BITCOIN ENDGAME

Accelerating Bitcoin to its Endgame

WHITEPAPER

Version 1.0, March 2026

Executive Summary

As the programmatic block subsidy of legacy proof-of-work networks slowly declines toward zero, their long-term security will eventually rely entirely on volatile transaction fees. This transition presents a profound existential challenge: can proof-of-work coins, such as Bitcoin, survive without significant programmatic and economic modifications in the post-subsidy world? While historical assumptions posited that an active blockspace market would seamlessly replace the dwindling subsidy, there are legitimate questions about whether this assumption holds true. A substantial reason for the uncertainty rests in the fact that we can only speculate how markets, miners, investors, and users will operate in a post-subsidy market environment. Bitcoin Endgame seeks to bring objective answers to the most critical questions: When subsidies for Bitcoin come to an end, will miners flee, join, or fluctuate? Without subsidies, will Bitcoin's 2016-block difficulty adjustment algorithm be able to account for the new realities? Will the value of Bitcoin, once all coins have been minted, exceed, fall behind, or mirror the current value?

To proactively observe, model, and survive this economic reality, this whitepaper introduces Bitcoin Endgame (ENDG). ENDG is a pristine, fixed-supply proof-of-work protocol designed to compress the full 130-year monetary issuance cycle into approximately 12.6 years. By combining an accelerated emission schedule with a highly responsive hybrid Difficulty Adjustment Architecture (DAA) and a deterministic, consensus-enforced liveness failover mechanism, ENDG provides a live cryptographic stress test of the zero-subsidy endgame while structurally guaranteeing chain continuity.

In short, ENDG uses a custom DAA to survive initial difficulty volatility during adoption, revert to Bitcoin's 2016-block difficulty adjustment algorithm at Year 8, and will function on this system unless there is a catastrophic, irreversible event that demonstrates the Bitcoin system cannot survive and must be replaced, at which time the program will automatically revert to the custom DAA and permit the coin to continue in perpetuity.

1. The Endgame Problem

The fundamental innovation of the Nakamoto Consensus relies on a robust security budget. Currently, this budget is overwhelmingly funded by the block subsidy, which heavily subsidizes network security during its adoption phase. When the block subsidy eventually drops to zero, assuming mining remains an open and competitive free market, the cost of mining a new block will converge entirely on the value of the transaction fees included in each block.

Concurrently, there exists legitimate questions about the mathematical rigidity of legacy DAAs. The traditional Bitcoin epoch-based Simple Moving Average (SMA), which adjusts only every 2,016 blocks, is arguably lethally inflexible during abrupt, systemic hash rate contractions. If a sudden drop in mining profitability causes a massive disconnection of network hardware, block times extend dramatically. During this multi-month "desert of long solve times," transactional throughput plummets and unconfirmed transaction fees skyrocket. This catastrophic loss of utility creates a self-reinforcing cascading failure universally termed the "chain death spiral."

2. Design Objective: The Bitcoin Endgame (ENDG) Protocol

To definitively model the economic endgame of Bitcoin in a zero-subsidy environment without exposing legacy networks to catastrophic risk, the ENDG protocol forces the market to grapple with absolute scarcity on an accelerated timeline.

While legacy Bitcoin distributes supply over more than 130 years, ENDG compresses the full monetary issuance cycle into approximately 12.6 years. Despite this extreme temporal compression, the protocol preserves the fundamental pillars of Nakamoto consensus: a fixed 21,000,000 supply cap, deterministic issuance, SHA-256 Proof-of-Work security, no governance override, and no monetary discretion.

To ensure a pristine experimental environment and total isolation from legacy state baggage, ENDG launches with independent foundational parameters, including a fresh genesis block, new network magic bytes ("ENDG"), a unique default port, unique address prefixes and a unique Bech32 HRP, and no inherited Bitcoin state. The ENDG codebase is derived from Bitcoin Core and intends to track upstream improvements where compatible with ENDG's consensus rules.

Crucially, all modern Bitcoin soft forks (BIP34, BIP65, BIP66, CSV, SegWit, Taproot) are enforced and active from Block 1. There are no legacy consensus eras, ensuring the network begins with optimal transactional efficiency immediately. Accordingly, Bitcoin Endgame will, outside the difficulty and emission systems, run functionally identical to Bitcoin.

Launch
- Early Network (Years 1–8)
  ASERT Difficulty Adjustment
- Year 8 Transition
  Switch to Bitcoin 2016-Block Retarget
- Liveness Protection Layer
  If network stalls:
  - 48 hours without block
  - 12-block average > 60 minutes
- Final Issuance Block
  Block 663,043 → Fee-Only Security Model

3. Monetary Policy and Terminal Emission

Identical to Bitcoin, the macroeconomic policy of ENDG strictly enforces a fixed maximum supply of exactly 21,000,000 ENDG (known as "Enders"). No inflation beyond this limit is possible under consensus rules. There is no tail emission, nor is there any discretionary extension.

The block subsidy schedule is fully deterministic and hard-coded into a 12.6-Year Emission Curve. Assuming a standard target of 10-minute blocks (approximately 52,560 blocks per year), the issuance transitions through four distinct phases:

Phase	Block Heights	Blocks in Phase	Subsidy per Block	Total ENDG Issued
Era 1	0 – 375,864	375,865	50 ENDG	18,793,250
Era 2	375,865 – 424,044	48,180	25 ENDG	1,204,500
Era 3	424,045 – 472,224	48,180	12.5 ENDG	602,250
Era 4	472,225 – 520,404	48,180	6.25 ENDG	301,125
Tail 1	520,405 – 536,255	15,851	3.125 ENDG	49,534.375
Tail 2	536,256 – 552,106	15,851	1.5625 ENDG	24,767.1875
Tail 3	552,107 – 567,957	15,851	0.78125 ENDG	12,383.59375
Tail 4	567,958 – 583,808	15,851	0.390625 ENDG	6,191.796875
Tail 5	583,809 – 599,659	15,851	0.1953125 ENDG	3,095.8984375
Tail 6	599,660 – 615,510	15,851	0.09765625 ENDG	1,547.94921875
Tail 7	615,511 – 631,361	15,851	0.04882812 ENDG	773.97453
Tail 8	631,362 – 647,212	15,851	0.02441406 ENDG	386.98726
Tail 9	647,213 – 663,042	15,830	0.01220703 ENDG	193.23728
Final Precision Block	663,043	1	0.00013867 ENDG	0.00013867

After block 663,043 (approximately 12.6 years after launch), issuance permanently ceases.

4. The Post-Subsidy Security Model

After the final subsidy block at height 663,043 (approximately 12.6 years after launch),
Bitcoin Endgame becomes a purely fee-driven proof-of-work system, and miner revenue derives exclusively from transaction fees and block space demand.

This structure is highly deliberate, allowing early empirical observation of fee market sufficiency in the absence of a block subsidy, hash rate equilibrium under zero systemic issuance, miner concentration dynamics when constrained by pure transaction demand, and volatility response and systemic security in a fixed-supply regime.

At the time of this transition, Bitcoin Endgame will run identical to Bitcoin, including its 2016-block difficulty adjustment algorithm. Thus, researchers can witness Bitcoin's Endgame, only decades earlier.

At launch, ENDG is designed to operate as its own independent blockchain. However, the community is free to implement changes such as the inclusion of Merged Mining (AuxPoW) protocols for when the difficulty system transitions to the Bitcoin 2016-block adjustment algorithm.

5. Hybrid Difficulty Architecture

To survive the extreme volatility inherent in its highly accelerated issuance curve while ultimately modeling standard legacy behavior, ENDG utilizes a unique Hybrid Difficulty Architecture.

Epoch	Block Heights	Half-Life
Year 1	0 to 52,559	ASERT (30 minutes)
Year 2	52,560 to 105,119	ASERT (1 hour)
Year 3	105,120 to 157,679	ASERT (2 hours)
Year 4	157,680 to 210,239	ASERT (4 hours)
Year 5	210,240 to 262,799	ASERT (8 hours)
Years 6 to 8	262,800 to 420,479	ASERT (12 hours)
Year 8+	420,480 to inf.	Legacy 2016-block window (N/A)

5.1 Phase I–II: ASERT (Early & Transitional Years)

During its highly volatile early adoption and subsidy reduction phases (Phase 1 and Phase 2, stretching until approximately Year 8), ENDG governs block production using a continuous, per-block adjustment algorithm: Absolutely Scheduled Exponentially Rising Targets (ASERT).

ASERT computes the subsequent target based strictly on the difference in timestamps from an anchor block, the ideal block time (600 seconds), and a defined half-life parameter (which varies across deployment epochs, reaching 172,800 seconds during the later ASERT phases). The implementation of per-block ASERT provides critical properties during the network's infancy, including a Continuous exponential adjustment matching any violent swings in deployed hash power, History Agnosticism that eliminates the long-window memory and positive feedback loops inherent in moving averages, and Exploit Neutralization that permits an extremely rapid response to macroeconomic shocks that could neutralize the chain.

ASERT ensures absolute algorithmic stability during the early high-volatility subsidy era.

5.2 Phase III: Bitcoin 2016-Block Retarget

At approximately Year 8, the protocol has mathematically matured and the network systematically transitions to Bitcoin's original 2016-block simple moving average (SMA) difficulty adjustment model. This architectural shift provides miners, pools, and users with a 2 year buffer under Bitcoin's 2016-block algorithm until the coin reaches its Year 12.6 emission expiration date.

6. Deterministic Liveness Failover

Because the network ultimately defaults to the rigid 2016-block retarget in its final phases, it inherits the known vulnerability of slow recovery from sudden hash-rate collapses, including but not limited to a potential "permanent chain death spiral" where rapid fluctuations in the mining hash rate can cause extreme block interval expansion, potentially freezing economic activity for prolonged periods. To ensure that users, miners, and investors in ENDG are not at risk of losing their time, energy, and investments, ENDG formally encodes deterministic bailout triggers into the consensus layer.

The Deterministic Liveness Failover mechanism operates without any human intervention. It activates automatically if either of the following exact criteria are met: (1) Time-Based Stagnation (No block is produced for 48 consecutive hours) or (2) Sustained Throughput Collapse (A sustained 12-block trailing window averages >60 minutes per block).

When either threshold is breached, indicating the 2016-block system has failed, the network deterministically exits 2016-block retarget mode and reactivates per-block ASERT. Because ASERT calculates the target based directly on the elapsed time and previous block difficulty, the system anchors to the last valid block and difficulty rapidly re-equilibrates downwards to meet the newly depressed hash rate. Thus, liveness is restored deterministically and Ender holders do not need to fear a loss of their coins. Once triggered, the network remains in ASERT mode permanently.

This failover mechanism is not governance-controlled, not discretionary, strictly consensus-enforced, and mathematically isolated to protect chain continuity without altering monetary policy.

7. Consensus Constants

- **Target Block Spacing:** 600 seconds (10 minutes).
- **Maximum Supply:** 21,000,000.00000000 ENDG.
- **Initial Block Reward:** 50 ENDG.
- **Emission Termination Height:** 663,043.
- **ASERT Half-Life (Post-Initial Phase):** 43,200 seconds (12 hours).
- **Bitcoin Retarget Window:** 2,016 blocks.
- **Legacy Algorithm Switch Height:** Block 421,344 (~Year 8).
- **Failover Trigger 1 (Dead Stall):** 48 hours without a block.
- **Failover Trigger 2 (Slow Window):** 12-block average exceeding 60 minutes per block.

Parameter	MainNet	TestNet	TestNet4	RegTest
Default Port (P2P)	21210	21211	21212	21214
Magic Bytes (Hex)	45 4e 44 47	53 54 41 4c	41 4e 43 48	fa bf b5 da
Bech32 HRP	endg	endt	end4	egrt
Address Prefix (Pubkey)	38	111	112	111

8. Economic Implications, Risk Factors, & ENDG Safeguards

ENDG represents a real-world experiment in proof-of-work economics. The protocol offers front-loaded mining incentives followed by a deterministic transition to a fee-only security model. Its Failover mechanisms prevent a complete and irreversible collapse that could result in fear-based aversion to adopting the coin.

8.1 Economic Implications

ENDG presents a new genesis mining opportunity characterized by high early issuance acceleration and a known terminal issuance date.

For Miners: The protocol offers front-loaded subsidy rewards, a clear reward schedule, and a rapid, unavoidable transition to pure fee competition using well-established SHA-256 protocols.

For Investors: The asset provides deterministic scarcity compression, offering early exposure to terminal Proof-of-Work economics and transparent supply modeling.

For businesses: ENDG provides a unique opportunity to utilize an innovative, one-of-its-kind cryptocurrency unlike any other that may offer competitive fee dynamics depending on network usage and hash-rate equilibrium.

8.2 Systemic Risk Factors

ENDG is a strict Nakamoto consensus protocol and does not eliminate broader market risks. Being that ENDG, by design, is intended to replicate the Bitcoin environment, it inherently adopts all of the well-known risks associated with it. However, whereas Bitcoin's 2016 block difficulty adjustment system is potentially susceptible to complete blockchain death spirals because of macroeconomic shocks, ENDG includes deterministic failover mechanisms strictly designed to ensure algorithmic liveness. Of course, no cryptocurrency can guarantee economic viability, and open markets will dictate whether ENDG's price matches, falls behind, or exceeds other currencies.

9. Conclusion

Bitcoin Endgame is more than a novel cryptographic asset; it is a definitive timeline for the most critical economic experiment in decentralized finance. The protocol is engineered to execute a precise, three-stage vision: it utilizes a custom per-block difficulty scheme (ASERT) to survive early volatility, restores Bitcoin's exact 2016-block algorithm to model true legacy conditions, and, should that legacy mechanism catastrophically fail in a fee-only environment, it deterministically triggers a permanent failover to a difficulty system designed to restore liveness under defined failure thresholds.

By compressing the emission schedule into approximately 12.6 years, the protocol strikes an essential temporal balance that provides the market, miners, and infrastructure sufficient runway to prepare for absolute scarcity without forcing the community to wait a lifetime to test the blockchain's viability when it reaches its subdity endgame.

For the first time, we do not have to rely on speculation to understand the post-subsidy crypto-world. By guaranteeing chain liveness through its hybrid architecture, Bitcoin Endgame will provide an objective, empirical environment to finally answer the ultimate question: What happens when a POW blockchain like Bitcoin reaches the Endgame?