Is Bitcoin the Sound Money of the AI Age?

- **Bitcoin's mathematically fixed supply of 21 million[1] coins creates a structural floor of value that no fiat currency can replicate.**
- **The convergence of AI and Bitcoin is promising: both technologies compete for the same energy, semiconductor, and infrastructure resources.**
- **As AI expands the global economy, the need for a neutral, censorship-resistant digital settlement layer grows and Bitcoin could be uniquely positioned to fill that role.**
- **VanEck's thematic ETF suite, including the VanEck Crypto and Blockchain Innovators UCITS ETF (DAPP), alongside strategies focused on semiconductors (SMH), nuclear energy (NUCL), global mining (GDIG), and rare earth metals (REMX), offers investors a coherent and diversified gateway to access this increasingly interconnected and converging investment landscape.**
- **Investments in Bitcoin, digital assets, semiconductors, nuclear energy, global mining, and rare earth elements involve significant risks, including high price volatility, regulatory uncertainty, and technological disruption.**

Bitcoin's Evolution: From Radical Idea to Global Asset Class

In 2009, a pseudonymous engineer named Satoshi Nakamoto published a nine-page document that would quietly redefine the meaning of money. Bitcoin: A Peer-to-Peer Electronic Cash System[2] described a currency that no government could print, no bank could freeze, and no central authority could debase. Sixteen years later, that experiment has grown into an asset class with a market capitalisation of approximately $1.4 trillion as of April 2026[3] one that is increasingly entangled with tone of the great technological transformations of our era: artificial intelligence.

This paper examines the monetary logic behind Bitcoin, its unique place within the digital asset ecosystem, and how VanEck's suite of thematic ETFs allows investors to access the broader infrastructure this convergence demands.

Fiat Currency Dynamics: Monetary Expansion and Purchasing Power Considerations

Modern fiat currencies operate on a system of discretionary issuance. Central banks expand the money supply through monetary policy decisions made by small committees, the US Federal Reserve's Federal Open Market Committee (FOMC) for example, votes on interest rates and asset purchases at eight scheduled meetings per year. There is no hard ceiling on how much money can be created. Since 2000, total US federal public debt grew from approximately $5.8 trillion to over $38.5 trillion by 2026, an increase of more than 565%[4].

[1] Ledger Academy. (2024). How many bitcoins are there? Total vs. circulating supply [Educational article]. Ledger. https://www.ledger.com/academy/topics/crypto/how-many-bitcoins-are-there
[2] Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system [White paper]. Bitcoin.org. https://bitcoin.org/bitcoin.pdf
[3] For live Bitcoin price, market capitalization, and historical chart data, see CoinMarketCap (2026): https://coinmarketcap.com/currencies/bitcoin/
[4] Board of Governors of the Federal Reserve System (US). (2026). Federal debt: Total public debt (GFDEBTN) [Dataset]. Federal Reserve Bank of St. Louis, FRED Economic Data. https://fred.stlouisfed.org/series/GFDEBTN

This dynamic could be described mathematically as an approximation of an exponential function: supply grows along somewhat an ex curve, with no fixed upper bound. When monetary expansion outpaces economic growth, the result is structural inflation each unit of currency purchases less overtime.

In extreme cases, this mechanism accelerates into hyper-inflation. Venezuela's bolivar lost over 99% of its value between 2016 and 2020 under sustained monetary expansion and government failure, with inflation reaching 929,790% in 2018 according to the IMF and 130,060% according to Venezuela's own Central Bank.[5] Zimbabwe offers an equally stark illustration: to cover government deficits, the Reserve Bank printed money so aggressively that by 2008 it issued a 100 trillion dollar banknote. At the height of the crisis, a loaf of bread cost 550 million Zimbabwean dollars, and the currency lost more than 99.9% of its value in a single year before being abandoned entirely[6].

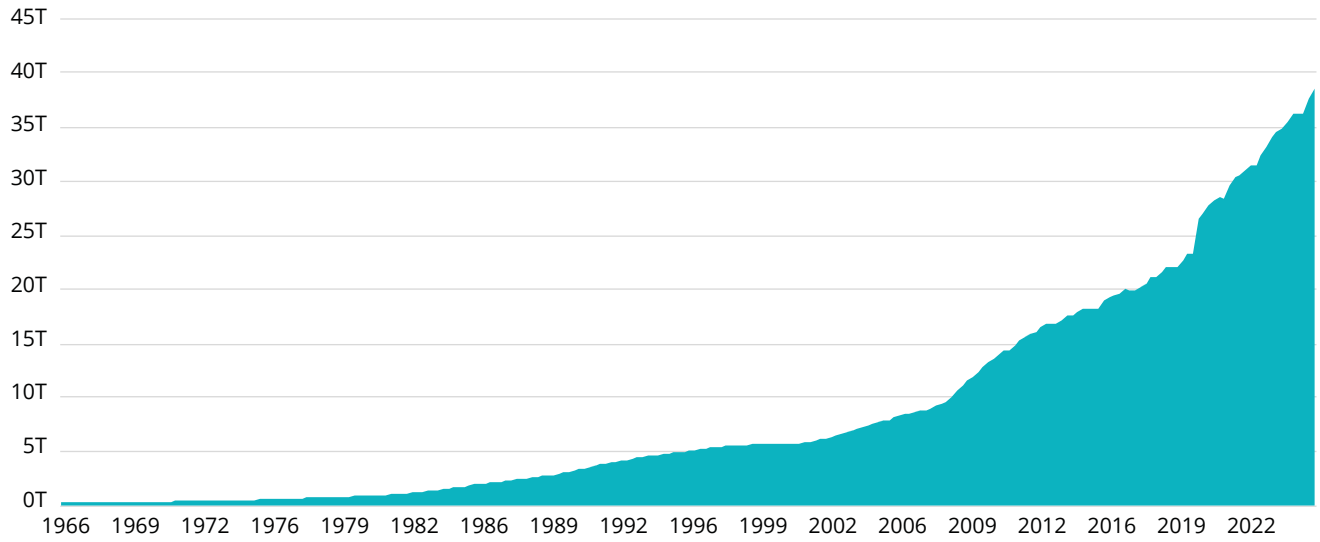
The basic mechanism could be tangible: more money in circulation chasing the same quantity of goods and services pushes prices upward. Sovereign debt amplifies this dynamic. When governments borrow heavily and struggle to service those obligations, the temptation to inflate the debt away, expanding the money supply to erode the real

Source: Smithsonian Institution. (2008). 100,000,000,000,000 dollars, Zimbabwe, 2008 [Object record]. National Museum of American History. https://www.si.edu/object/100000000000000-dollars-zimbabwe-2008:nmah_1694052

value of outstanding liabilities, could become structural. During COVID-19, major developed economies saw debt-to-GDP ratios surge by an average of +17% in a single year. When a government can expand its money supply without set up limits, the theoretical floor for that currency's value is zero.[7]

The relationship between monetary expansion and broad price inflation is, however, more complex than it first appears. Digitalization, automation, and AI adoption are generating genuine disinflationary forces in sectors where supply can be scaled: software, logistics, content production, and professional services. The Bank for International Settlements (2024) finds that AI adoption is "initially disinflationary" as productivity gains expand

US Federal Debt 1960-2026 (USD Trillions)



Source: Board of Governors of the Federal Reserve System (US). (2026). Federal debt: Total public debt (GFDEBTN) [Dataset]. Federal Reserve Bank of St. Louis, FRED Economic Data. https://fred.stlouisfed.org/series/GFDEBTN

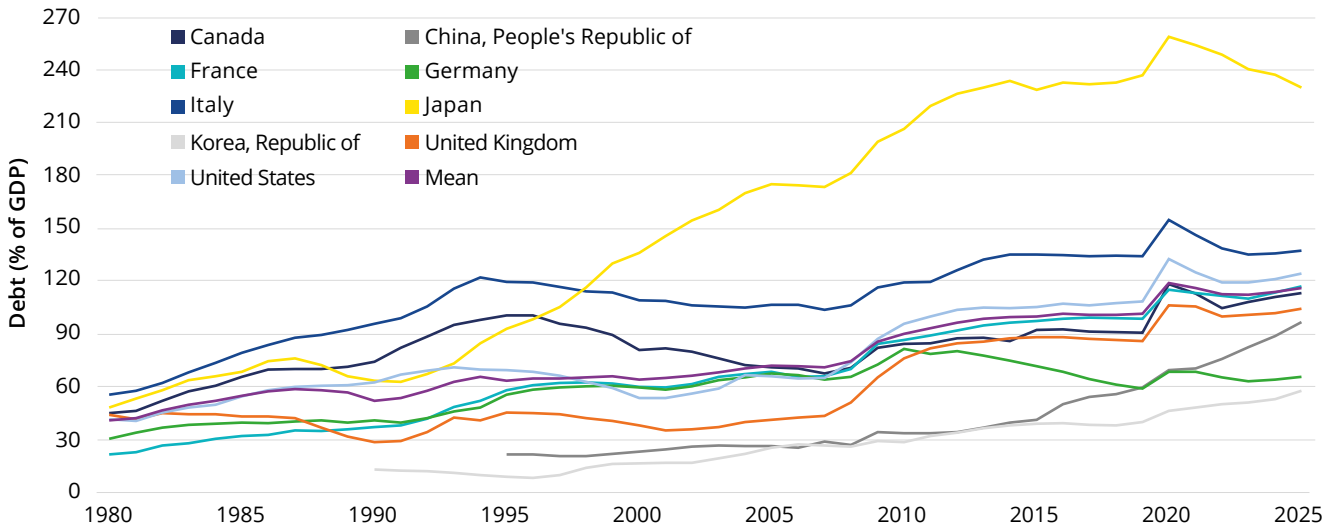
[5] International Monetary Fund. (2025). Inflation, average consumer prices Venezuela [Dataset]. IMF World Economic Outlook Database. https://www.imf.org/external/datamapper/PCPIPCH@WEO/WEOWORLD/VEN | Central Bank of Venezuela. (2019, May 29). Inflation data 2018 [Official release]. Cited in: CNN Business. Venezuela's inflation rate hits 130,060%. https://www.cnn.com/2019/05/29/economy/venezuela-inflation-intl

[6] Hanke, S. H., & Kwok, A. K. F. (2009). On the measurement of Zimbabwe's hyperinflation. Cato Journal, 29(2), 353–364. https://www.cato.org/sites/cato.org/files/serials/files/cato-journal/2009/5/cj29n2-8.pdf | Smithsonian Institution. (2008). Hanke, S. H., & Kwok, A. K. F. (2009). On the measurement of Zimbabwe's hyperinflation. Cato Journal, 29(2), 353–364. https://www.cato.org/sites/cato.org/files/serials/files/cato-journal/2009/5/cj29n2-8.pdf | Smithsonian Institution. (2008). 100,000,000,000,000 dollars, Zimbabwe, 2008 [Object record]. National Museum of American History. https://www.si.edu/object/100000000000000-dollars-zimbabwe-2008:nmah_1694052

[7] International Monetary Fund. (2026, April 10). General government debt (% of GDP) [Dataset]. IMF DataMapper, Global Debt Database. https://www.imf.org/external/datamapper/GG_DEBT_GDP@GDD/CAN/FRA/DEU/ITA/JPN/GBR/USA/CHN/KOR

supply faster than demand.[8] This does not mean inflation has disappeared, it means inflation has migrated. Where technology cannot replicate supply, in scarce and non-scalable assets, monetary expansion has produced persistent and pronounced price growth. Prime residential real estate in supply-constrained cities (London, New York, Paris, Amsterdam, ...), top-tier university education, advanced healthcare, and gold have all significantly outpaced headline CPI over the past two decades. Gold alone returned +809% from 2000 to 2024, against a US CPI increase of +86% over the same period.[9]

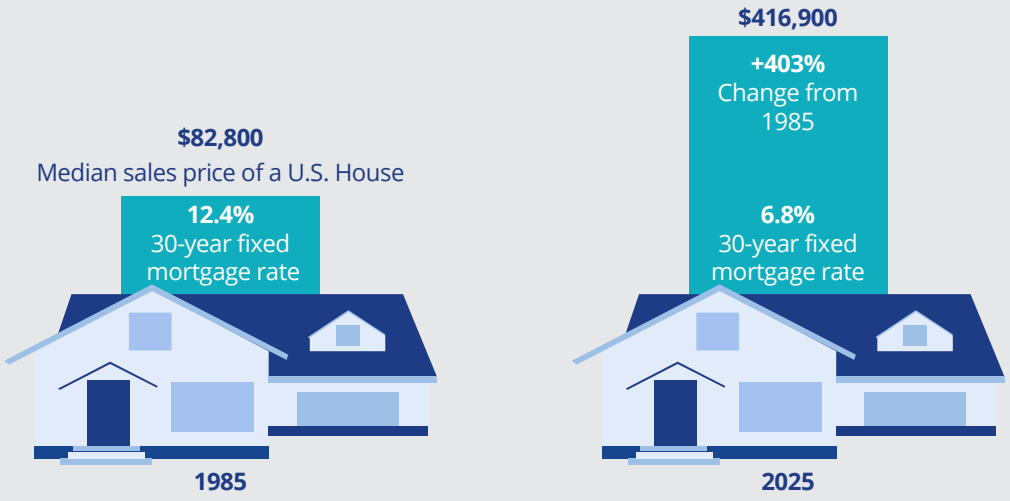
Government Debt as % of GDP (1980–2025)



Sources: International Monetary Fund. (2026, April 10). General government debt (% of GDP) [Dataset]. IMF DataMapper, Global Debt Database. https://www.imf.org/external/datamapper/GG_DEBT_GDP@GDD/CAN/FRA/DEU/ITA/JPN/GBR/USA/CHN/KOR For 2025 data for the following country are estimation: IMF Article IV Consultation, April 2026 (United States); IMF via Trading Economics (Canada); IMF via FRED, Federal Reserve Bank of St. Louis (Germany, United Kingdom); IMF Article IV Consultation, November 2025 (South Korea).

U.S. Income & House Prices

The home price-to-income ratio (Years of income to buy a typical home) has risen from 3.5 in 1985 to 5.0 in 2025.



Sources: Federal Reserve Bank at St. Louis, Motia Research. Mortgage rates are on avg. through calendar year.As of July 8 for 2025. 1985 figures in nominal dollars (not adjusted for inflation)

[8] Bank for International Settlements. (2024). The impact of artificial intelligence on output and inflation (BIS Working Papers No. 1179). https://www.bis.org/publ/work1179.htm | International Monetary Fund. https://www.imf.org/en/publications/fandd/issues/2024/09/ais-promise-for-the-global-economy-michael-spence | McKinsey Global Institute. (2025). State of AI 2025. https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai

[9] On asset-price inflation in scarce categories: Bank for International Settlements. (2025). Annual Economic Report 2025. https://www.bis.org/publ/arpdf/ar2025e.htm | European Central Bank. (2025). Financial Stability Review. https://www.ecb.europa.eu/press/financial-stability-publications/fsr/html/index.en.html

These are not random exceptions: they share one property that technology cannot solve, structurally fixed supply. Liquidity concentrates where scarcity is genuine. Bitcoin might be the only asset that is simultaneously scarce: hard capped at 21 million coins by protocol, hard to inflate by any institution and fully digital, accessible to any investor globally without the constraints of geography, zoning laws, or physical infrastructure. If AI-driven productivity continues to widen the gap between monetary expansion and real economic absorption, Bitcoin's fixed supply and non-sovereign nature position it as a natural beneficiary of that surplus.[10]

Bitcoin's Design: Logarithmic Scarcity

Bitcoin was engineered to solve the fiat debasement problem through mathematically enforced scarcity. Nakamoto's 2009 protocol hard-codes a maximum supply of exactly 21 million coins, a ceiling that no government, central bank, or majority vote can ever raise.

How mining works and why not all Bitcoin exists yet

Bitcoin is not printed, it is "mined". Miners are computers worldwide that compete to validate groups of transactions (called blocks). The winner earns newly created Bitcoin as a reward. This process serves two purposes simultaneously: it creates new coins, and it secures the network against fraud. Every transaction ever made is recorded on the blockchain: a public, tamper-proof ledger maintained by thousands of independent computers.

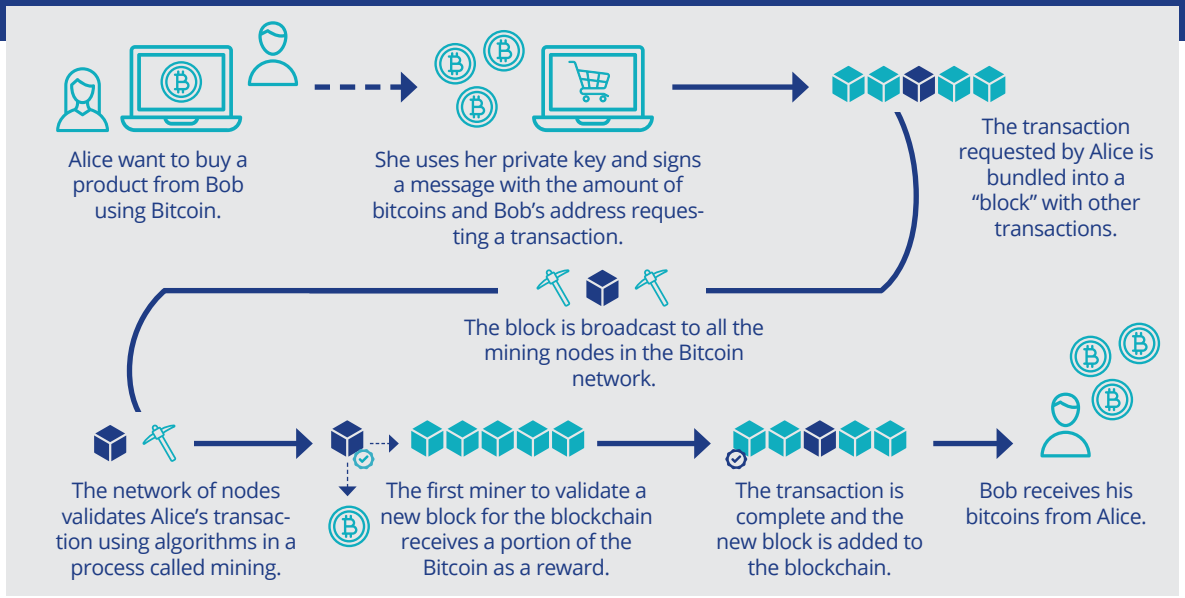
The reason not all 21 million Bitcoin exist yet is by design. The protocol releases coins gradually, at a rate that halves every 210,000 blocks, approximately every four years. This event is called the 'halving'. When Bitcoin launched in 2009, the reward was 50 BTC per block. By the 2024 halving, it had fallen to 3.125 BTC[11]. As of 2026, approximately 20 million of the 21 million coins have been mined. The final Bitcoin is projected to be mined around the year 2140[12].

The ln(x) supply dynamic and what it means for value

Where fiat currency supply could be approximated to an exponential trajectory. Bitcoin's cumulative supply follows a logarithmic ln(x) curve: always growing but decelerating toward a fixed ceiling. Once 21 million coins are reached, no further supply enters circulation, ever. Bitcoin's inflation rate, currently below 1%, will approach zero asymptotically and reach it entirely.

A 2024 peer-reviewed study in the Journal of Economics and Finance (Springer) found that after the April 2024

What is Bitcoin Mining
How Bitcoin Transactions work



Source: https://www.geeksforgeeks.org/computer-networks/how-does-bitcoin-mining-work/

[10] VanEck. (2025). The investment case for Bitcoin. https://www.vaneck.com/corp/en/news-and-insights/blogs/digital-assets/the-investment-case-for-bitcoin/
[11] Swan Bitcoin. (2024). Bitcoin halving dates: History and what to know. https://www.swanbitcoin.com/education/bitcoin-halving-dates/
[12] Blockchain Council. (2026, March 4). How many bitcoins are there and how many are left to mine? https://www.blockchain-council.org/bitcoin/how-many-bitcoin-are-there/

halving, the rate of Bitcoin lost from dormant or abandoned wallets exceeded the rate of new coin issuance meaning effective circulating supply is already shrinking. An estimated 3–4 million Bitcoin are considered permanently lost (forgotten passwords, destroyed hardware, dormant Satoshi wallets). This makes the practical supply ceiling lower than 21 million and getting lower[13].

The investment implication could be direct: as demand for Bitcoin grows across institutional investors, sovereign wealth funds, and corporate treasuries, it meets a supply curve that is not only fixed but declining in its marginal rate of growth. This is the structural opposite of fiat currency. However, this dynamic is subject to several risks. Regulatory developments across key jurisdictions could constrain adoption or market access. Bitcoin's price remains highly volatile, which may deter more risk-averse investors or lead to sharp drawdowns. Technological or security vulnerabilities, while unlikely, could undermine confidence in the network. Additionally, shifts in macroeconomic condition, such as changes in liquidity, interest rates, or risk sentiment, could weaken demand. Finally, concentration of holdings among large investors may amplify market movements and introduce liquidity risks during periods of stress.

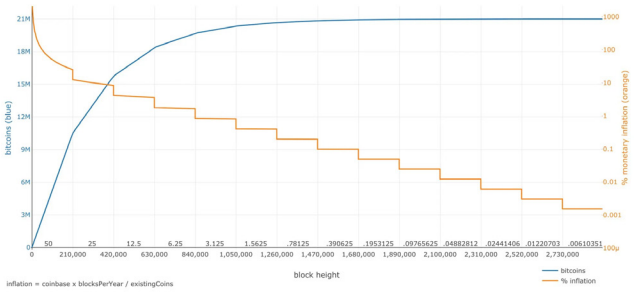
Complexity and Risks: An Honest Assessment

Bitcoin is a compelling asset, but a credible investment thesis requires acknowledging its risks openly.

Volatility: Bitcoin can fall 50–80% from its peak within a single market cycle. This stems from its relatively small market size, 24/7 trading with no circuit breakers, and sensitivity to regulatory news. That said, volatility has been declining with each cycle as institutional investors enter the market and the asset matures.

Regulatory risk: The approval of Bitcoin spot ETFs in the US in January 2024 and the EU's MiCA framework mark real progress, but regulation remains evolving globally. Can a government ban Bitcoin entirely? China tried in 2021, mining temporarily shifted to other countries and the network fully recovered within months. There is no server to shut down, no CEO to arrest. Governments can restrict access through exchanges but cannot eliminate the protocol itself. The US–Iran conflict of 2025–2026 illustrated Bitcoin's dual nature: when US and Israeli forces struck Iranian nuclear infrastructure in February 2026,

Bitcoin Monetary Inflation



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

Bitcoin fell around 7% alongside other risk assets as institutional investors deleveraged. Yet within months the market recovered and separately, Iranian civilians used Bitcoin to preserve wealth against a collapsing currency, with on-chain data recording $7.8 billion in Iranian crypto flows in 2025. Bitcoin behaved as a risk asset in the short term and as a monetary lifeline in the medium term[14].

Quantum computing: Bitcoin's elliptic-curve cryptography could theoretically be broken by a sufficiently powerful quantum computer. In March 2026, Google's Quantum AI team published a paper showing the qubit requirement to break Bitcoin's encryption had fallen approximately 20-fold compared to prior estimates (from millions of qubits to fewer than 500,000 physical qubits) with a potential attack window of just a few minutes, theoretically within Bitcoin's 10-minute block confirmation time. Google itself is targeting a post-quantum security transition by 2029. This is no longer a risk measured purely in decades: the Bitcoin development community and NIST are already working on post-quantum cryptographic upgrades, and the urgency is real.[15]

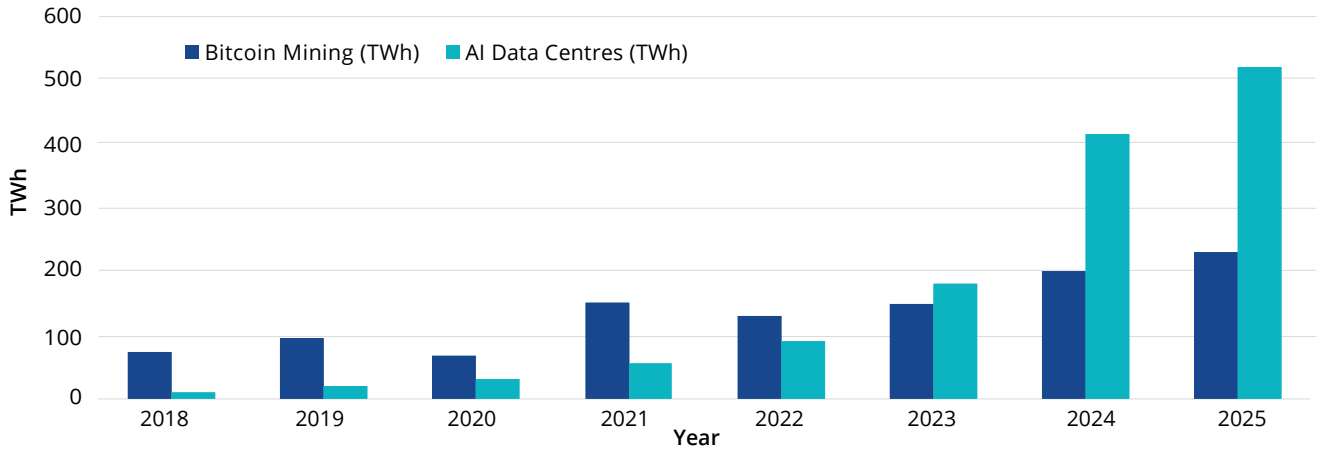
Deflationary nature: Because Bitcoin's supply is fixed, its purchasing power tends to rise over time, meaning people have more incentive to hold it than spend it. This makes it better suited as a store of value, like digital gold, than as an everyday payment currency. That said, this distinction is narrowing. The Lightning Network (a payment layer built on top of Bitcoin) enables near-instant, low-cost transactions, making Bitcoin viable for everyday spending. Block Inc. reported 7x growth in Lightning usage in 2024 and has rolled out Bitcoin payment

[13] Ambrosia, M., Dorrell, J., & Stockwell, T. (2024). Is active Bitcoin supply decreasing? An empirical analysis. Journal of Economics and Finance, 48(4). https://doi.org/10.1007/s12197-024-09691-w

[14] CoinDesk. (2026, February 28). Bitcoin drops to $63,000 as U.S. and Israel launch strikes on Iran. https://www.coindesk.com/markets/2026/02/28/bitcoin-slides-under-usd64-000-as-u-s-and-israel-launch-strikes-on-iran | Chainalysis. (2026, January 15). Inside Iran's growing $7.8 billion crypto ecosystem. https://www.chainalysis.com/blog/iranian-crypto-activity-geopolitical-tensions-2026/ | Chainalysis. (2026, March 6). Iranian crypto outflows spike after airstrikes. https://www.chainalysis.com/blog/iranian-crypto-outflows-spike-after-airstrikes/

[15] Google Quantum AI. (2026, March 31). Securing elliptic curve cryptocurrencies against quantum vulnerabilities. Google Research Blog. https://research.google/blog/safeguarding-cryptocurrency-by-disclosing-quantum-vulnerabilities-responsibly/ | CoinDesk. (2026, March 31). Bitcoin bulls scramble for post-quantum protection as Google drops bombshell paper. https://www.coindesk.com/tech/2026/03/31/bitcoin-bulls-scramble-for-post-quantum-protection-as-google-drops-bombshell-paper | National Institute of Standards and Technology. (2024, August 13). NIST releases first 3 finalized post-quantum encryption standards [News release]. U.S. Department of Commerce. https://www.nist.gov/news-events/news/2024/08/nist-releases-first-3-finalized-post-quantum-encryption-standards

Energy consumption: Bitcoin mining vs AI data centres (TWh)



Source: Cambridge Centre for Alternative Finance. (2026, April 13). Cambridge Bitcoin Electricity Consumption Index (CBECI) [Interactive dataset]. Cambridge Blockchain Network Sustainability Index, University of Cambridge. https://ccaf.io/cbnsi/cbeci
de Vries-Gao, A. (2025, May 22). AI rapidly on its way to becoming the largest energy consumer [News release]. Vrije Universiteit Amsterdam. https://vu.nl/en/news/2025/ai-rapidly-on-its-way-to-becoming-the-largest-energy-consumer

capability to over 1,700 merchants via Square POS[16]. Coinbase reports that Lightning already facilitates 15% of its Bitcoin transaction volume[17]. Bitcoin remains primarily a store of value today but the infrastructure for everyday use is maturing rapidly.

The AI–Bitcoin Convergence: Two Sides of the Same Infrastructure

Artificial intelligence and Bitcoin appear at first glance to be unrelated phenomena. In structural terms, they share a deep kinship: both are fundamentally computation-intensive technologies that compete for the same energy, semiconductor capacity, and cooling infrastructure.

Bitcoin's proof-of-work mechanism requires miners worldwide to solve cryptographic puzzles continuously, consuming substantial electrical energy. In 2025, Bitcoin consumed 230 TWh of electricity globally[18], comparable to a mid-sized European country. AI data centers consumed approximately 520 TWh in 2025. Research from VU Amsterdam projects AI power demand reaching 23 GW by end-2025, versus Bitcoin's approximately 10 GW[19]. This competition has produced an unexpected symbiosis. Bitcoin miners, whose operations require industrial-scale power contracts and specialized cooling, are increasingly pivoting facilities to host AI compute workloads. Companies such as Iris Energy (IREN) are repurposing gigawatt-scale power contracts for AI inference, effectively transforming Bitcoin mining infrastructure into the physical backbone of the AI economy. Beyond physical infrastructure, there is a monetary dimension. As AI dramatically increases economic productivity and creates new forms of autonomous economic activity, the demand for a neutral, trustless, global settlement layer grows. Traditional payment systems are jurisdictional, subject to sanctions, and dependent on intermediaries. Bitcoin is none of these things.

The VanEck Ecosystem: A Coherent Multi-Layer Thesis

For investors who accept this convergence thesis, the challenge becomes portfolio construction. Bitcoin is highly volatile. The semiconductor supply chain carries geopolitical concentration risk. Nuclear energy requires long-horizon capital commitments. Rare earth metals are subject to supply disruptions and China's export policy. No single instrument captures the full opportunity, but VanEck's thematic ETF suite was built, product by product, to address exactly these layers.

Layer 1: VanEck Crypto and Blockchain Innovators UCITS ETF - DAPP

The VanEck Crypto and Blockchain Innovators UCITS ETF (DAPP)[20] provides the broadest entry point into the digital assets economy. It tracks companies participating across the digital asset value chain: exchanges (Coinbase), Bitcoin miners (Marathon Digital, Riot Platforms), blockchain

[16] Block, Inc. (2025, May 22). Block announces Bitcoin business stack, makes historic Lightning payments push at Bitcoin 2025. Nasdaq. https://www.nasdaq.com/articles/block-announces-bitcoin-business-stack-makes-historic-lightning-payments-push-bitcoin-2025
[17] CoinLaw. (2026). Bitcoin Lightning Network usage statistics 2026: Growth & data. https://coinlaw.io/bitcoin-lightning-network-usage-statistics/
[18] Cambridge Centre for Alternative Finance. (2026, April 13). Cambridge Bitcoin Electricity Consumption Index (CBECI) [Interactive dataset]. Cambridge Blockchain Network Sustainability Index, University of Cambridge. https://ccaf.io/cbnsi/cbeci
[19] de Vries-Gao, A. (2025, May 22). AI rapidly on its way to becoming the largest energy consumer [News release]. Vrije Universiteit Amsterdam. https://vu.nl/en/news/2025/ai-rapidly-on-its-way-to-becoming-the-largest-energy-consumer
[20] VanEck. (2026, April 13). Crypto ETF overview [Product page]. VanEck Netherlands. https://www.vaneck.com/nl/en/investments/crypto-etf/overview/

infrastructure providers, and companies holding material Bitcoin on their balance sheets (MicroStrategy). DAPP is the most direct expression of the Bitcoin thesis in equity form, capturing the ecosystem of companies whose revenues, assets, or operations are materially linked to Bitcoin and digital assets more broadly. Investing in DAPP involves significant risks, including high price volatility, regulatory uncertainty, liquidity risk, and concentration in a nascent and rapidly evolving sector.

Layer 2: VanEck Bitcoin ETN - VBTC

For investors seeking direct exposure to Bitcoin's price, VanEck offers Bitcoin-linked exchange-traded[21] providing regulated access to the underlying asset without the complexity of direct custody, private keys, or exchange accounts. This is the purest expression of the ln(x) scarcity thesis. Investing in VBTC involves significant risks, including extreme price volatility, regulatory and custody risks, and the possibility of total loss of capital.

Layer 3: VanEck Semiconductor UCITS ETF – SMH & VanEck Quantum Computing UCITS ETF – QNTM

AI does not run on software alone. Every large language model, training run, and inference request flows through physical silicon. The VanEck Semiconductor ETF (SMH)[22] tracks the 25 largest US-listed semiconductor companies: chip designers, fabricators, and equipment manufacturers, in a single vehicle. The same advanced chips powering AI data centers are also enabling next-generation Bitcoin mining hardware and forming the foundation of quantum computing research, a theme directly captured by the VanEck Quantum Computing UCITS ETF (QNTM)[23]. As a result, SMH holders gain indirect exposure to all three technological frontiers simultaneously. Investing in SMH and QNTM involves significant risks, including concentration in capital-intensive sectors, geopolitical supply chain disruptions, and rapid technological obsolescence.

Layer 4: VanEck Uranium and Nuclear Technologies UCITS ETF - NUCL

Solar and wind are intermittent; a data centre cannot go dark when the wind stops. Nuclear energy delivers what both AI and Bitcoin infrastructure require: reliable, scalable, near to zero-carbon baseload power, 24 hours a day. Microsoft, Google, Meta, and Amazon have all signed long-term nuclear power agreements for their AI infrastructure[24]. The VanEck Uranium and Nuclear Technologies ETF (NUCL)[25] covers the full nuclear value chain, from uranium mining to advanced small modular reactors (SMRs), offering diversified exposure to this structural energy demand. Investing in NUCL involves significant risks, including regulatory and political uncertainty around nuclear energy, long project development timelines, and uranium price volatility.

Layer 5: VanEck Global Mining UCITS ETF – GDIG & VanEck Rare Earth and Strategic Metals ETF – REMX

The AI and Bitcoin buildout requires vast quantities of physical materials. Electrification at this scale: data centres, power grids, semiconductor fabs, and cooling infrastructure, depends on metals and minerals that must be mined, refined, and processed globally. Rare earth elements (neodymium, dysprosium, lithium) are indispensable for the magnets in wind turbines, electric motors, batteries and semiconductor manufacturing processes. The VanEck Global Mining UCITS ETF (GDIG)[26] provides diversified exposure to major miners of copper, gold, nickel, zinc, and other industrial metals. The VanEck Rare Earth and Strategic Metals ETF (REMX)[27] targets pure-play producers and processors of the critical minerals that sit at the heart of the AI supply chain, including those subject to China's export controls on rare earth elements, first introduced in April 2025 and partially suspended following the Trump–Xi Busan agreement in November 2025. Investing in GDIG and REMX involves significant risks, including commodity price volatility, geopolitical supply disruptions, emerging market exposure, and concentration in cyclical industries.

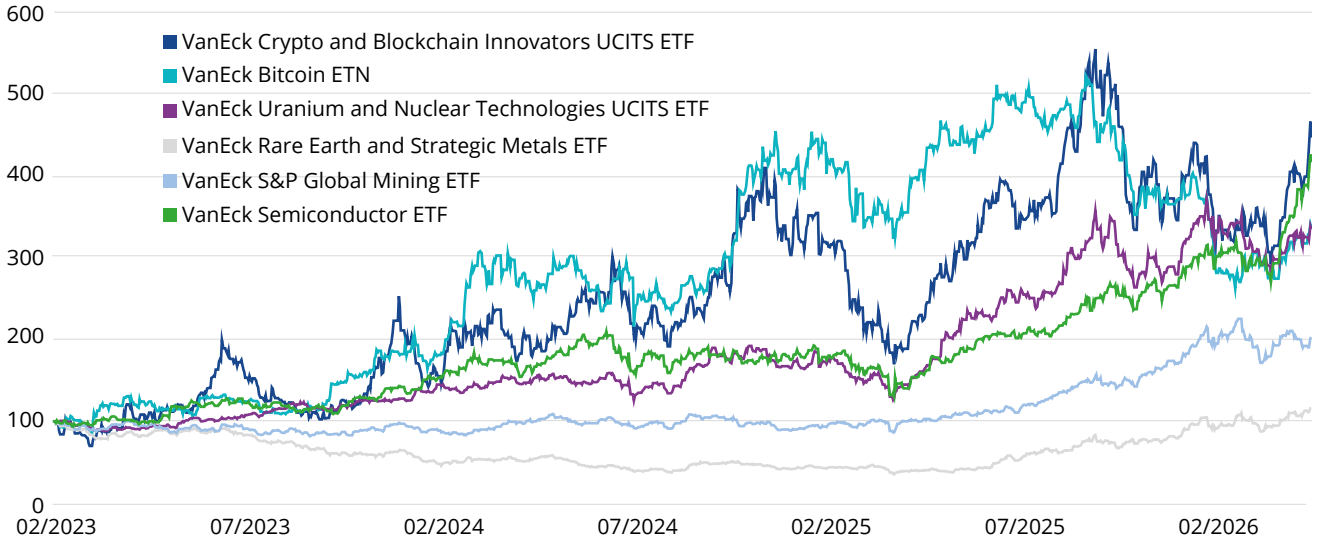
Together, these five layers could form not an arbitrary collection of thematic products but a coherent architecture: each ETF captures a different node in the same global transition, from analogue, centralised, fossil-fuel-based systems toward digital, decentralised, electrified ones.

For further information on risks read the KID and the Prospectus.

[21] VanEck. (2026). Bitcoin ETP overview [Product page]. VanEck Netherlands. https://www.vaneck.com/nl/en/investments/bitcoin-etp/overview/
[22] VanEck. (2026). Semiconductor ETF overview [Product page]. VanEck Netherlands. https://www.vaneck.com/nl/en/investments/semiconductor-etf/overview/
[23] VanEck. (2026). Quantum computing ETF overview [Product page]. VanEck Netherlands. https://www.vaneck.com/nl/en/investments/quantum-computing-etf/overview/
[24] Waltz, E. (2024, December 12). Big tech embraces nuclear power to fuel AI and data centers. IEEE Spectrum. https://spectrum.ieee.org/nuclear-powered-data-center
[25] VanEck (2026). Nuclear ETF Overview. https://www.vaneck.com/nl/en/investments/nuclear-etf/overview/
[26] VanEck. (2026, April 13). Mining ETF overview [Product page]. VanEck Netherlands. https://www.vaneck.com/nl/en/investments/mining-etf/overview/
[27] VanEck. (2026, April 13). Rare earth ETF overview [Product page]. VanEck Netherlands. https://www.vaneck.com/nl/en/investments/rare-earth-etf/overview/

Investment Growth

Time Period: 04/02/2023 to 22/04/2026



Source: MorningStar as of 21/04/2026

Correlation Matrix

Time Period: 01/03/2023 to 31/03/2026

Investment	1	2	3	4	5	6
1 VanEck Bitcoin ETN	1.00					
2 VanEck Crypto and Blockchain Innovators UCITS ETF	0.62	1.00				
3 VanEck Uranium and Nuclear Technologies UCITS ETF	0.23	0.48	1.00			
4 VanEck Rare Earth and Strategic Metals ETF	0.00	0.31	0.31	1.00		
5 VanEck S&P Global Mining ETF	-0.17	0.18	0.36	0.63	1.00	
6 VanEck Semiconductor ETF	0.24	0.57	0.51	0.37	0.22	1.00

1.00 to 0.80 | 0.80 to 0.60 | 0.60 to 0.40 | 0.40 to 0.20 | 0.20 to 0.00
0.00 to 0.20 | -0.20 to -0.40 | -0.40 to -0.60 | -0.60 to -0.80 | -0.80 to -1.00

Source: MorningStar as of 21/04/2026

VanEck Thematic ETFs — Calendar-Year Total Returns
Annual performance (%) by strategy, 2019–2025

Strategy	2019	2020	2021	2022	2023	2024	2025
VanEck Crypto and Blockchain Innovators UCITS ETF	–	–	–	(85.9%)	276.1%	43.4%	13.9%
VanEck Bitcoin ETN	–	–	66.8%	(65.3%)	156.4%	120.3%	(8.1%)
VanEck Uranium and Nuclear Technologies UCITS ETF	–	–	–	–	–	29.1%	68.9%
VanEck Rare Earth and Strategic Metals ETF	–	–	–	(30.6%)	(19.5%)	(35.1%)	89.6%
VanEck S&P Global Mining ETF	27.4%	29.5%	9.9%	1.9%	4.8%	(8.5%)	90.5%
VanEck Semiconductor ETF	–	–	43.6%	(34.8%)	73.1%	23.2%	50.1%

Source: VanEck. Returns shown in EUR/local currency as reported. Past performance is not indicative of future results. Blank cells indicate the strategy was not yet trading.

End Note

We could be at a genuine inflection point in both monetary history and technological development. The emergence of AI as a transformative economic force coincides with growing institutional recognition that the 20th-century monetary framework, built on discretionary central bank policy and unbounded money supply, may be approaching structural limits.

Bitcoin does not solve all these problems. It is volatile, technically complex, and still early in its institutional adoption curve. But its design, a logarithmically bounded supply in a world of exponential money creation, gives it properties that no other asset class shares. And as the infrastructure of the AI economy converges with the infrastructure of Bitcoin across compute, energy, and materials, the investment case for understanding these technologies together becomes increasingly compelling. VanEck's suite of thematic products: DAPP, VBTC, SMH, NUCL, GDIG, and REMX offers investors a diversified and regulated pathway into this converging landscape, with the transparency and risk management that institutional and retail investors require.

The future remains inherently uncertain, and while these industries show structural promise, the funds discussed may not be able to satisfy investors' aspirations for growth or keep pace with the rapid evolution of these sectors. All investments involve risk, including the possible loss of principal.

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