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Fin-Tech and Digital Assets
The New Digital-Energy Paradigm
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The New Digital-Energy Paradigm

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Executive Summary

The convergence of artificial intelligence, quantum computing, and nuclear energy (particularly nuclear fusion) is creating unprecedented strategic opportunities that can be exploited by the cryptocurrency industry, while simultaneously generating new dependencies and geopolitical dynamics. The energy consumption of digital assets and AI is driving fundamental shifts in global energy infrastructure, redefining the economic and political power balances of the 21st century.

1. The New Digital-Energy Paradigm

- ✦ The convergence of AI, quantum computing, and nuclear energy represents a turning point in human technological history. Countries dominating fusion, AI, and quantum computing will have massive competitive advantages.
- ✦ AI plays a crucial role in overcoming challenges in both quantum computing and fusion energy development. Mastery of these technologies offers significant strategic advantage in global markets and political influence, as it creates a new form of technological supremacy based on energy control.

2. A New Theoretical Perspective on Cryptocurrency Energy Consumption

- ✦ Bitcoin's energy consumption should be viewed as the foundation of value in a post-fiat world, not as a negative externality. The energy required to mine Bitcoin, or other cryptos approaches infinity asymptotically, creating a direct link between energy cost and its value.
- ✦ Nuclear fusion technology could theoretically disrupt Bitcoin's value proposition by making energy abundant, but energy supply will never be infinite and demand will be driven by the requests deriving from the entire digital economy.

3. Cryptocurrency and Blockchain Energy Evolution

- ✦ Bitcoin mining consumes 175.87 TWh annually, comparable to Poland's electricity consumption. Over 52% of Bitcoin mining now uses sustainable energy sources, with nuclear gaining prominence.
- ✦ Proof-of-Stake cryptos achieve 99.95% energy reduction compared to Bitcoin's Proof-of-Work. The industry is driving a transition toward clean energy sources rather than hindering it.

4. CBDC and Stablecoin Energy Efficiency

- ✦ Central Bank Digital Currencies (CBDCs) can be designed for significantly lower energy consumption than existing payment systems.
- ✦ Stablecoins on efficient blockchains consume minimal energy while providing stability.
- ✦ Design choices in digital currencies determine their environmental and economic impact.
- ✦ Trade-offs exist between energy efficiency and decentralization/censorship resistance.

5. AI's Explosive Energy Demand

- ✦ Global data center electricity demand is projected to double by 2030, reaching 945 TWh. AI could account for 20% of data center electricity consumption by 2030. US data centers may consume up to 13% of total electricity by 2030, driven primarily by AI.
- ✦ This growth is redefining global energy priorities and accelerating innovation in energy solutions.

6. Nuclear-Digital Infrastructure Synergy

- ✦ Tech giants investing billions in nuclear partnerships: Microsoft (Three Mile Island), Google (Kairos Power), Amazon (X-energy). Small Modular Reactors enable scalable, co-located energy for data centers and mining operations.
- ✦ Nuclear provides 24/7 reliability essential for AI and blockchain operations. Co-location offers synergistic advantages including waste heat utilization and reduced transmission losses.

7. Geopolitical Nuclear Competition

- ✦ US, China, EU, and Russia competing for nuclear technology leadership in the digital age.
- ✦ China has 25 reactors under construction, potentially overtaking US nuclear capacity by 2030.
- ✦ Competition extends to control of critical raw materials (uranium, rare earths, battery materials).
- ✦ This nuclear-digital competition is redefining 21st-century global power balances and creating new forms of energy-based geopolitical influence.

1. The New Digital-Energy Paradigm: The 21st Century Technological Convergence

The convergence of artificial intelligence, quantum computing, and nuclear energy represents the most significant paradigmatic shift in modern technological history, redefining not only industrial dynamics but the entire global geopolitical balance. This technological triad, defined as "the crucial moment in human evolution"¹, is creating unprecedented strategic opportunities that transcend traditional boundaries between economic sectors and spheres of national influence.

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Artificial intelligence might emerge as the primary catalyst of this convergence, playing a crucial role in overcoming fundamental technical challenges in both quantum computing and nuclear energy. In quantum computing, AI algorithms are addressing the intrinsic fragility of qubits through advanced error correction and stabilization systems. Simultaneously, in nuclear energy, AI is proving more and more indispensable for driving investments in products like the Small Modular Reactors or drive research into issues like plasma confinement management, in nuclear fusion, one of the most complex challenges in modern energy engineering.²

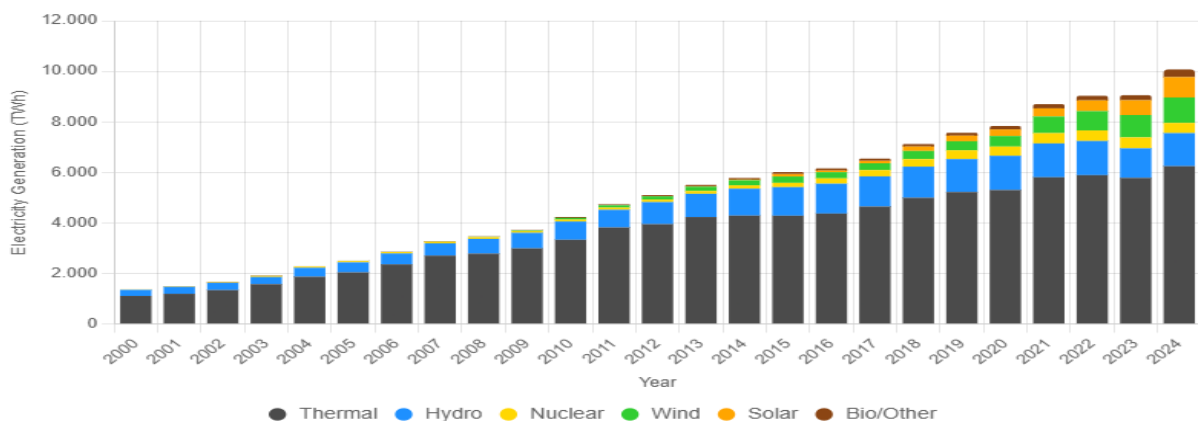
This technological synergy is creating what we can define as a "multiplier effect" in innovation, where advances in one field exponentially accelerate development in others. This means that the focus on new energy sources is very present in ever government's agenda.

A recent research highlights how governments are adopting an increasingly "state-centric" approach toward these emerging technologies, effectively nationalizing industries through massive subsidies and technological leveraging to serve national interests and enhance state power.³

The security and defense sector represents the epicenter of this transformation, with implications extending from cyber-attacks to military surveillance and to AI-guided weapons. The dual-use nature of these technologies - simultaneously civilian and military - is redefining traditional concepts of national security and strategic competition. Semiconductors, in particular, have acquired geopolitical importance comparable to oil in the 20th century, being present in every electronic device and with an industry projected to reach one trillion dollars by the end of the decade.⁴

The energy dimension of this convergence is particularly critical. While AI and quantum computing require ever-increasing amounts of energy to operate, state and non-state actor strive to acquire new energy sources and ramp up what they already have. This dynamic creates a temporal paradox: in the short term, exponential growth in digital energy demand could accelerate dependence on traditional energy sources, but in the long term, success in nuclear fusion or technologies like SMRs (small modular reactors) could completely revolutionize the global energy economy. China adds to its grid every year the energy generation of a middle size country, but it's still very reliant on energy sources imported from abroad (gas, coal etc) despite its renewable push (**Figure 1**).

Figure 1: China's Electricity Generation by Source (2000-2024)

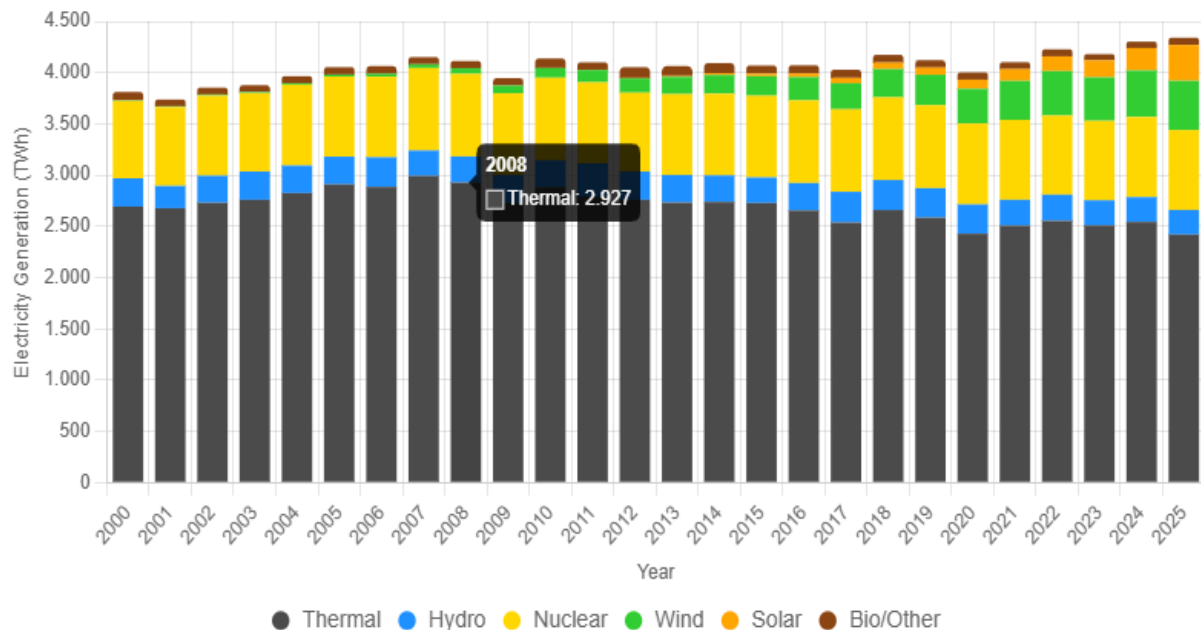


Source: EIA.

US is late to the game, but it's mostly self-sufficient and while it might find it harder to catch up and generate enough energy for its AI and crypto developments, it also makes America safer or more "sovereign" in terms of energy generation, with significant strategic implications (**Figure 2**). For example, it means that the American AI and crypto industry does not depend on pipeline on foreign countries or sea lines of communication transporting gas and coal, possibly controlled by a hostile nation.

Figure 2: US Electricity Generation by Source (2000-2025)

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Source: EIA.

The most revolutionary aspect of this paradigm lies in its ability to redefine the very foundations of economic value. In a world where energy could become abundant, and where AI and quantum computing can solve previously intractable problems, traditional economic models based on scarcity could become obsolete. This has profound implications for cryptocurrencies, monetary systems, and global wealth distribution.

Competition for leadership in this technological triad is already redefining geopolitical alliances and national strategies. The United States, China, and the European Union find themselves in a technological race reminiscent of the Cold War space race, but with much broader economic and strategic implications. Emerging countries like Saudi Arabia and the United Arab Emirates are investing heavily to position themselves in this transition, recognizing that control of these technologies will determine the global power hierarchy in the coming decades.⁵

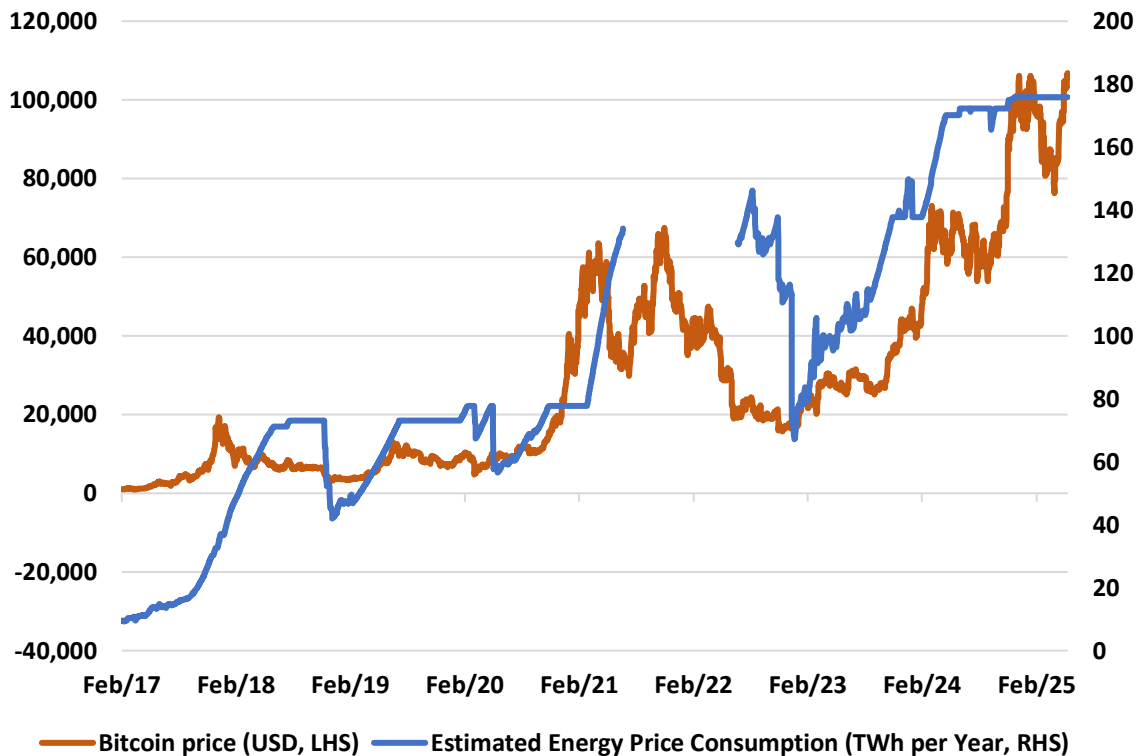
2. A New Theoretical Perspective on Cryptocurrency Energy Consumption: From Externality to Intrinsic Value

For over a decade, the debate on Bitcoin's energy consumption has been dominated by a narrative that considers it an undesirable byproduct, a negative externality of the mining process. In our view, this perspective, however, fails to grasp the fundamental nature of value in cryptocurrencies and the profound implications of energy scarcity in the digital economy.

The starting point of this analysis lies in recognizing that Bitcoin, like many digital assets, possesses theoretically zero intrinsic value. Unlike gold, which at least has industrial applications, or fiat currencies, which are backed by the coercive force of states, Bitcoin derives its value exclusively from network mechanisms, social acceptance, and what we might define as "artistic valuation" - the principle whereby the value of something is simply the price at which it changes hands, regardless of any intrinsic utility.

In this context, Bitcoin's artificial scarcity - limited to 21 million units - takes on profound significance. However, true scarcity does not just reside in the number of Bitcoins, but also in the energy required to produce them. This creates a direct and inescapable relationship between Bitcoin's value and the energy cost of its production (Figure 3).

Figure 3: Bitcoin Price vs Energy Price Consumption



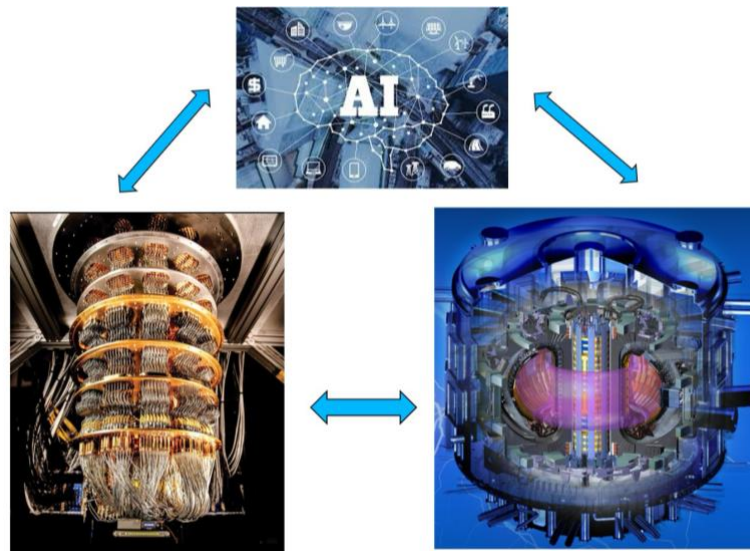
Source: Bitcoin Energy Consumption Index - Digiconomist

Consider the implications of this relationship in a scenario of energy abundance through the most advanced frontier of research: nuclear fusion. If energy became practically free and unlimited, the marginal cost of Bitcoin mining would approach zero, and consequently, in a perfectly efficient market, Bitcoin's value would also tend toward zero. Of course, only a given number of Bitcoins can be mined, thus still limiting its quantity, but one of the two elements defining its scarcity would be removed. This theoretical scenario reveals the fundamentally energetic nature of Bitcoin's value: in a post-energy scarcity world, Bitcoin might lose its main value proposition or just turn into an NFT.

However, reality is much more complex and strategically interesting. Nuclear fusion, even if technically feasible, will not be immediately accessible to all economic actors. The technology will require massive infrastructure investments, advanced technical skills, and sophisticated supply chains. This creates a temporal window - potentially decades - during which control of efficient energy sources will confer an extraordinary competitive advantage in cryptocurrency mining and, more generally, in the digital economy. Energy supply will never be infinite and its demand will derive from the requests of the entire digital economy.

Countries and entities that manage to simultaneously dominate three sectors – energy generation, artificial intelligence, and quantum computing - will find themselves in a position of unprecedented economic supremacy. Nuclear and, to some extent, renewables, will provide low-cost energy, AI will optimize mining and energy management processes, while quantum computing could revolutionize both cryptography and computational efficiency. This technological triad represents the new "trinity" of 21st-century economic power (Figure 4).

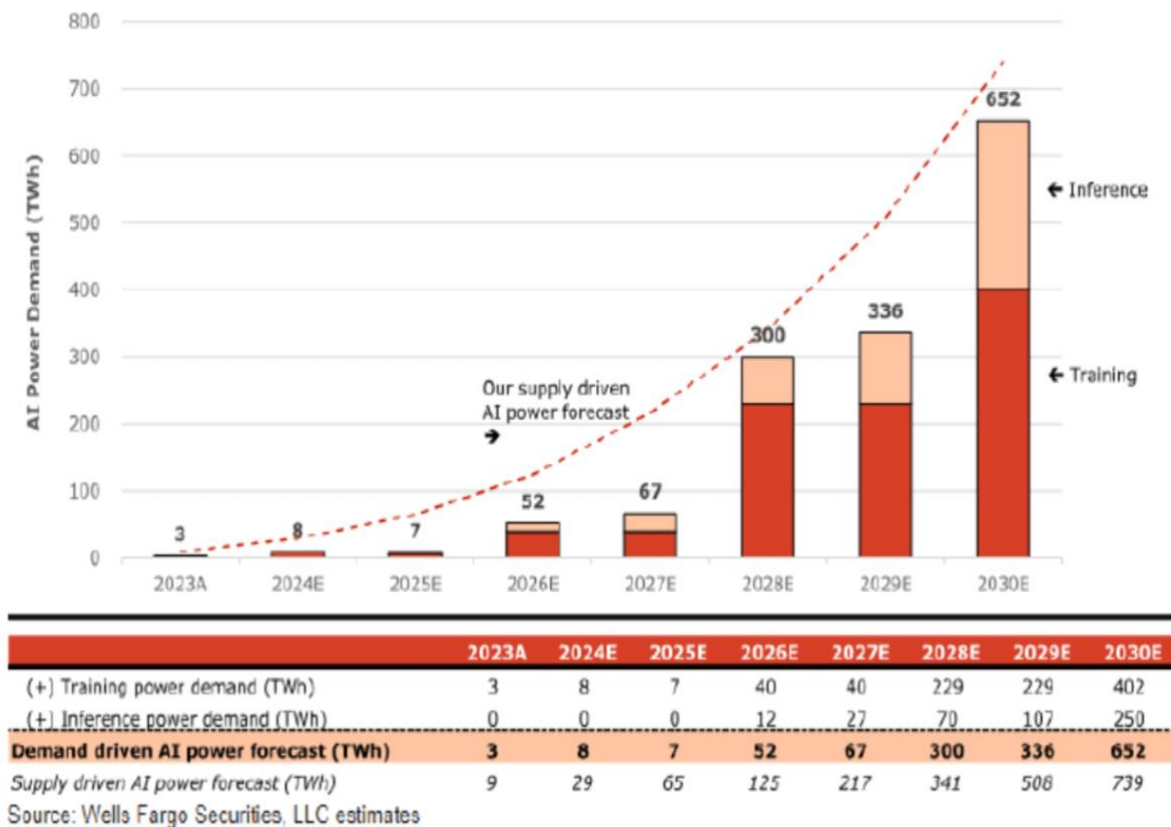
Figure 4: The New “Holy Trinity” of Technologies



Source: Authors' design

The most profound implication of this analysis concerns [the need for cryptography to become "quantum-safe."](#) Current cryptographic implementations, including those used by Bitcoin, could become vulnerable to quantum attacks. However, this challenge also represents an opportunity: cryptocurrencies that manage to adapt first to quantum threats, while maintaining their energy intensity, could emerge as the new monetary standards of the post-quantum era.

Figure 5: Summary of GenAI Demand Forecast



Source: Wells Fargo Securities LLC estimates. Note: Total US Electricity Demand – 4,000 TWh (2023)

The battle for energy thus becomes the battle for digital assets, including not only traditional cryptocurrencies but also stablecoins and tokenized Real World Assets (RWA) such as real estate. In this new paradigm, control of energy resources translates directly into control of the digital economy, creating new forms of energy colonialism and technological dependence.

This perspective requires a fundamental reconsideration of energy and monetary policies. Instead of seeing cryptocurrency energy consumption as a problem to solve, we should recognize it as an indicator of real economic value and a driver of energy innovation.

Cryptocurrencies are effectively incentivizing the development of more efficient and sustainable energy sources, acting as a catalyst for the global energy transition.

3. Cryptocurrency and Blockchain Energy Evolution: Data, Trends, and Strategic Implications

Quantitative analysis of cryptocurrency energy consumption reveals an ongoing transformation that challenges many conventional narratives about blockchain technology's environmental impact. The latest data from Digiconomist's Bitcoin Energy Consumption Index in Figure 3 shows that Bitcoin currently consumes 175.87 TWh annually, a figure comparable to Poland's total electricity consumption⁶. However, this statistic, often cited as evidence of Bitcoin's unsustainability, requires more sophisticated analysis to understand its true economic and strategic implications.

To put this consumption in perspective, it's useful to compare it with other payment systems and industries. A single Bitcoin transaction consumes an average of 1,208.08 kWh, enough energy to power 812,806 VISA transactions. This seemingly dramatic disparity, however, conceals fundamental differences in the nature and function of the two systems. While VISA is a payment system that relies on existing banking infrastructure, Bitcoin is a complete monetary system that includes issuance, validation, settlement, and custody functions.

A more appropriate comparison might be with the gold industry, given that Bitcoin is often called "digital gold." Gold mining globally consumes approximately 131 TWh annually, a figure surprisingly close to Bitcoin's consumption⁷. However, the carbon footprint per unit of value is significantly different: while gold mining produces 47 tons of CO₂ for the equivalent of one Bitcoin in gold, Bitcoin mining generates 590 tons of CO₂ per Bitcoin⁸. This difference highlights the importance of the energy source used in mining⁹.

And it is precisely here that one of the most significant trends in cryptocurrency evolution emerges: the transition toward sustainable energy sources. According to the latest data from the Cambridge Centre for Alternative Finance, over 52% of Bitcoin mining now uses sustainable energy sources, with consistent growth in recent years. This percentage is notably higher than the global average for most industries, suggesting that the cryptocurrency industry is becoming a driver of energy transition rather than an obstacle.

Nuclear is emerging as a particularly attractive energy source for cryptocurrency mining. Its ability to provide 24/7 baseload energy aligns perfectly with mining operational needs, which require continuous operation to maximize profitability. Additionally, nuclear energy offers one of the lowest carbon footprints among all energy sources, making nuclear-powered mining both economically and environmentally sustainable.

The evolution toward Proof-of-Stake represents another significant development in the cryptocurrency ecosystem. Ethereum, the second-largest cryptocurrency by market capitalization, completed its transition from Proof-of-Work to Proof-of-Stake in 2022, reducing its energy consumption by 99.95%¹⁰. This transition demonstrates that it is technically possible to maintain blockchain security and decentralization while drastically reducing energy consumption.

However, the debate between Proof-of-Work and Proof-of-Stake goes beyond energy considerations. Bitcoin's Proof-of-Work creates a direct link between network security and real energy investment, making attacks

economically prohibitive. Proof-of-Stake, while more energy-efficient, introduces new centralization dynamics and systemic risks that must be carefully evaluated.

The mining industry is also innovating in terms of "stranded" energy utilization - energy that would otherwise be wasted. Bitcoin miners are increasingly exploiting gas flaring (which globally could provide 688 TWh of recoverable energy), excess renewable energy during low-demand periods, and transmission and distribution losses (which in the US amount to 206 TWh annually) [14]. This "non-rival" approach to energy consumption positions Bitcoin mining as an energy user that doesn't directly compete with other uses, but rather monetizes otherwise wasted energy.

The geographical distribution of mining is evolving in response to energy, regulatory, and geopolitical factors. After China's 2021 ban, hash rate redistributed globally, with the United States emerging as the primary mining hub, followed by Kazakhstan, Russia, and Canada¹¹. This redistribution has significant geopolitical implications, as control of Bitcoin's hashrate can influence network security and governance.

The emergence of sustainable "mining pools" and growing attention to Environmental, Social, and Governance (ESG) criteria are pushing the industry toward higher standards of environmental responsibility. Initiatives like the Bitcoin Mining Council are promoting transparency in energy reporting and incentivizing adoption of clean energy sources.

4. CBDCs and Stablecoins: Energy Efficiency and Macroeconomic Implications

Central Bank Digital Currencies (CBDCs) and stablecoins represent a critical frontier in the evolution of digital monetary systems, offering an interesting contrast with traditional cryptocurrencies in terms of energy consumption and architectural design. While Bitcoin and other Proof-of-Work cryptocurrencies require significant energy resources to maintain security and decentralization, CBDCs can be designed to operate with drastically superior energy efficiency, raising fundamental questions about centralization and monetary control.

CBDCs, being issued and controlled by central banks, can utilize permissioned blockchain architectures or even traditional distributed database systems that require a fraction of the energy needed for public blockchains. The People's Bank of China, a pioneer in CBDC development with the Digital Currency Electronic Payment (DCEP), has designed a system that consumes energy comparable to traditional electronic payment systems, while maintaining the programmability and traceability characteristics of digital currencies¹².

However, CBDC energy efficiency comes at the cost of decentralization and censorship resistance. While Bitcoin requires energy to maintain trustless consensus among parties that don't trust each other, CBDCs rely on trust in the issuing authority. This fundamental trade-off between energy efficiency and decentralization represents one of the most important architectural choices in the digital currency era.

Stablecoins present an interesting intermediate case. Stablecoins like USDC and USDT, operating on efficient blockchains like Ethereum (post-Merge) or Solana, can provide value stability with minimal energy consumption per transaction. However, their stability depends on collateralization and governance mechanisms that introduce new systemic risks and dependencies on traditional assets.

The emergence of algorithmic stablecoins, which attempt to maintain stability through automated mechanisms rather than collateral, represents a fascinating but risky experiment. The collapse of TerraUSD in 2022 highlighted the systemic risks of these approaches, but also stimulated innovation in more robust designs that could eventually provide monetary stability without dependence on external assets.

5. AI's Explosive Energy Demand: Projections and Systemic Implications

Artificial intelligence is emerging as the primary driver of global energy demand growth, with implications extending well beyond the technology sector to influence national energy planning and geopolitical strategies.

The latest data from the International Energy Agency paints a picture of exponential growth that requires fundamental reconsideration of global energy priorities.

Global data center electricity demand is projected to more than double by 2030, reaching 945 TWh, equivalent to Japan's annual electricity consumption¹³. This growth represents an annual growth rate of 15% from 2024 to 2030, more than four times higher than total electricity demand growth [18]. AI represents the primary driver of this growth, with projections indicating it could represent 20% of data center electricity consumption by 2030.

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In the United States, projections are even more dramatic. American data centers could consume up to 13% of the country's total electricity by 2030, compared to 4.4% in 2023.¹⁴

This growth is driven primarily by the expansion of generative AI models and increasing computational complexity required for training and inference of these models.

The geographical distribution of this energy growth is not uniform, creating specific challenges for local electrical grids. Technology companies tend to build data centers in concentrated clusters, which can overload local grid systems. The IEA estimates that 20% of planned data centers could face delays in grid connection due to infrastructure limitations.

AI energy intensity varies significantly depending on the type of application and model used. GPT-3, one of the most energy-intensive models trained in 2024, consumed over 1,000 megawatt-hours for training¹⁵. However, the energy required for inference - actual use of the trained model - is generally much lower, creating a complex economic dynamic where training energy costs must be amortized over millions of inference queries.

This explosive growth in energy demand is accelerating innovation in several directions. On one hand, it's driving development of more efficient chips and specialized computational architectures for AI. On the other, it's incentivizing massive investments in clean and reliable energy sources, with particular emphasis on nuclear energy for its ability to provide 24/7 baseload power.

The geopolitical implications of this energy growth are significant. Countries that manage to provide abundant and reliable energy for AI will have a competitive advantage in the digital economy of the future. This is already influencing data center location decisions and could lead to new forms of "energy colonialism" where energy-rich countries attract technology investments at the expense of those with limited energy resources.

6. Nuclear-Digital Infrastructure Synergy: Big Tech's New Strategic Alliance

The year 2024 marked a historic turning point in the intersection between digital technology and nuclear energy, with tech giants announcing billion-dollar investments in nuclear partnerships that redefine the global energy landscape. These agreements represent much more than simple energy supply contracts: they constitute a coordinated strategy to ensure the energy independence necessary to maintain supremacy in the age of artificial intelligence.

Microsoft led the way with its revolutionary agreement to restart Unit 1 of Three Mile Island, the site of the most famous nuclear accident in American history. The twenty-year agreement with Constellation Energy, announced in September 2024, provides for the supply of 835 MW of nuclear energy dedicated exclusively to Microsoft's data centers¹⁶. The project, expected to be operational by 2028, represents a multi-billion dollar investment and will create at least 650 permanent jobs, plus hundreds of positions during the recommissioning process.¹⁷

The choice of Three Mile Island is symbolically powerful and strategically brilliant. Despite its controversial history, Unit 1 (which was not involved in the 1979 accident) operated safely for decades before its closure in 2019 for economic reasons. The restart demonstrates that nuclear energy economics can be transformed when there is guaranteed, long-term demand from customers with high credit reliability like Microsoft.

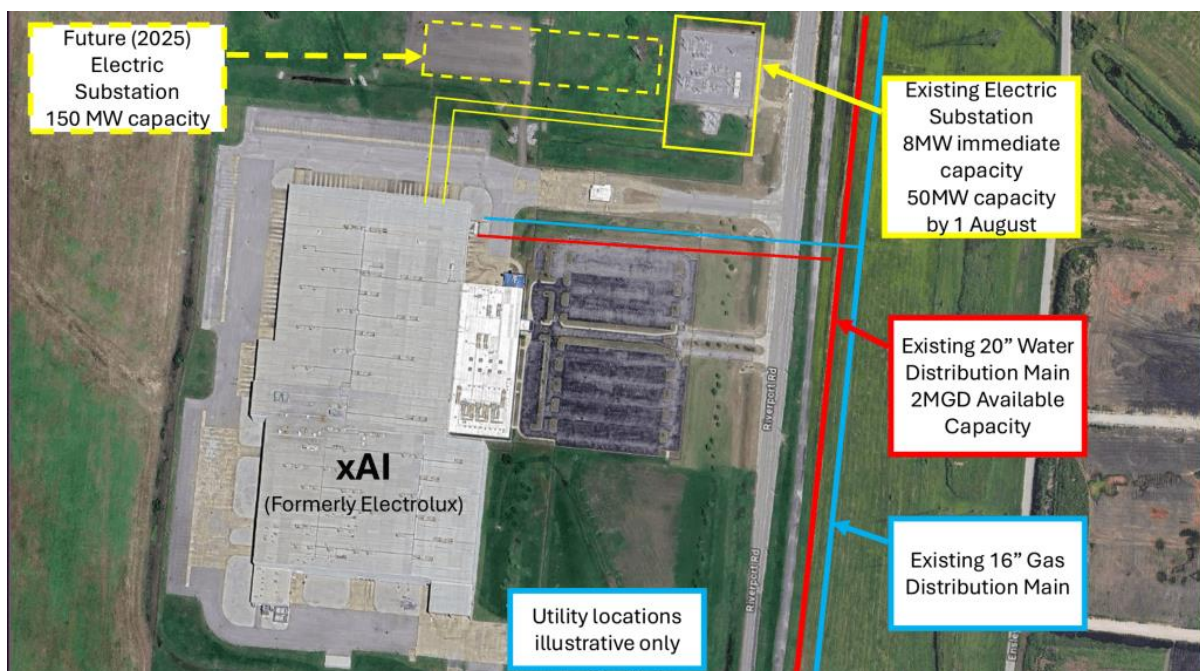
Google followed with a different but equally ambitious approach, signing a Master Plant Development Agreement with Kairos Power in October 2024. This agreement provides for the development of a fleet of Small Modular Reactors (SMRs) for a total capacity of 500 MW by 2035.¹⁸ The partnership represents Google's first nuclear agreement in history and marks the company's entry into next-generation nuclear technology that promises greater flexibility and safety compared to traditional reactors.

Kairos Power's Small Modular Reactors use innovative technology based on TRISO (TRi-structural ISOtropic) fuel and molten salt cooling, which offers significant advantages in terms of passive safety and operational flexibility. These reactors can be built in standardized modules and scaled according to needs, making them ideal for powering data centers of various sizes.¹⁹

Amazon adopted the most aggressive approach, with a \$500 million investment in X-energy and the goal of developing over 5 GW of nuclear capacity by 2039.²⁰ The investment includes partnerships with Dominion Energy in Virginia and Energy Northwest in Washington state, with an initial 320 MW project. In February 2025, Amazon participated in a \$700 million Series C-1 funding round for X-energy, demonstrating its long-term commitment to SMR technology.²¹

AI is also in the energy race, having recently taken over the former Electrolux plant to build a massive computational plant in Memphis (Figure 6).

Figure 6: AI Plant in Memphis (US)



Source: Google Maps

These investments reflect a deep understanding of AI and high-performance computing's unique energy needs. Unlike many industrial applications that can tolerate energy interruptions, data centres require reliable 24/7 energy with minimal quality variations. Nuclear energy, with its capacity factor exceeding 90% and its ability to operate independently of weather conditions, represents the ideal solution for these needs.

Also, co-location of nuclear reactors and data centres offers in theory might offer significant synergistic advantages. Data centres can use waste heat from reactors for building heating and other thermal processes, improving overall energy efficiency. Additionally, physical proximity reduces transmission losses and eliminates dependence on existing electrical grids, which often represent a bottleneck for large-scale data centre projects.

These projects are also accelerating innovation in nuclear technology. Guaranteed demand from big tech provides the financial security necessary for R&D investments and commercialization of advanced nuclear technologies. This could significantly accelerate the development of fourth-generation reactors and other innovative technologies that could eventually find application in broader sectors.

7. Geopolitical Nuclear Competition: The New Technological Arms Race

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The convergence between digital technologies and nuclear energy is redefining global geopolitical competition, creating a new form of arms race based not on traditional military capabilities, but on control of technologies that will define the 21st-century economy. The United States, China, European Union, and Russia find themselves engaged in multidimensional competition for nuclear technological leadership in the digital age, with implications extending well beyond national borders.

China has adopted the most aggressive strategy, [with 25 nuclear reactors currently under construction and plans to potentially surpass US nuclear capacity by 2030](#).²²

The "Made in China 2025" plan explicitly identifies nuclear energy, artificial intelligence, and semiconductors as priority strategic sectors, with massive state-coordinated investments to achieve global leadership in these technologies.²³

The Chinese strategy is based on an integrated approach that combines internal technological development, acquisition of foreign technologies, and strategic partnerships with developing countries. The Belt and Road Initiative includes significant investments in nuclear infrastructure in partner countries, creating a network of technological dependence that extends Chinese influence. China has become ASEAN's main trading partner, with trade that more than doubled from \$443 billion in 2013 to over \$975 billion in 2022.²⁴

The United States has responded with a strategy of technological containment combined with massive domestic investments. The CHIPS and Science Act of 2022 allocated nearly \$53 billion for semiconductor research, development, and production, with the explicit goal of "lowering costs, creating jobs, strengthening supply chains, and countering China".²⁵ Simultaneously, the US has implemented increasingly stringent export controls to limit Chinese access to advanced technologies.

The American strategy also includes building technological alliances with key partners. Japan and the Netherlands have agreed to limit exports of advanced chips to China, in a coordinated effort to slow Chinese military development.²⁶ These alliances also extend to the nuclear sector, with partnerships for SMR technology development and agreements for sharing technical expertise.

The European Union finds itself in a complex position, seeking to balance strategic autonomy with the need for international cooperation. The European Green Deal and REPowerEU plan include significant investments in nuclear energy as part of the decarbonization strategy, but the EU must also navigate different national positions on nuclear energy, with countries like Germany and France having radically different approaches and companies like Newcleo and Ansaldo emerging on the European scenario.

Russia, despite Western sanctions, continues to leverage its nuclear exports for geopolitical influence. Rosatom, the Russian state nuclear company, maintains contracts for reactor construction in several countries, creating long-term technological dependencies. Also, Russia has a long tradition of building led cooled reactors, and has just build one on a barge, the Akademik Lomonosov²⁷ anchored to the port of a Siberian town proving interrupted power supply all year round.

The main advantage of SMRs to fusion is that the technology is already existing and has been around for decades, primarily for military purposes as in nuclear propelled aircraft carriers or submarines, while fusion is a technology possible in theory but yet to be implemented. The main challenges of SMRs are mainly economical: while

building a submarine powered by a nuclear small modular reactor might be a matter of national security, using the same technology to provide power to your country must be economically feasible and scalable

This is why emerging countries like Saudi Arabia and the United Arab Emirates are investing heavily to position themselves in this technological transition. These countries recognize that their fossil fuel-based wealth could become obsolete in the era of abundant nuclear energy, and are diversifying toward digital and nuclear technologies to maintain their geopolitical relevances.

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Competition also extends to control of critical raw materials necessary for these technologies. Uranium, rare earths for semiconductors, and battery materials are becoming strategic resources comparable to oil in the 20th century. Control of these supply chains is becoming a key element of geopolitical competition, with one notable exception: if the SMR technology proves effective at scale, the reactors can also be powered by small quantities of nuclear waste and eliminate the need to fight for resources like uranium.

This new form of geopolitical competition has profound implications for world order. Countries that manage to dominate the triad of energy generation, artificial intelligence, and quantum computing will find themselves in a position of economic and technological supremacy that could last for decades. What's at stake is not just economic leadership, but the ability to define the rules and standards of the global digital economy of the future.

However, this transition also presents significant risks. The concentration of technological power in few hands - both at corporate and national levels - could create new forms of inequality and dependence. The need to ensure that the benefits of these technologies are distributed equitably represents one of the most important challenges for 21st-century policymakers.

The implications for the international monetary system are particularly profound. The emergence of energy-efficient CBDCs or Stablecoins. Combined with quantum-safe cryptocurrencies, could lead to fragmentation of the global monetary system in macro regions or, alternatively, to the emergence of new monetary standards based on completely different principles from current ones.

In conclusion, the new digital-energy paradigm requires fundamental reconsideration of our economic, political, and social categories. Decisions made in the coming years regarding the development and governance of these technologies will determine not only the structure of the global economy, but the very nature of human society in the post-industrial era. It is imperative that these decisions be made with full understanding of their long-term implications and with commitment toward a more equitable and sustainable future for all humanity.

NOTES

¹ Ali, Nathan. "Fusion, Quantum, and AI: The Triad Shaping Tomorrow's Energy Landscape and Geopolitical Balance." Rosa & Roubini Associates, October 24, 2024, p. 3.

² Ibid.

³] Meyer, Vanina. "Semiconductors, AI, and Quantum Technologies: The Race to Emerging Technologies." Rosa & Roubini Associates, February 23, 2024, p. 3. Page | 14

⁴ Ibid.

⁵ Ali, Nathan. Op. cit., p. 3.

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