S19 XP Hyd' this March. As it employs liquid cooling, it is able to generate 255 TH/s computing power while only running at 5.3 kW. For comparison, the average air conditioner unit uses about 3.5 kW during warmer days.

If this latest generation of ASIC miners is to be fully deployed, Bitcoin's total energy consumption would be significantly downgraded:

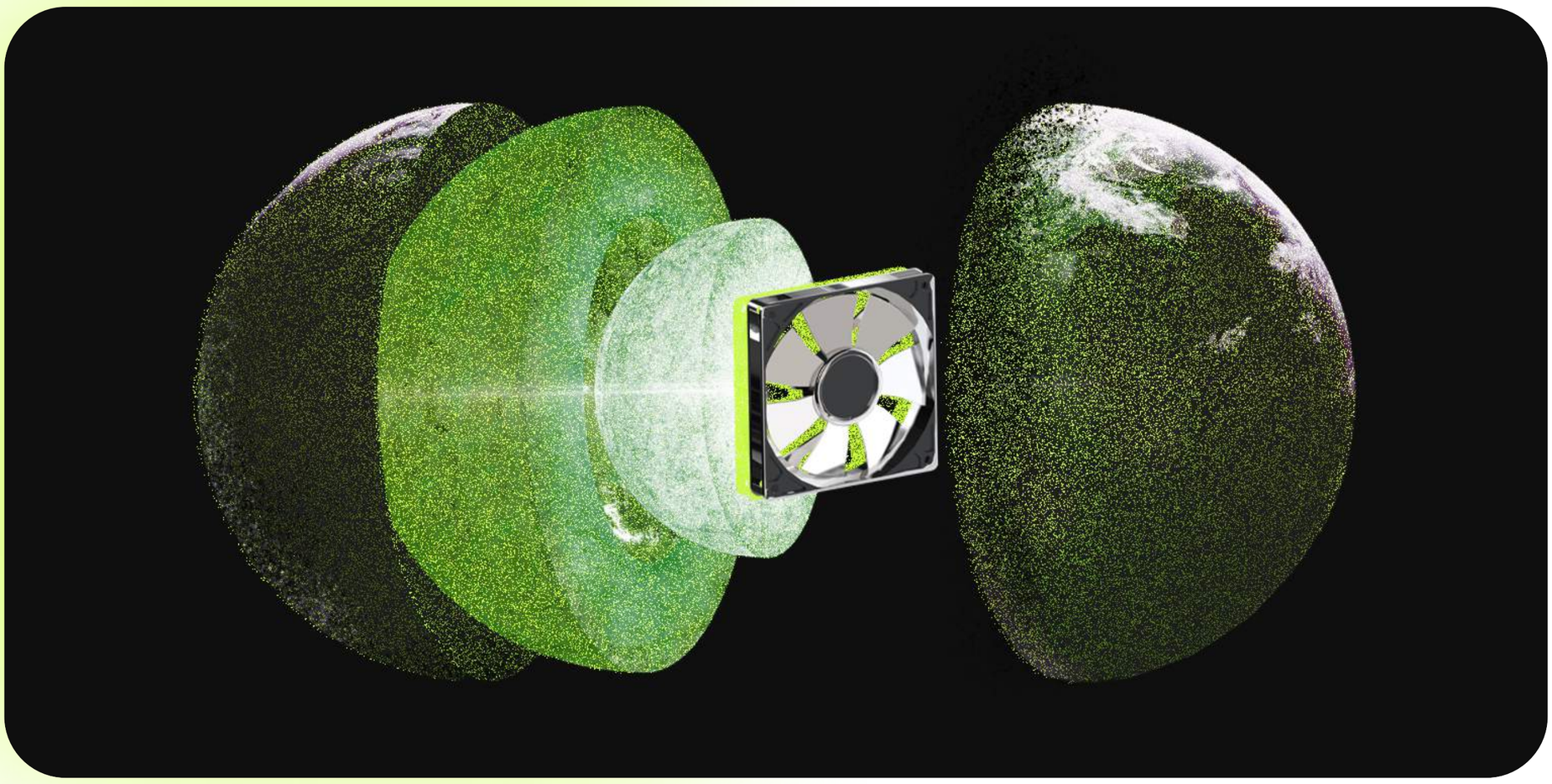
- Total Bitcoin hashrate - 196 million TH/s
- One 'Antminer S19 XP Hyd' - 255 TH/s
- 768,627 new Antminers are needed to fill 196 million TH/s
- Each running at 5.3 kW would then exert a total energy drain of 4 gigawatts

Moreover, alongside more efficient mining rigs in the near future, there is a wide range of green initiatives to inch Bitcoin closer to 100% green status. Mining companies themselves launch such initiatives on a regular basis. For instance, Bitmain joined the US-based Merkle Standard for sustainable Bitcoin mining in February 2022.



Merkle Standard launched to develop North America's negative carbon footprint when it comes to mining digital assets. While Merkle Standard uses hydroelectric power in Eastern Washington, Bitmain has been tasked to develop 500 megawatt worth of clean mining infrastructure with its 150k mining rigs.

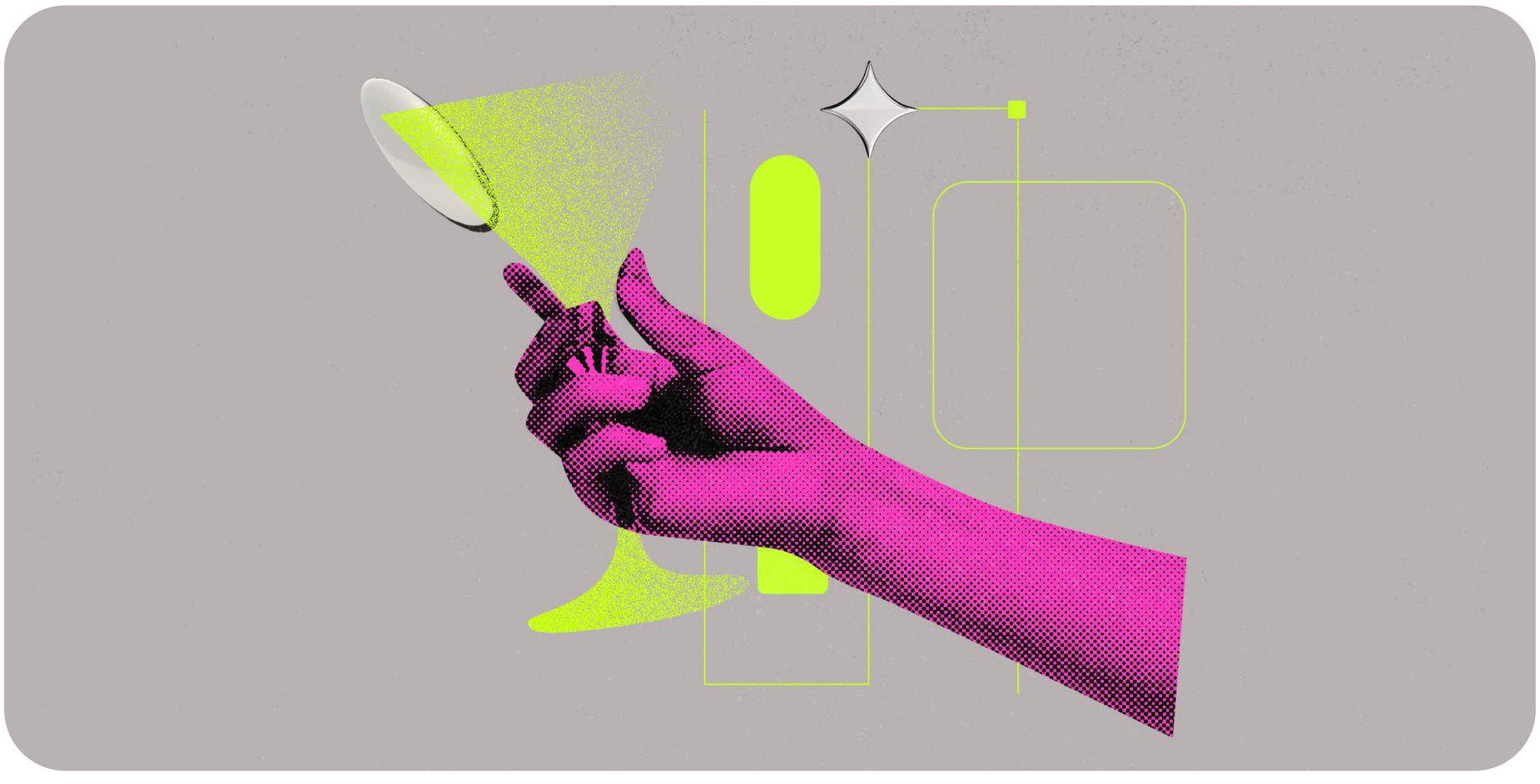
El Salvador Relying On Bitcoin Mining Powered By Volcanoes



Soon after the President of El Salvador, Nayib Bukele, made Bitcoin legal tender last September, he announced the next big move — Bitcoin mining powered by geothermal energy. This source of energy has a massive advantage over both solar and wind, as it is available 365 days per year, 24/7. Therefore, it doesn't create intermittent daily fluctuations that stress the electric grid.

El Salvador is heading to build a Bitcoin City near the geothermal vents, financed by volcano-backed bonds. The total financing package holds $1 billion in bonds, with a 6.5% interest rate paid back to bondholders. That is, if everything goes according to plan.

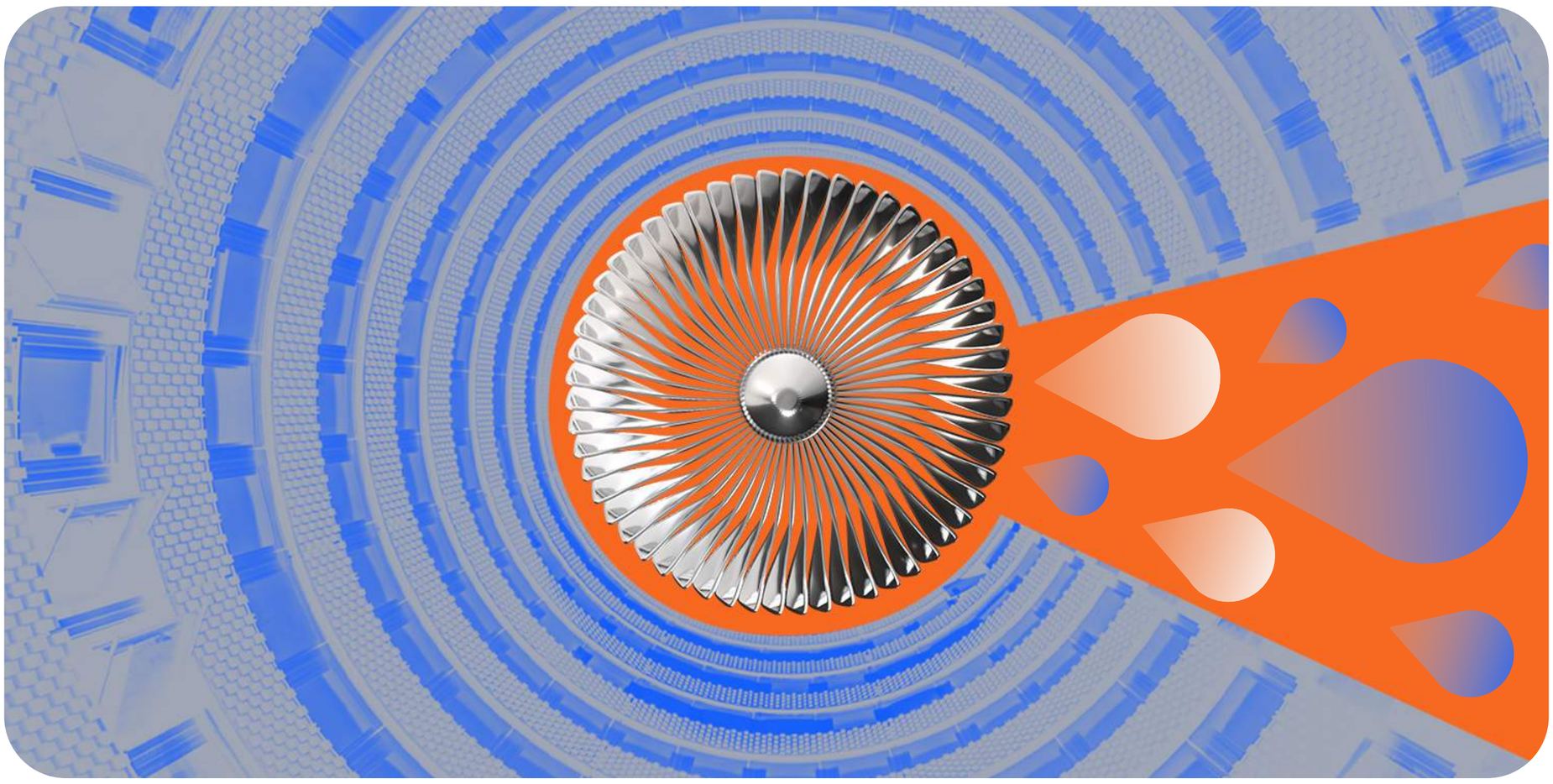
The architect of this ambitious project is Samson Mow, former chief strategy officer for Blockstream, a Canadian blockchain company. He intends to issue $1 billion in bonds through the Liquid Network, a layer 2 scalability network specific to Bitcoin transactions. At the end of the bond chain will be Bitfinex exchange, using both Bitcoin's Lightning Network and Liquid Network, while the bonds will be purchasable as securities via either BTC or USD.



At the end of the line, half of the bond proceeds will go into buying Bitcoin, and the other half into funding energy and mining infrastructure for Bitcoin City. Suffice to say, the success of this project depends on Bitcoin's appreciation. If successful, Bitcoin City will showcase the dominant cryptocurrency as the building block for revitalizing an entire nation.

In the meantime, President Bukele already spent $180 million to roll out over 200 Bitcoin ATMs. However, the anticipation itself is turning profitable as El Salvador increased its tourism by 30% since Bitcoin's adoption.

Hydroelectric Power Plants To Power Bitcoin Mining



Alongside geothermal, hydroelectric has been a staple of renewable energy due to its reliable stability. Furthermore, hydropower plants are ideally suited to be used for mining because they often deliver excess energy during snow melts and rainy seasons. Without proper storage facilities, this energy is wasted.

Case in point, when China's hydroelectric installations across southwestern Sichuan ramp up, the authorities lower electricity rates to record low levels, at $0.03 per kWh. This pricing mechanism stimulates over-consumption of cheap energy.

As a receptacle of this waste, Bitcoin mining farms are often seen tapped into hydropower. One of such many examples is the 100-year-old Alta Novella hydro plant in northern Italy. In its turbine room, it houses 40 ASIC miners.

Interestingly, during relatively dry conditions, such plants are usually shut down, as it is too cost-ineffective to keep them running. However, even at low output it's worthwhile keeping them operational to run Bitcoin mining rigs.

Furnished by Alps Blockchain, Alta Novella hydro plant is just one of 18 in northern Italy, with the aim to double the number by the end of 2022. In fact, taking over old or defunct hydropower facilities has become a trend.

The CEO of Digital Power Optimization, Andrew Webber, has specialized in this venture. His company provides cryptocurrency mining as a service and even facilitates other miners to better manage their energy resources. More importantly, it seeks underfunded hydro plants to repair them and put them to mining use.

> *"There's a lot of defunct and underfunded hydroelectric assets around North America and elsewhere, frankly, that maybe haven't had their maintenance ... kept up to date,"*
>
> *Andrew Webber*

Harnessing Wasted Gas

Continuing with the theme of utilizing energy that would have gone to waste, ExxonMobil, the largest US oil and gas producer, has been working on a pilot project to mine Bitcoin in North Dakota. In collaboration with Crusoe Energy Systems, a Denver-based company specialized in managing natural gas flaring, Exxon is diverting natural gas into generators which then power Bitcoin miners in shipping containers.

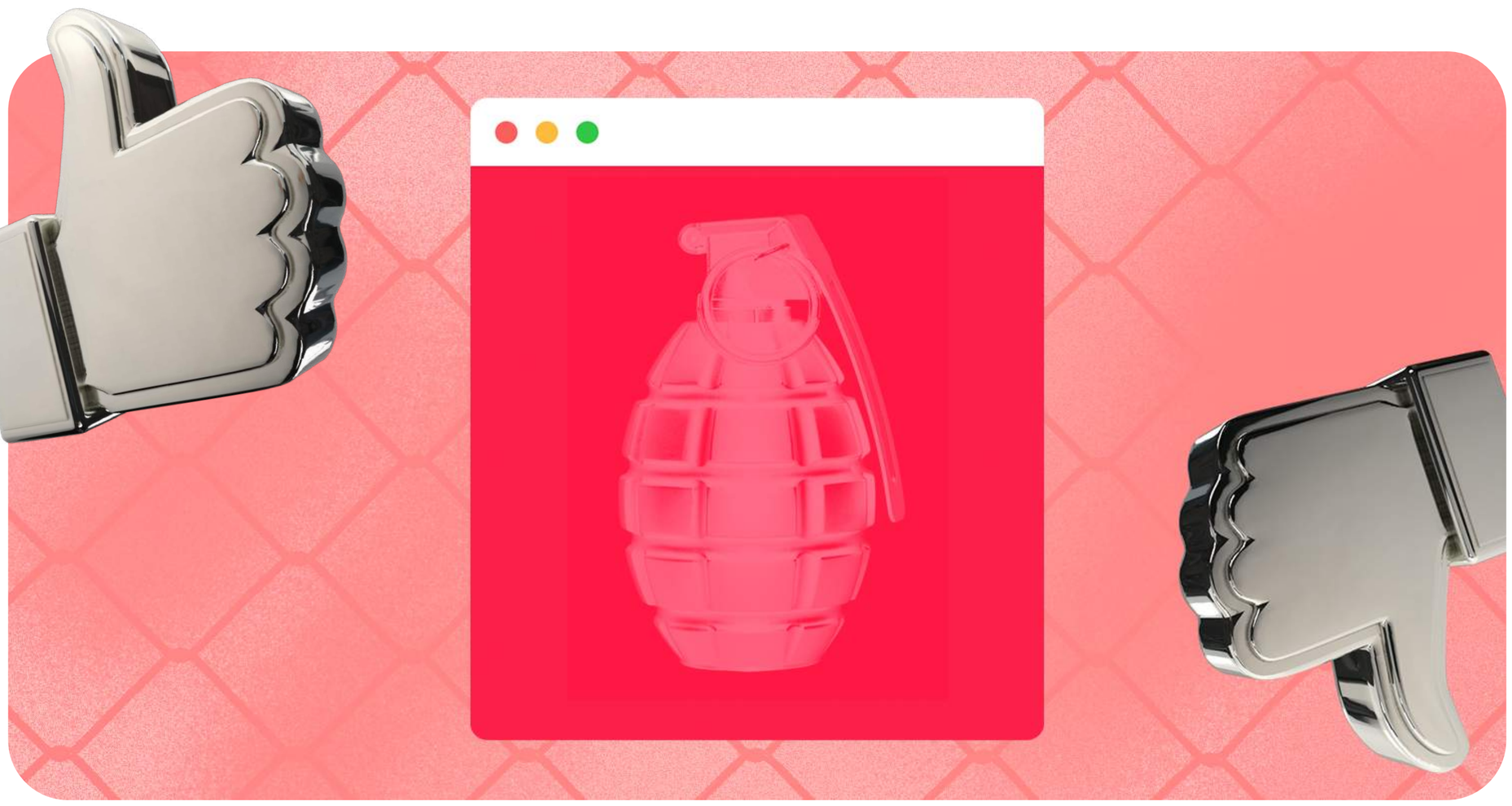
Without this funneling, the gas would be burned off, i.e., wasted. Exxon has been experimenting and expanding this project since January 2021. According to Eric Obrock's LinkedIn profile, who is a 10-year NGL (natural gas liquids) industry veteran, the project was a big success as it patched up a traditional waste of energy.

> *"first successful commercial and technical demonstration of using Bitcoin Proof-of-Work mining as a viable alternative to natural gas flaring in the oil patch."*

For those not familiar with gas flaring, it often happens when drillers hit a natural gas formation. If that gas cannot be safely and timely captured and transported, it is burned instead. This is why these installations often have burning flames as a part of their regular landscape.

With the flaring turned into energy for Bitcoin mining rigs, such an environmental hazard is nullified and employed to good use.

Are NFTs A Real Threat To Nature?



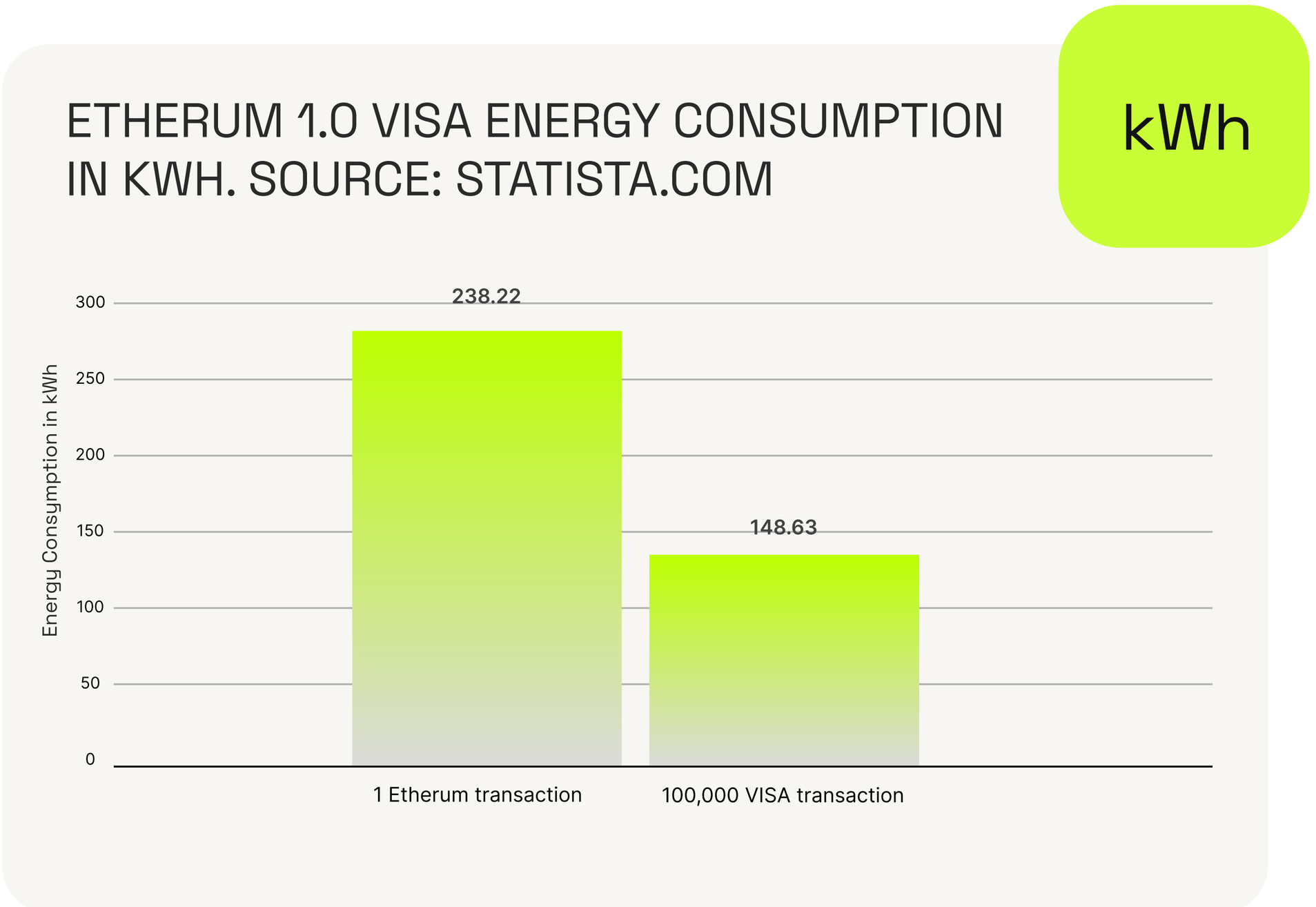
Unlike regular tokens that are mostly Ethereum's ERC-20 smart contracts, NFTs are ERC-721 or ERC-1155 smart contracts. Consequently, minting an NFT means creating a smart contract that is stored on a blockchain network.

Because smart contracts can tokenize a wide range of human activities, so too is NFT usage wide in scope. They can tokenize:

- Artwork, whether standalone or in blockchain games/trading cards.
- Tickets for sports and events, which can also serve as memorabilia.
- Video and music.

- Virtual merchandise on metaverse platforms for avatar characters.
- Domain names and documents.
- Real-world assets, such as real estate (CityDAO in Wyoming).

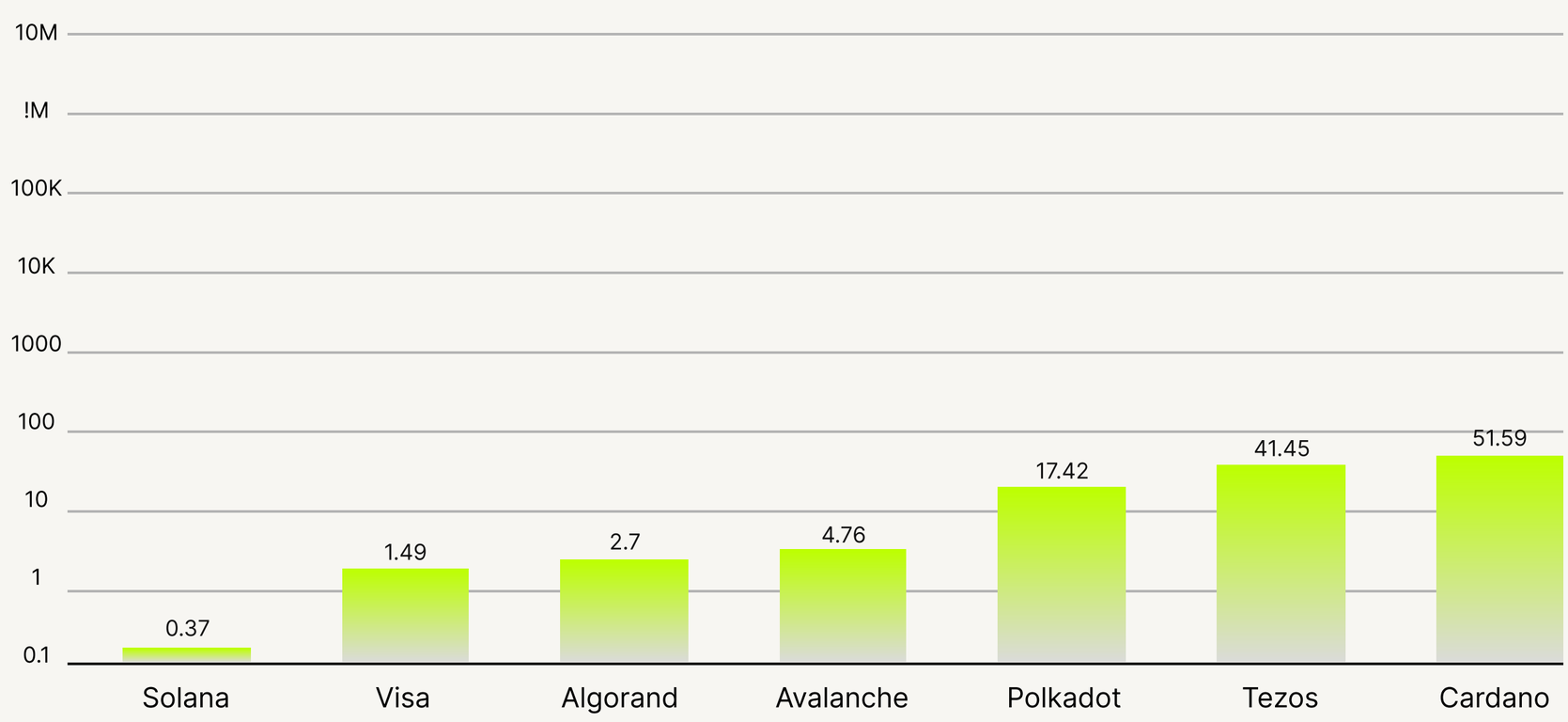
Therefore, because NFTs are smart contracts, they use smart contract platforms with Bitcoin not being one of them. Accordingly, NFT trading is as energy-intensive as one can expect to see from PoS blockchains. In its non-upgraded state, Ethereum is the largest smart contract platform using 238.22 kWh per transaction, according to Statista.



However, Ethereum is also in the process of moving from a proof-of-work model to a proof-of-stake model. This has been a long-term project for the Ethereum Foundation, and may reduce the energy per transaction to as low as 35Wh, as there will no longer be countless computers competing to finish each task, replaced with validators with their staked funds instead.

“If it works, this is a reduction from an annual power usage similar to some medium-sized countries to that of a small U.S. town. Since these transactions would use some energy anyway, this move is a good step toward making cryptocurrencies and non-fungible tokens much better for the environment.”

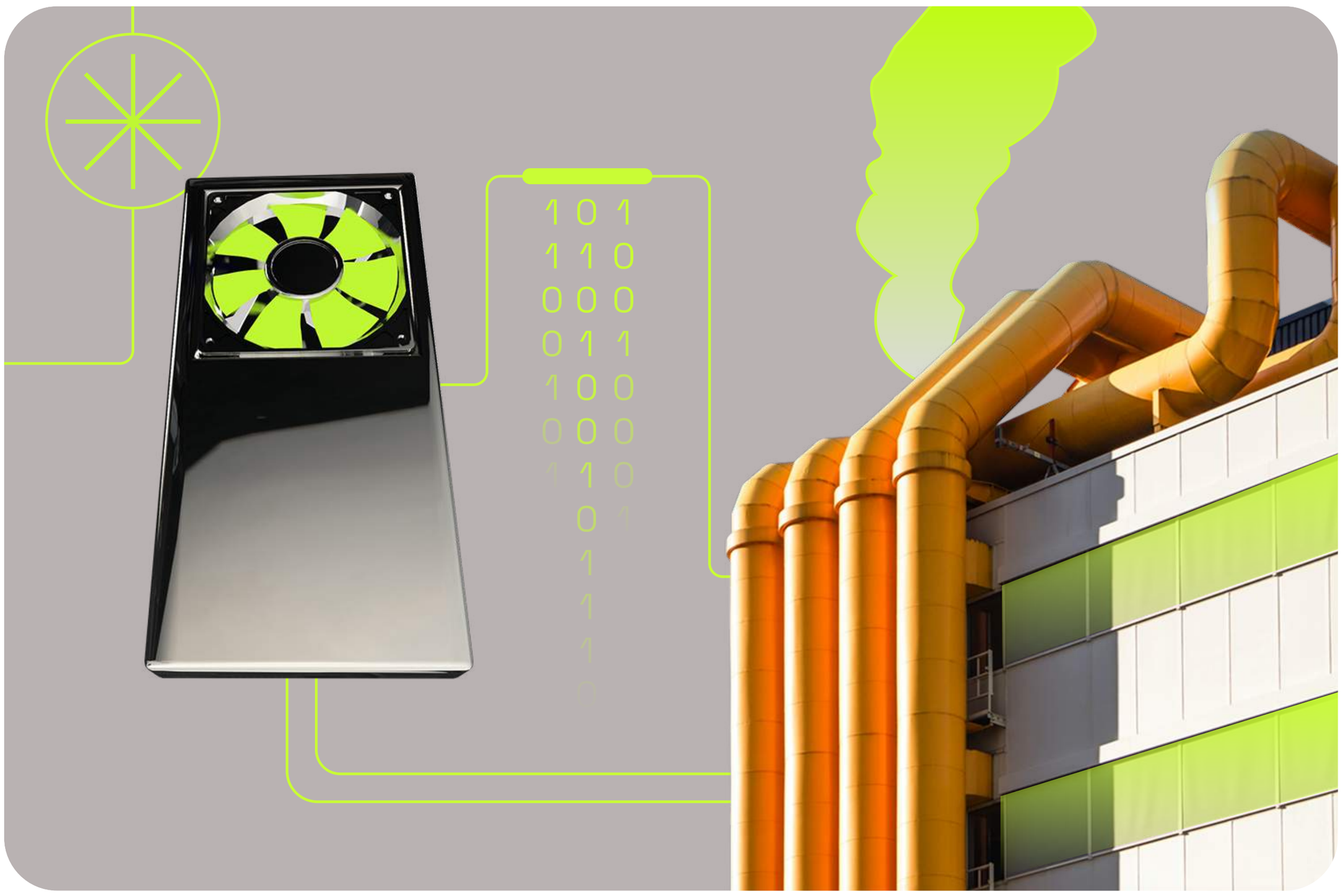
Electricity consumption of top PoS amart contract blockchains per transaction in WH, compared to Visa as a traditional payment network. Source: Crypto Carbon Ratings Institute (CCRI).



If the Ethereum’s Merge completes as scheduled, it would then be aligned with other PoS blockchains in terms of energy expenditure. Then, we can compare previous Visa energy usage with the wide PoS ecosystem of blockchains in which Ethereum will enter.

This is a good metric to overview the NFT market's energy drain. To bring it to a more granular and illustrating level, Visa's energy consumption equals around 20,000 US households for 2019, according to Digiconomist.

2021 saw the NFT market size grow to $41 billion with weekly sales between 15,000 to 50,000 NFTs. With the upper range picked as a baseline and multiplied by the average PoS energy expenditure of 20 Wh per transaction, this leaves the NFT market at 1,000 kWh energy consumption per week.

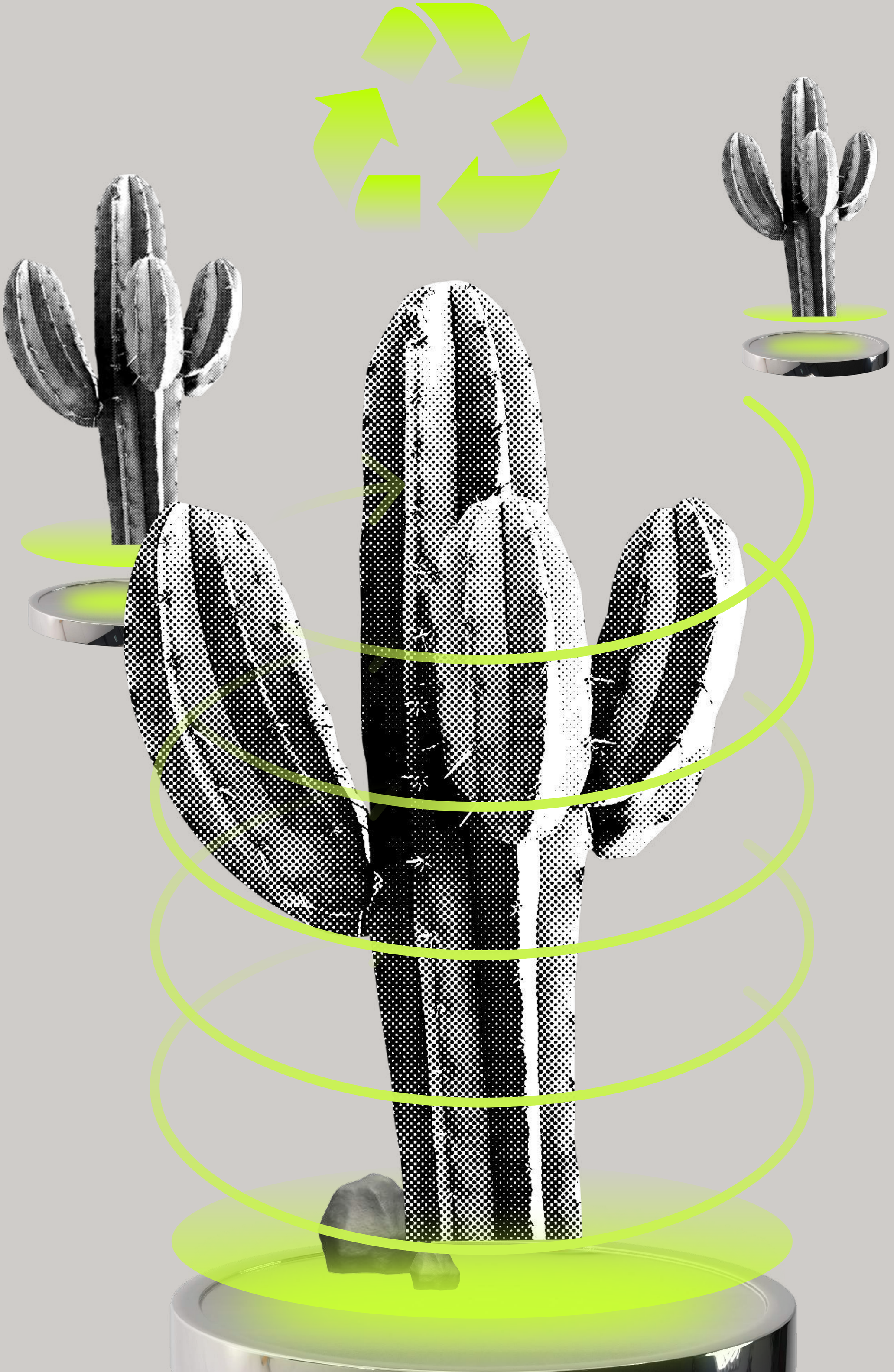


On an annual basis, this translates to 0.052 GWh. According to the U.S. Energy Information Administration (EIA), the average annual electricity consumption for a U.S. residential utility customer was 10,715 kilowatt hours (kWh) in 2020.

Comparatively, this means:

- 0.0107 GWh per single US household per year.
- 0.052 GWh per entire NFT market at upper range of activity (50k weekly sales), per year.

From this, we can conclude that PoS blockchains are inherently aligned with eco-requirements compared to PoW networks.



CHAPTER III

WHAT ARE THE CRYPTO CURRENCIES THAT ARE “GREEN” IN NATURE?

What Are The Cryptocurrencies That Are “Green” In Nature?

As explained in Chapter II, the upcoming Ethereum upgrade to proof-of-stake translates to a 99.95% energy consumption reduction. The same is the case with other PoS cryptocurrencies that use economic validation instead of mining computing power. Here are some of the more prominent ones that have been developed as proof-of-stake from the get-go.

Play it Green

Play it greens aim is to reduce the carbon footprint of people and businesses whilst ensuring they make an environmental and impact on the way to net-zero. They do this through planting trees, offering educational tips in weekly newsletters and offering sustainability news updates and much more.

Every Play It Green Product & Service Always Delivers Upon
Our 3 Step Solution to Climate Change

#REDUCE footprints through weekly tips, support and discounts.

#REPAIR the planet and rebalance footprints by planting trees.

#REGIVE as 10% of all revenues go to a good cause of your choice.

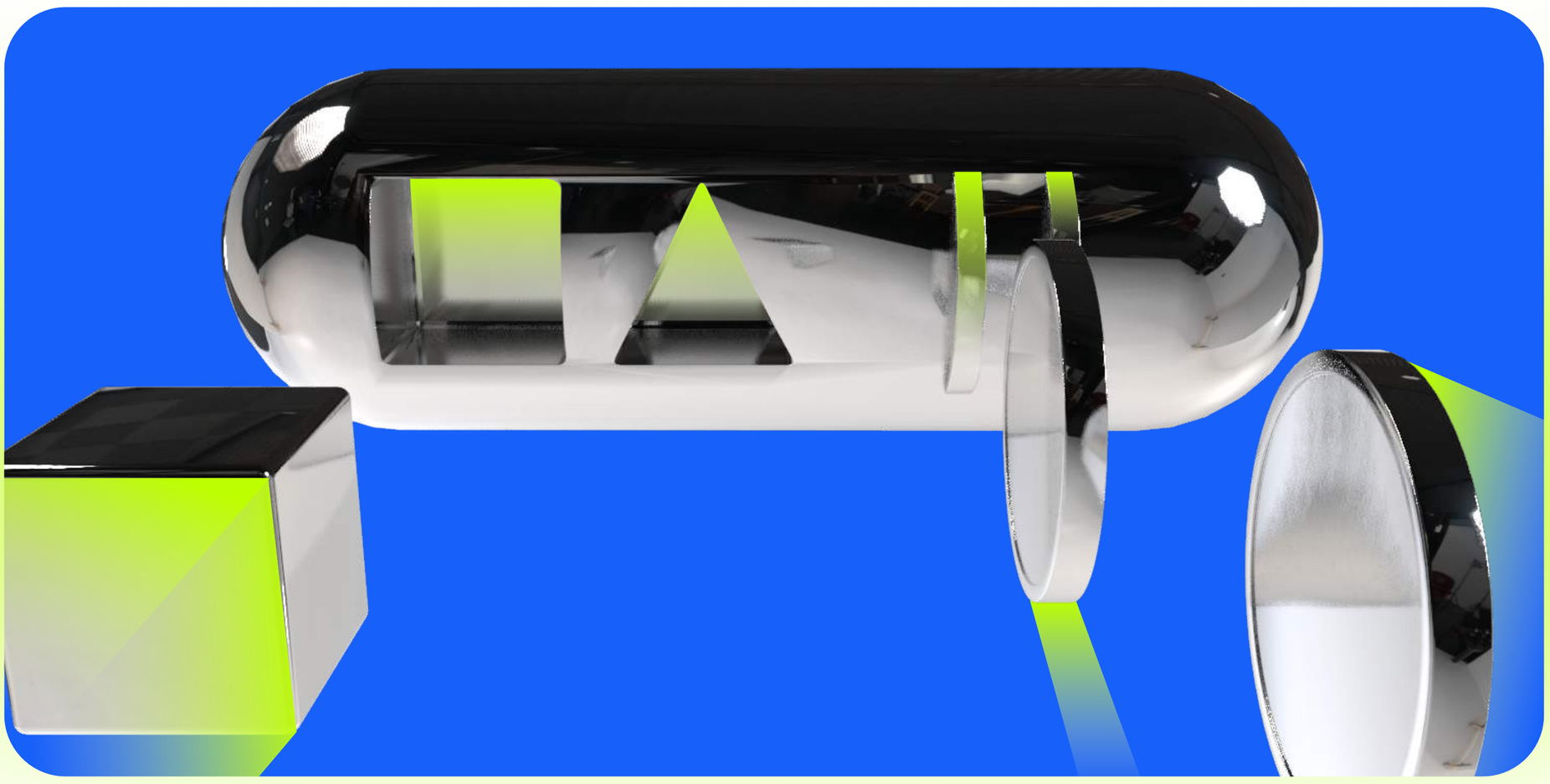
Helping you make an instant Environmental & Social Impact whilst on being supported to lower your Carbon Footprint

Efinity

An effort of NFT and gaming-focused project Enjin, Efinity is a blockchain built on the Polkadot network. The network is attempting to serve as a mainstream and developer and user-friendly NFT experience that runs at low cost and high speeds. It describes itself as an NFT highway, as opposed to a general computing blockchain. Enjin CTO Witek Radomski has spoken about the use of Polkadot and its eco-friendly nature, saying,

> *“There are other, greener PoS protocols available: Polkadot is proving to be among the most viable and carbon-conscious options, using the equivalent of 6.6 US households worth of energy per year, which is why we’ve chosen it as the destination for our NFT parachain, Efinity. Parachains do not require additional energy resources to operate, so Polkadot's energy consumption will remain less than 0.001% of Bitcoin.”*

Efinity aims to become a hub for both fungible and non-fungible assets, with a new token standard for compatibility across all networks and standards.



Efinity's native token, EFI, is used to transact and reward network participants. The latter group includes collator nodes that run the network, users who govern the network, buyers and sellers, early adopters and creators, as well as developers who can receive grants in the form of these tokens from a community pool. EFI rewards even go so far as to reward those who simply initiate the highest bid on an NFT.

Among the features of the project are Discrete Accounts, which are virtual accounts that allow users to play blockchain games without needing to set up a crypto wallet, and crafting, which allows existing NFTs to be modified (or new ones created) using a predetermined recipe.

Radomski adds that, in the end, all of this will end up having a positive impact:

> *"The intrinsic cultural value of NFTs has been overlooked, and I believe it is worth pursuing for the sake of our collective future. With so many Web 3.0 players and networks aiming to secure carbon neutrality, it's only a matter of time before a complete migration from Web 2.0 takes place, underpinning a net positive impact on our environment."*

Nano

Nano (NANO) cryptocurrency represents a shift from both Bitcoin and Ethereum. Instead of having nodes with full blockchain records, each wallet address has its own blockchain (block lattice) that is updated when transactions are executed. The updated status of this ledger is then relayed to the Nano blockchain, verified and integrated after confirmations from other Nano nodes.

Therefore, unlike both PoW and PoS networks, in which transactions are lined up for block inclusion and fee distribution, Nano nodes have a voting power on who creates blocks. Because this can be done at low or zero fee, having transactions included in the Nano blockchain is executed without cost.

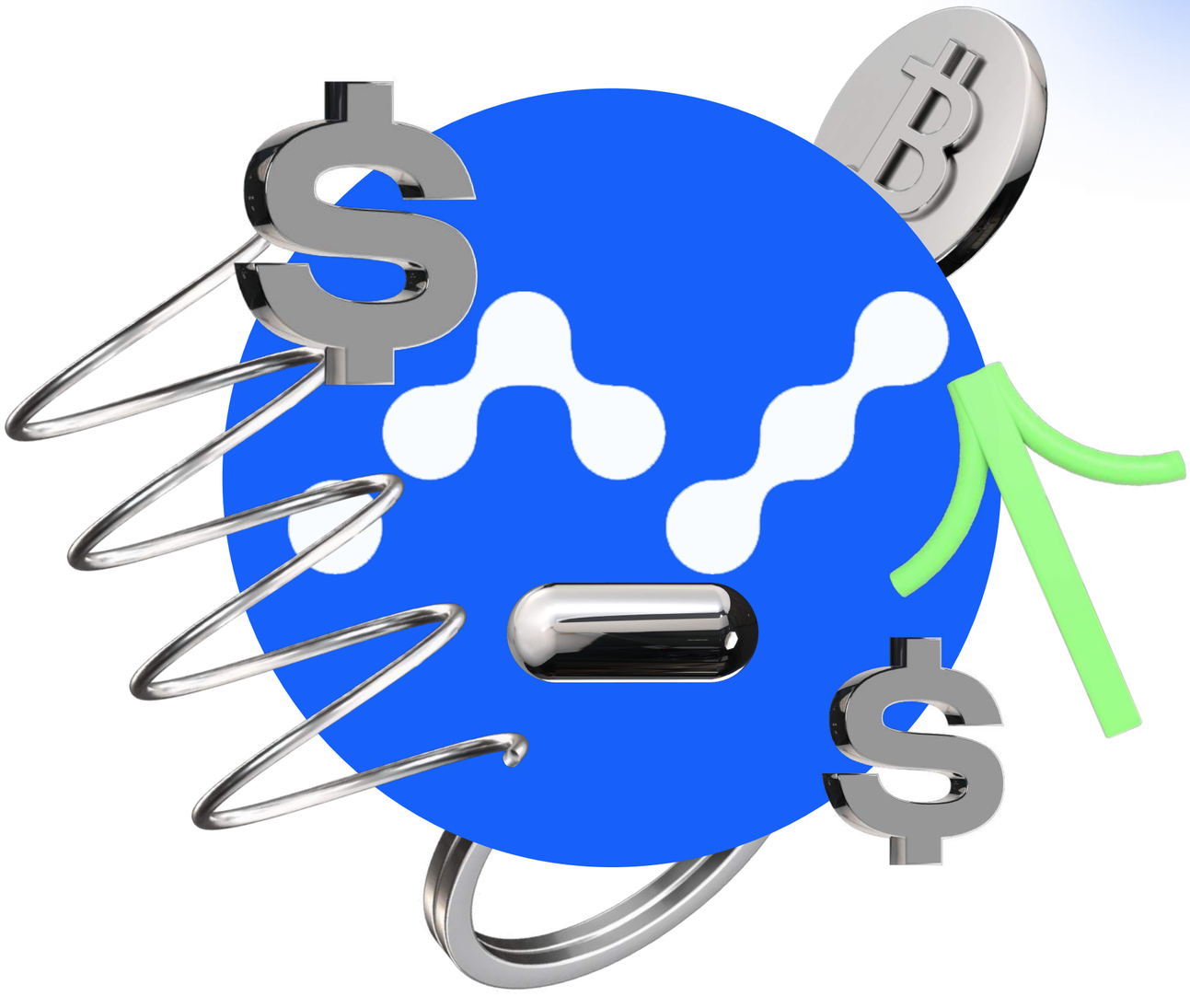
Nano has talked about how the argument around bitcoin’s energy usage is outright wrong,

“The argument around energy usage of Bitcoin in the cryptocurrency space is not about who is right or wrong, it is fundamentally about progress. If a better solution comes along, you use it - that has always been the case with technological progression through the ages. Arguments around the energy consumed for the bitcoin network revolve around statements such as, ‘it uses renewable energy so it's fine’ or ‘It’s fine because the energy being used has already been created’ - this is the creation of a positive feedback loop of support and misguidances. The defense statements themselves may not be factually incorrect, it doesn't really matter. My point is that if there is a technology that has burst onto the scene, whether cryptocurrency or not - that is not looking towards an energy sustainable future of the world, then more innovation needs to happen to make it so.”

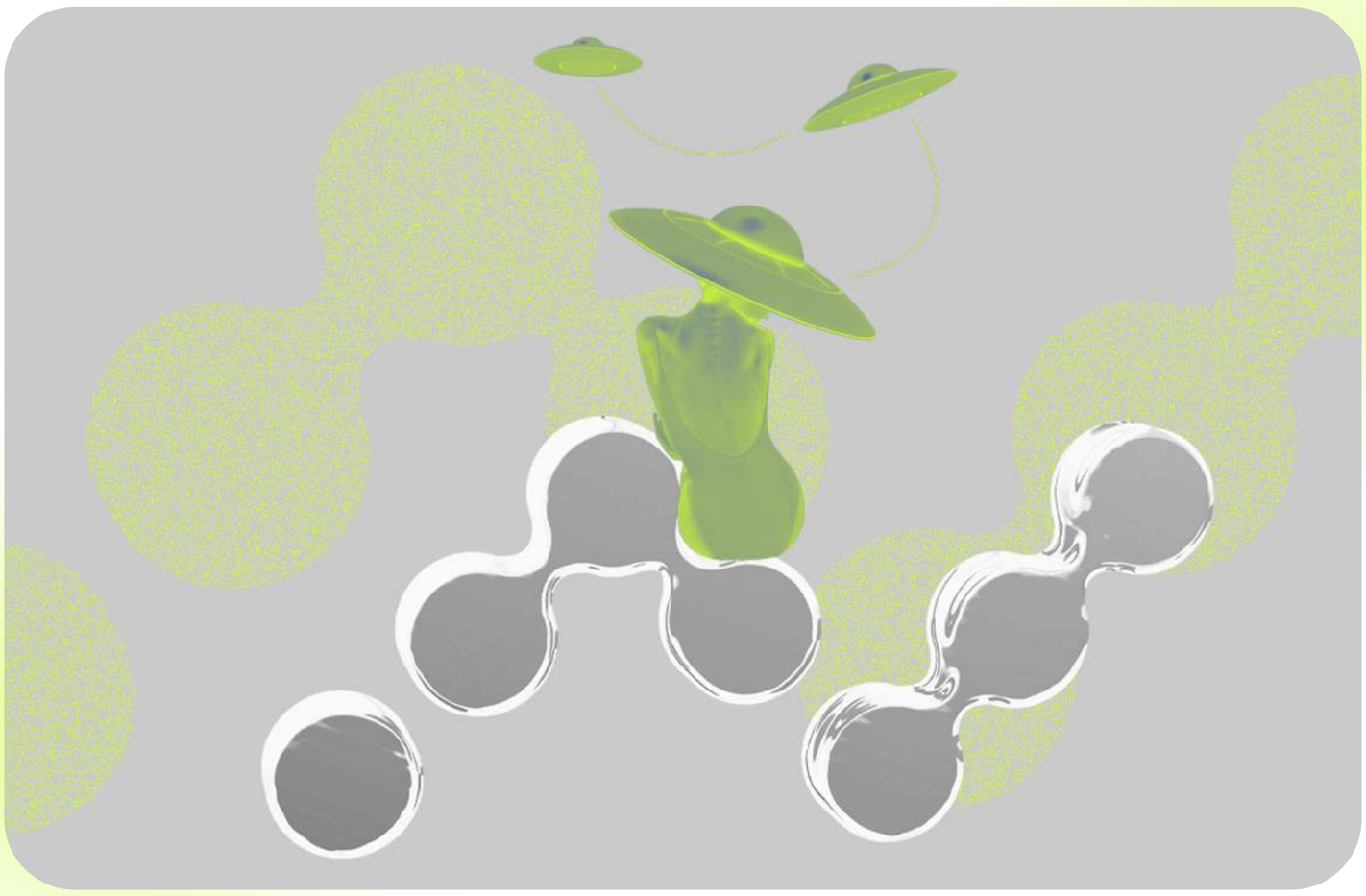
(George Coxon, director of the Nano Foundation)

In technical terms, Nano uses not just proof-of-stake consensus but a delegated proof-of-stake (DPoS), and not just DPoS but its variation dubbed Open Representative Voting. Depending on the account balance, each node is delegated with a voting weight. These votes can then be used or distributed to another Nano node. As for Nano's energy consumption, Nano's executives say,

> *"Nano has an energy footprint for 1 transaction being 0.00012kWh and a whole network that could run off a single wind turbine- to put this into perspective, that is 15.5million nano transactions using the same energy as a single bitcoin transaction."*
>
> *(Colin LeMahieu, founder and director of the Nano Foundation)*



With sufficient voting weight, each node can become a Principal Representative, able to vote on transactions in proportion to held funds. Furthermore, individualized account blockchains, called Block Lattice, make it possible for users to immediately update their account balances, without waiting for network confirmations.



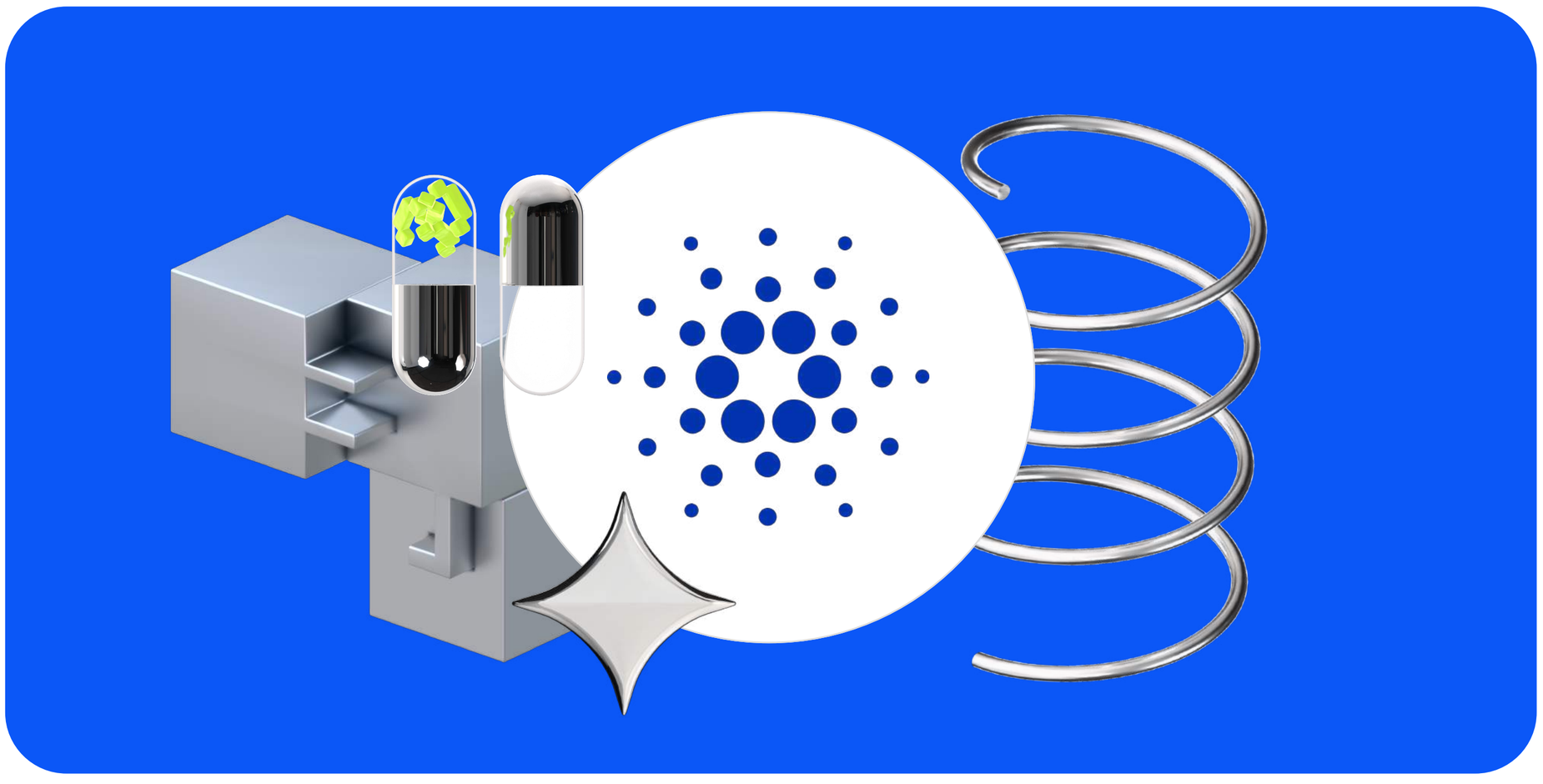
Interestingly, Nano also uses some measure of proof-of-work energy proofing as a discouragement tool against spamming the network with transactions.

Nano has already accomplished what Greenpeace is asking from Bitcoin now. However, those in charge are firm in their belief that crypto should support eco-friendly initiatives,

“Cryptocurrency firms that support and facilitate non-sustainable technologies yet have their tag line being ‘bank the unbanked’ or USP to provide banking for those in emerging economies - it is those people that you are supposedly trying to help that will feel the largest brunt of climate change and responsibility to not using or facilitating greener solutions must be taken.
Digital money should not cost the Earth.”

(Colin LeMahieu, founder and director of the Nano Foundation)

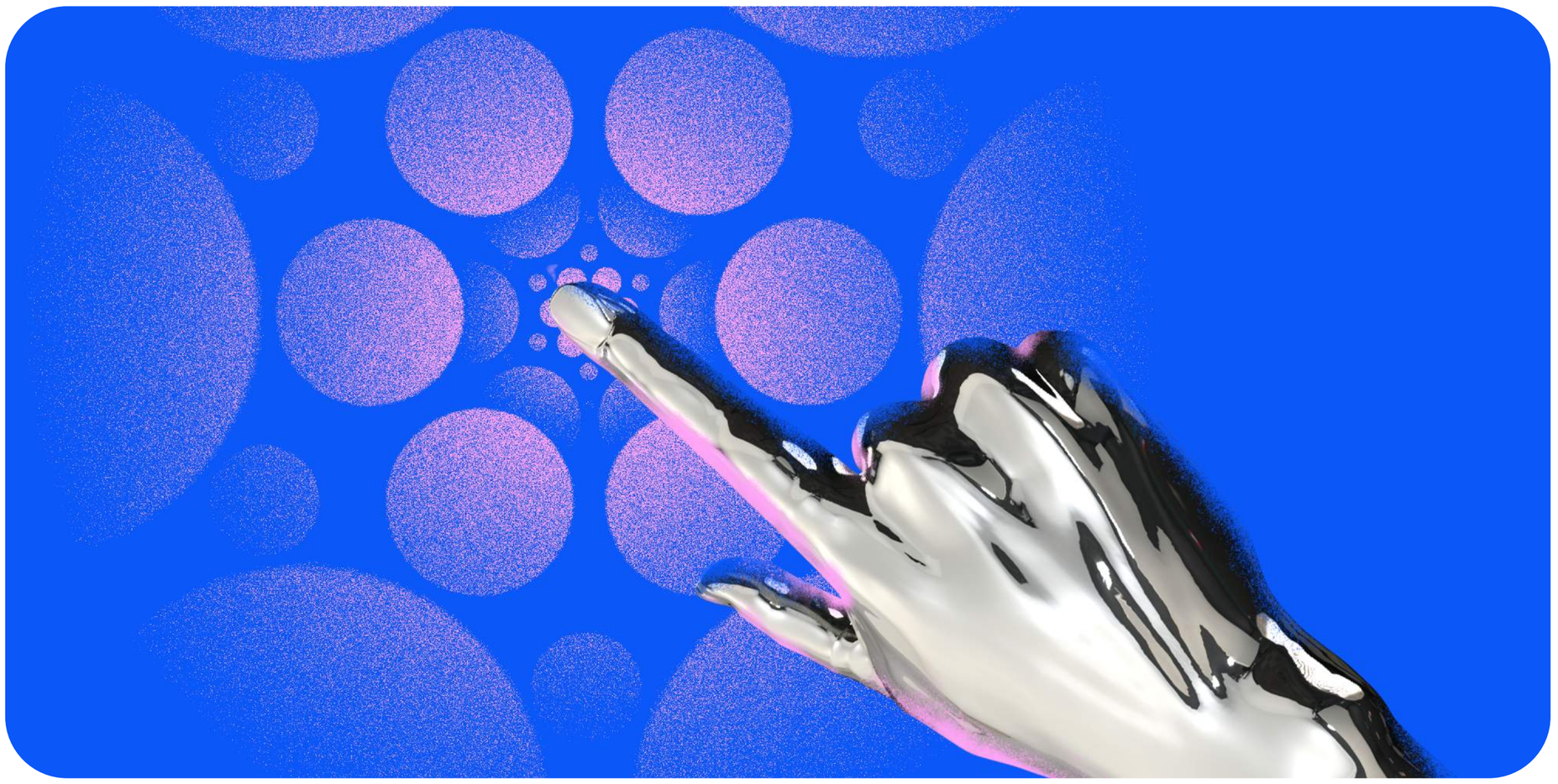
Cardano



Cardano (ADA) shares its origin with Ethereum, as Cardano's key developer, Charles Hoskinson, also co-founded Ethereum with Vitalik Buterin and six other founders. Given this shared legacy, Cardano is also a generalist smart contract platform, designed to deploy dApps that cover NFT marketplaces, decentralized finance (DeFi), and blockchain gaming.

Named after Italian mathematician Gerolamo Cardano, the network shares a commonality with Bitcoin in that it has a fixed coin supply. While Bitcoin maxes out at 21 million, Cardano's ADA tokens are capped at 45 billion. Compared to Ethereum, which is yet to fully transition into a proof-of-stake consensus, Cardano was one from the get-go, dubbed as a third-generation smart contract platform.

Although Hoskinson left Ethereum for a monetary reason, as Vitalik sought to keep it open-source and nonprofit, Cardano turned out to be one of the most decentralized public blockchains with over 3,000 validator nodes. That may seem tiny compared to Ethereum's over 300k validators, however, such contrast is misleading.



As long as Ethereum validator has over 32 ETH (~$112k) they can run multiple nodes. In contrast, the maximum capacity of Cardano's staking pool is 64 million ADA (~$77m). Presently, there are 3,219 ADA staking pools with a 72.5% stake/supply ratio. Therefore, if Ethereum's validator accounting is to be applied to Cardano's ecosystem, the latter would have 200k validators (64 × 3,219).

With that said, Cardano dApp ecosystem is yet to fully come online. While Ethereum hosts 2,948 dApps tied to blockchain's smart contracts, Cardano only has 72 listed. The reason for this wide gap between the two platforms is that Hoskinson took a more robust, peer-review approach to code development.

Mirroring its delayed smart contract deployment and stagnant dApp ecosystem, ADA price has been less exciting than ETH over the last year.

Whether a more secure and robust coding practice pays in the end, the market will decide. However, when it comes to Cardano's energy output, it will certainly not draw attention from any environmentalist group. According to Cardano Blockchain Insights, the entire network consumes only 0.00282160 TWh. Compared to Bitcoin, this is 46,400 times less energy consumption.

NETWORK ENERGY USAGE 🔋

3,221
Last Epoch Stake
Pool Number

2.4
Energy Usage Per Pool Per Day in KWh

2,821,596
Energy Usage of Whole Netwrok Yearly KWh

256.51
Energy Usage of Netwrok in US Households

876
Yearly Single Pool Usage Per Pool in Kwh

2.82
Energy Usage of Whole Netwrok GWh

0.00282160
Energy Usage of Whole Netwrok TWh

CONSTANTS:

11,000
Yearly Average US Household Energy Usage in Kwh

365
Days in Year

100
Watts Per Pool

Norway

124.3

TWh per Year

Ukraine

124.5

TWh per Year

Bitcoin

131.0

TWh per Year

Egypt

149.1

TWh per Year

Poland

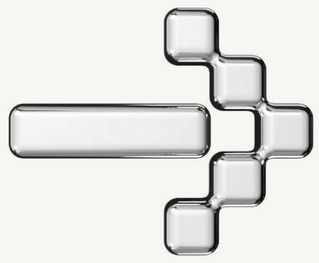
149.5

TWh per Year

Although this energy usage is bound to increase if Cardano approaches Ethereum-level of dApp activity, it will still be in the same ballpark range due to Cardano's economic staking instead of computational mining.

131 TWh

Bitcoin Network Energy Usage:



46.4K

Cardano How Many More Times Energy Efficeint Than Bitcoin

Algorand

Algorand (ALGO) is another open-source PoS network aiming to create a dApp ecosystem based on blockchain's smart contracts. Developed by MIT computer scientist Silvio Micali, Algorand's main focus is to facilitate near-instant payments. Specifically, by having the capacity to process over 1,000 transactions per second (tps) and executing them in under five seconds.

This is way ahead of Ethereum's current standard of 14–17 tps under five minutes. Algorand makes this possible by having integrated a two-tier network structure. While Ethereum relies on layer 2 scalability networks, such as Arbitrum, Polygon, Optimism, Loopring, Immutable X, and others, Algorand was developed from the beginning with scalability in mind:

- The first layer enables developers to create Algorand Standard Asset (ASA), which is equivalent to Ethereum's ERC-20 smart contract token standard. Layer 1 handles these simple token transactions, executed as Algorand Smart Contracts (ASC1s).

- The second layer handles more complex smart contracts one commonly finds in the DeFi space revolving around borrowing and lending dApps. Because they are executed off the main Algorand chain, they relieve the network to handle the most typical transactions — token transfers, i.e., payments.

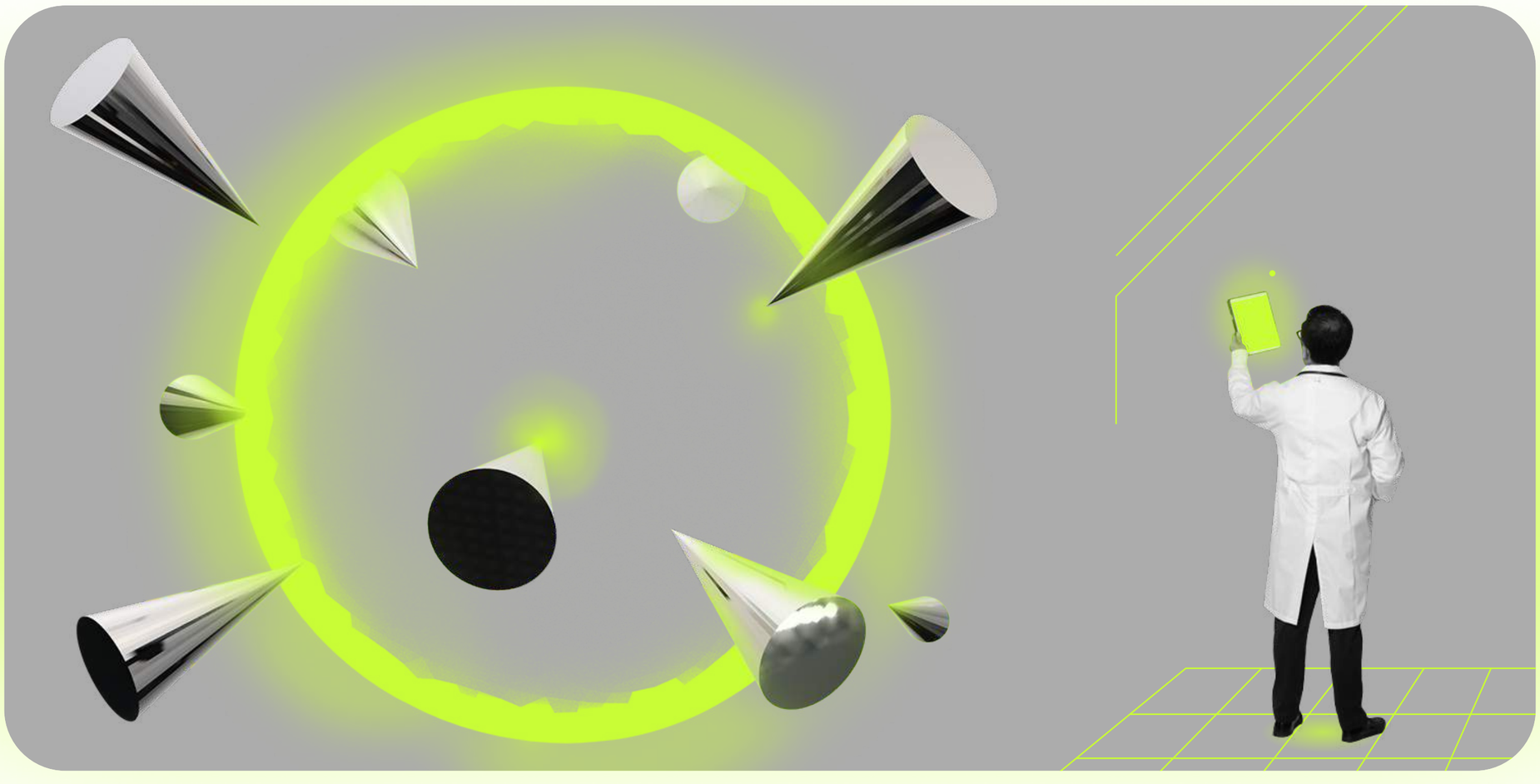
Algorand founder Silvio Micali kept energy consumption in mind when designing the network,

> *"While some blockchains consume as much energy as a small country, Algorand consumes as much as 10 homes. Being green is our pride and our moral obligation. The less privileged are the first to suffer from the degradation of the environment - a blockchain that is bad for the environment is a bad blockchain. Period."*
>
> said Silvio Micali in a recent keynote.

Algorand developed a public blockchain that runs on a version of proof-of-stake, which drives electricity consumption to almost zero...on a fundamental level," Silvio Micali said, "I care about the planet."

Just like Cardano, Algorand has a fixed token supply of 10 billion ALGO tokens. However, because Algorand uses a PoS variation — pure proof-of-stake (PPoS) — it means that all ALGO holders participate in securing the network and receiving transaction fees. Moreover, the minimum threshold is only 1 ALGO compared to Ethereum's high threshold of 32 ETH.

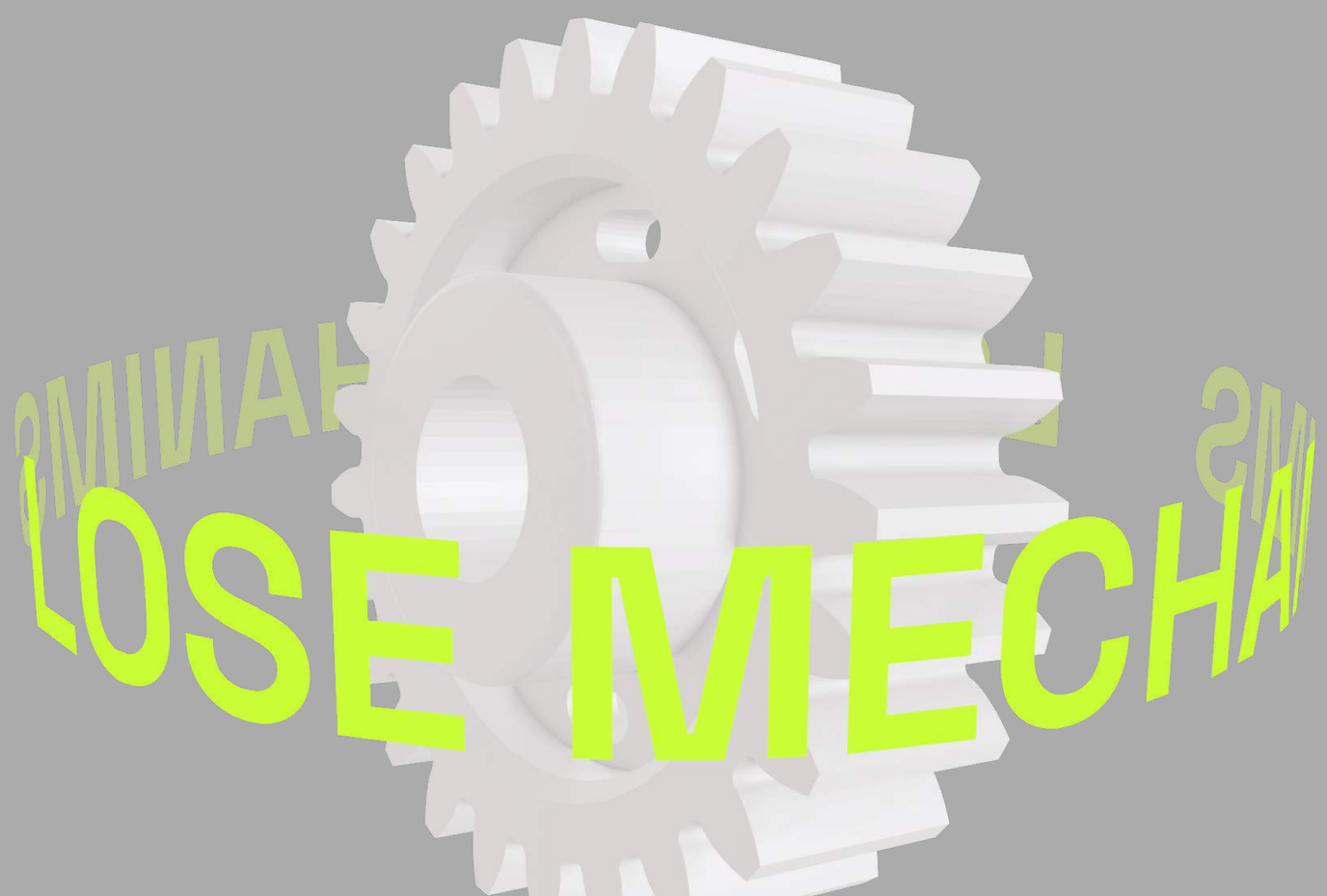
While this drastically lowers the barrier of entry and incentivizes network participation, it remains to be seen if this will negatively affect the network's security in the long run. After all, a higher stake incentivizes greater care. Furthermore, Algorand doesn't even employ an Ethereum-like slashing mechanism for users who propose bad blocks.

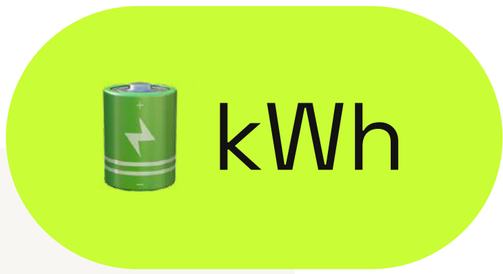


However, that does not appear to have been a concern for others, as Climatetrade CEO Francisco Benedito has said that Algorand was the right technology for its needs,

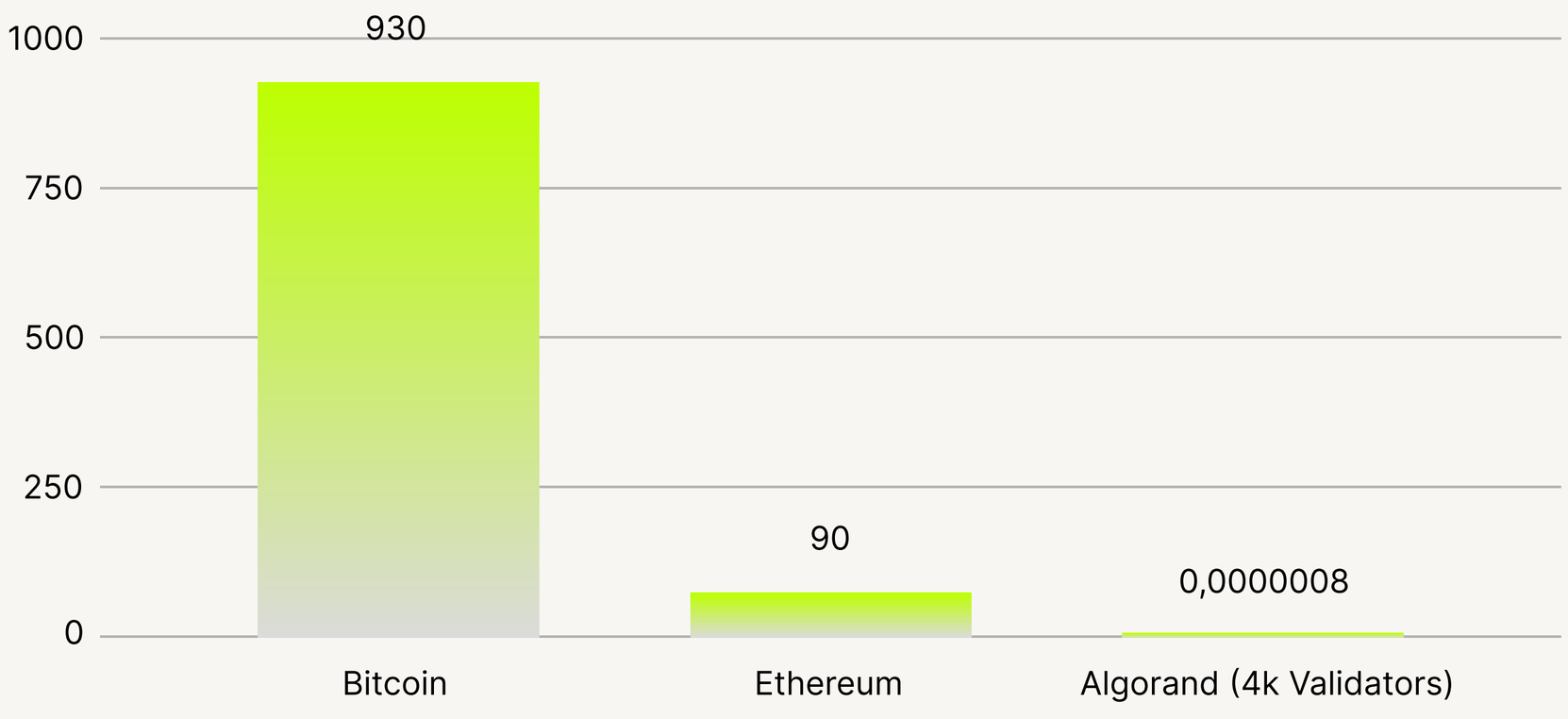
> *“After analyzing several technology providers and rigorous due diligence, we chose Algorand as the blockchain infrastructure to power our platform. We have no doubt, Algorand is the perfect solution due to its flexible architecture, low transaction fees and scalability of transactional performance. In addition, they are the only pure proof-of stake (PPoS) network and we have an aligned business vision.”*

In September 2021, Algorand Foundation introduced a slashing mechanism proposal in which bad actors would lose 8% of their staked ALGOs. However, it failed to pass in favor of the existing system in which they only lose distributed rewards without further penalties. As is the case with other PoS blockchain networks, Algorand's energy consumption is negligible at 0.000008 kWh per transaction.





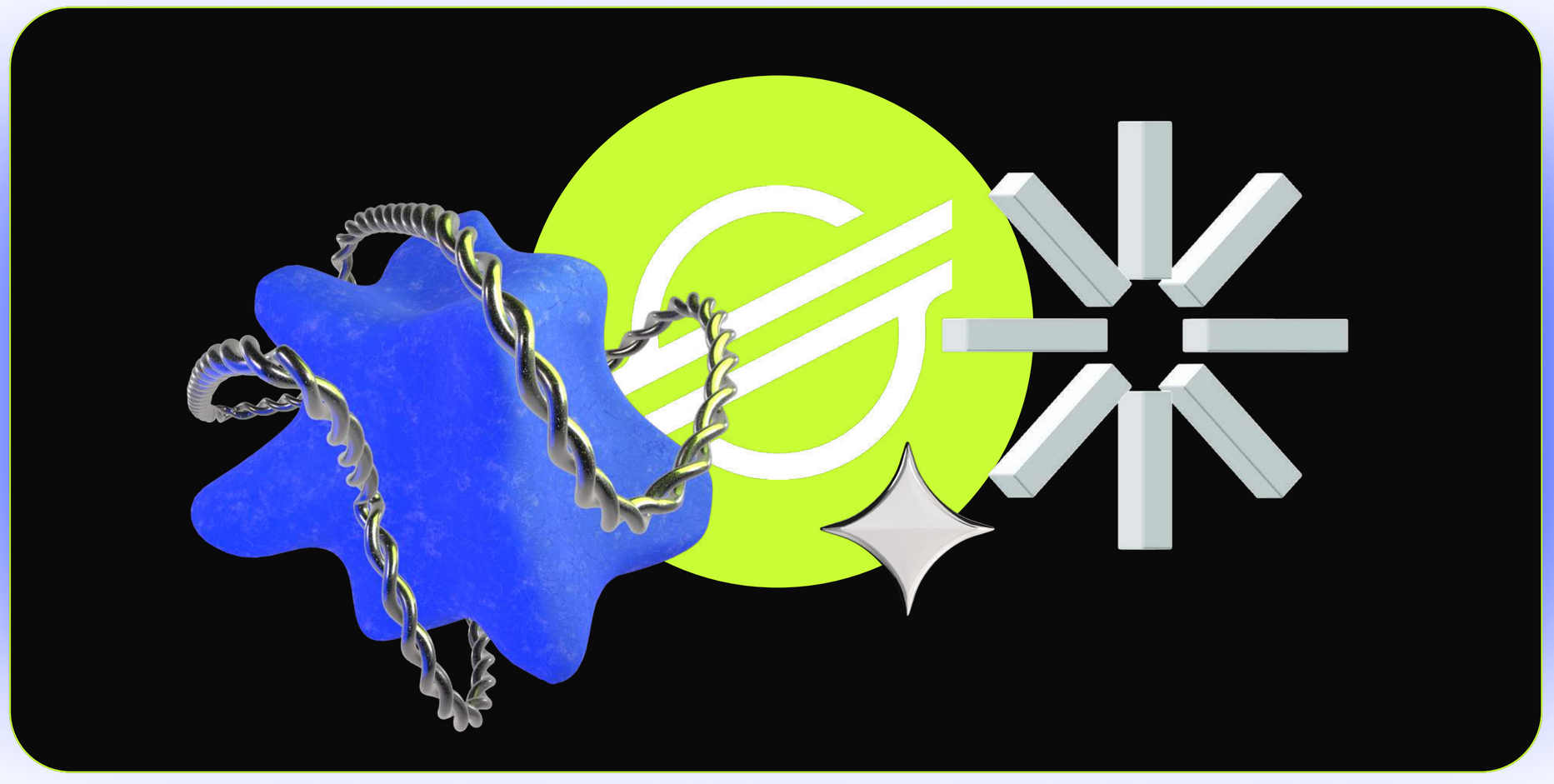
AVERAGE ENERGY CONSUMPTION PER TRANSACTION (APRIL 2021)



Source: Algorand Foundation

As of April 2022, Algorand has a $2 billion market cap with fewer than 100 dApps, some of which are still in the testing phase. As Ethereum transitions into PoS this year with the Merge, Algorand's integrated two-tier structure and low energy consumption may not be enough for its long-term appeal.

Stellar Lumens

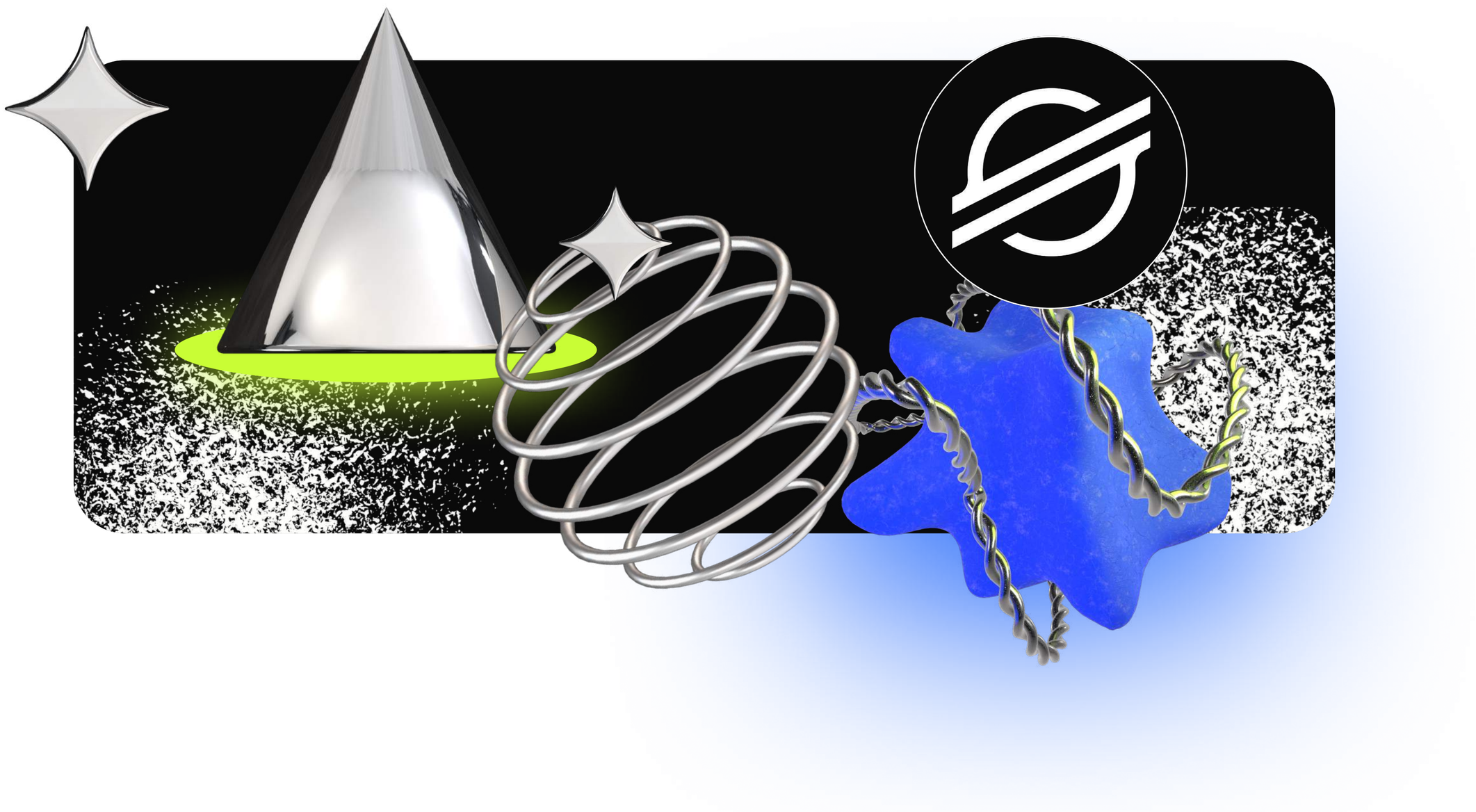


Stellar Lumens (XLM) shares its origins with Ripple, both peer-to-peer (P2P) digital currencies developed by Jed McCaleb. However, while Ripple leans on the institutional side of money transfers with its banking and payment processors network, Stellar is focused on granular, individual payment service.

To achieve that, the Stellar Network, launched in 2014, runs XLM tokens. Via this P2P money, the goal is to facilitate borderless payments with least transaction fees possible. In other words, it helps the unbanked enter the digital economy by creating a decentralized remittance market, provided they have basic internet access and a smartphone capable of hosting a digital wallet.

While Terra and Tron blockchains already provide such a service with stablecoins, Lumens act as an intermediary money transmitter. Meaning, when user A sends user B money, the former can pick different currency than the one user B receives.

The Stellar Network converts the original currency into XLM and seeks the optimal trading pair to deliver the destination currency. Stellar's Anchors make that exchange possible as they hold deposits and even issue credit. With all the Anchors within the same Stellar network, transactions complete in under 5 seconds with a fee of only 0.00001 XLM ($0.00000216).



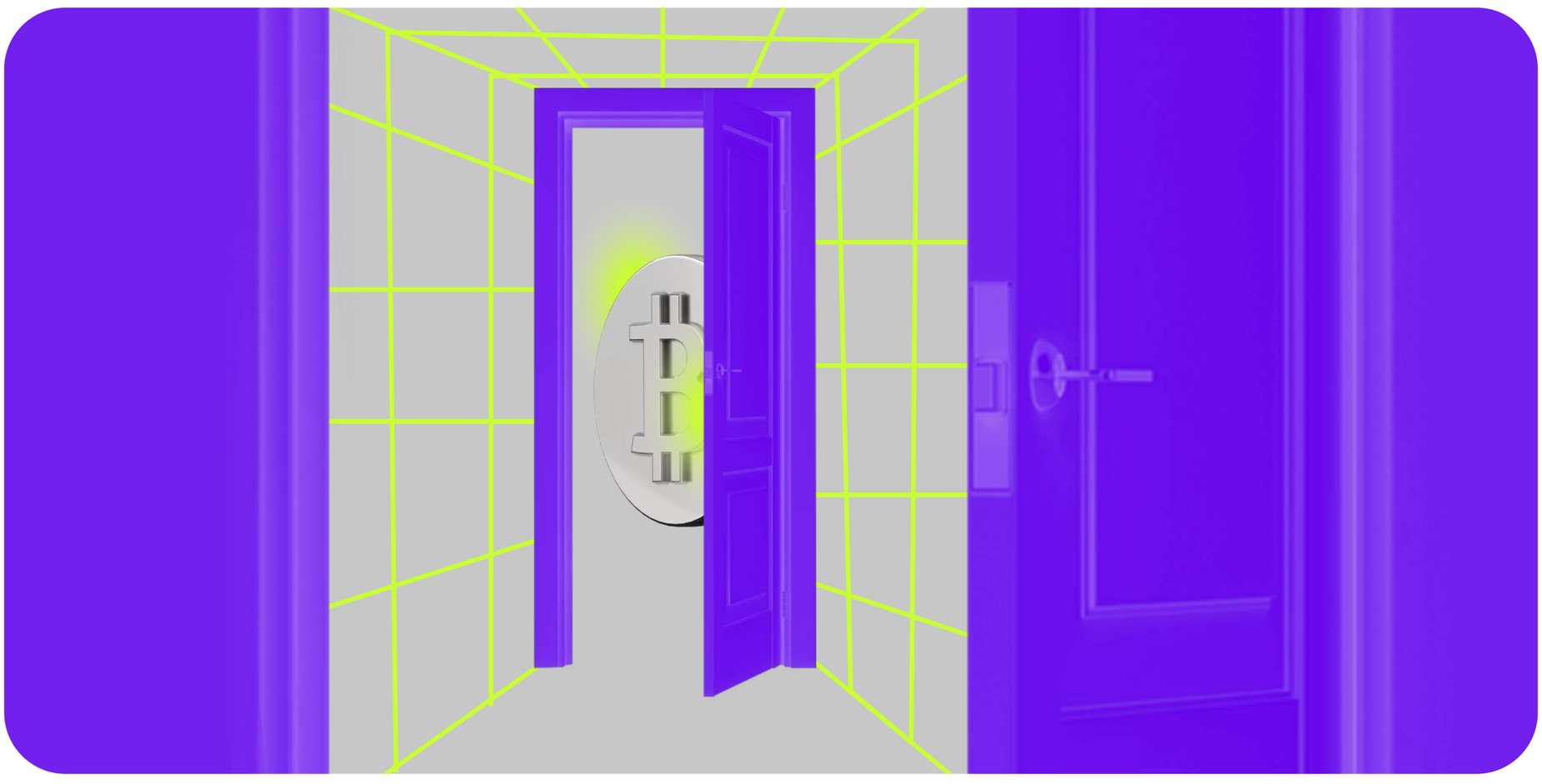
Without a doubt, this makes the Stellar Network one of the most cost-effective ways to transfer money. Moreover, there is no mining or staking involved as the Stellar Development Foundation (SDF) controls XLM supply, set at 50 billion.

Because it doesn't use either PoS or PoW but its own consensus algorithm based on the Federated Byzantine Agreement (FBA), dubbed Stellar Consensus Protocol (SCP), Stellar Lumens (XLM) is another network with exceedingly low energy consumption of only 0.00022 kWh per transaction.

Just like Ripple, Stellar has accrued a large list of partners enabling its network to spread globally. Among them are IBM World Wire, CEX.io, Blockchain.com, MoneyGram, Circle, and Flutterwave. The latter is ideal for money transfers between Africa and Europe. Likewise, Blocknify can use the Stellar network to notarize official documents.

Presently, Stellar's market cap is $5.3 billion.

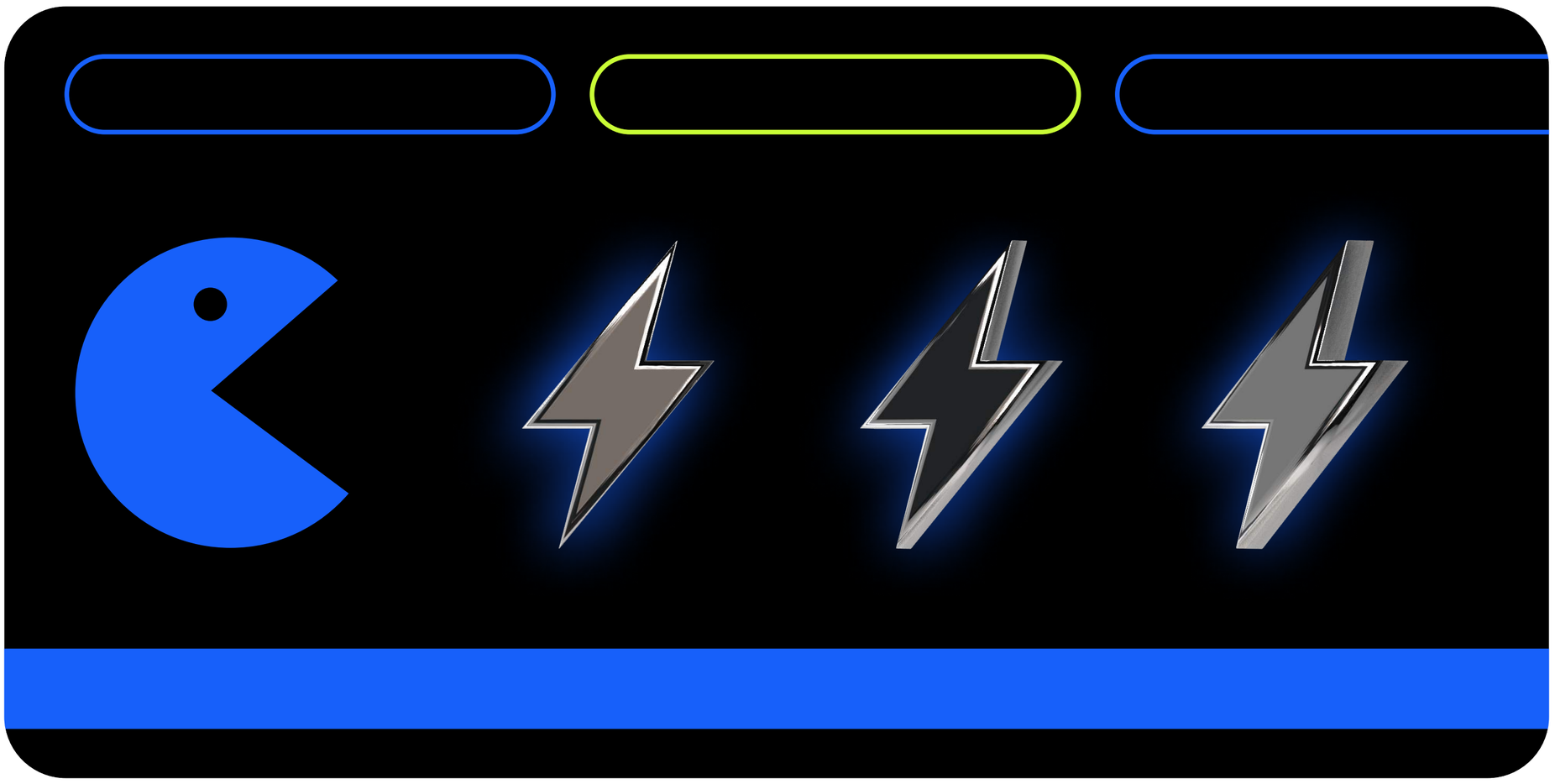
LUSION CONCLUSION CONCLUSIO



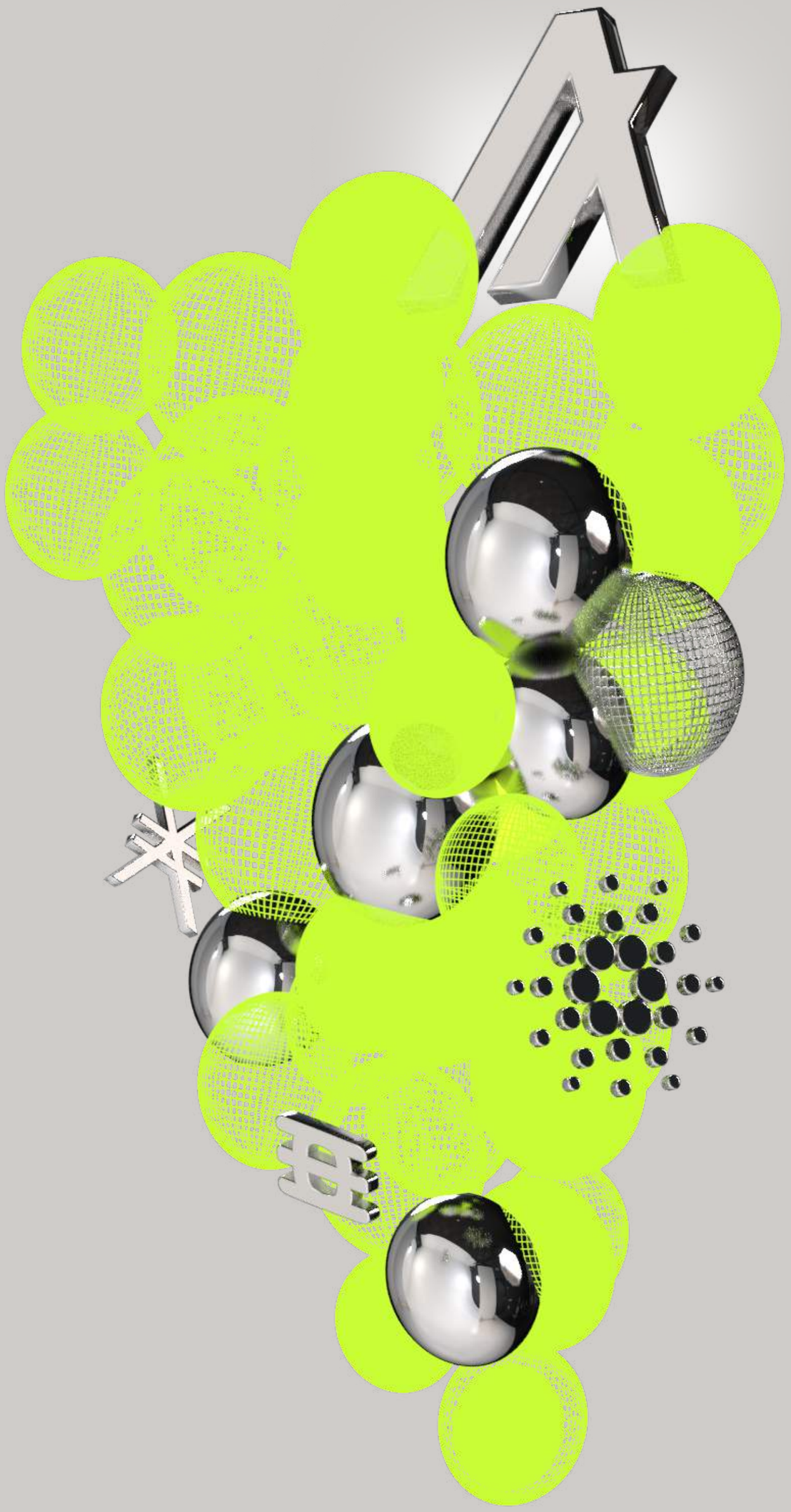
Bitcoin ushered the concept of decentralized money for the first time in human history. Layered on top of the internet as native digital currency, Bitcoin's creator had to ensure its long-term viability as unassailable access to virtual and private banking. One that is outside the scope of central banking money supply manipulation.

Because of the importance of securing this monumental monetary revolution, proof-of-work consensus was the go-to solution that provided the physical foundation for a virtual asset. This was critical during the first crypto decade due to the difficulty of grasphing such a novel and untested blockchain concept.

If Bitcoin had been a proof-of-stake blockchain from the beginning, it might have never taken off. After all, the first wave of adopters could have taken over the network by owning 51% of the staking funds. In such a scenario, the digital cryptocurrency experiment would have failed, proving itself to be too unreliable.



Even Ethereum, as a more generalist smart contract platform, grew to its present $423 billion market cap on the back of energy-proofing PoW. Now that Bitcoin has been thoroughly tested, having birthed the crypto ecosystem with it, it is easy to have the luxury to demand its PoS remake. And as Dr. Gebert of the European Blockchain Association pointed out, solutions require targeted economic and policy-related incentives,



However, as the data clearly shows, utilizing 0.12% of the world's energy for such a valuable, equalizing financial service has to be contrasted with other industries and financial sectors. On equal footing, the blockchain sector is shaping to be one of the most innovative ones, always looking to not only seek alternative energy sources, but upgrade base code as well.

> *“To fully realize the benefits of DLTs and support digital innovation, it will require targeted economic and policy-related incentives. This would be in line with the UN's Digital Cooperation recommendation to test new approaches "on a small scale before being rolled out widely—for example, through pilot zones, regulatory sandboxes, or trial periods.”*

In the end, due to the open-source nature of Bitcoin, which underpins the entire crypto market, such views can easily be accommodated via a hard PoS fork. It would then be up to the market to decide whether to adopt it or reject it.

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