SATOSHI'S ENGINE

The Loops Inside the Engine

A companion map to Carnot local, Brownian global

The book builds the mechanism one piece at a time. This companion puts the pieces in motion at once.

The Engine in One Sentence

A profitability gap calls forth the competition that closes it, while the process of closing it leaves physical changes behind that the next cycle inherits.

The engine is not one loop. It is several feedback loops operating at different speeds, with different delays, through two linked markets: the coin and the machinery used to produce it. Most variables can reverse. The physical efficiency frontier cannot.

1. The profitability loop

Price rises -> profitability gap widens -> viable mining conditions widen -> more and less-efficient miners can operate -> hashrate rises -> difficulty / work per coin rises -> cost per coin rises -> profitability gap closes.

The opportunity summons the competition that consumes the opportunity.

2. The ASIC-price loop

Profitability gap widens -> expected ASIC return rises -> payback shortens -> ASIC demand rises -> ASIC price / capex rises -> expected return falls -> payback lengthens.

The mining opportunity is partly capitalized into the machine price.

3. The manufacturing-delay loop

Profitability gap widens -> ASIC orders rise -> manufacturers build -> production lag -> machines arrive -> hashrate rises -> difficulty rises -> profitability gap closes.

The answer arrives after the signal that caused it. Hashrate can therefore keep rising after the coin market has already turned.

4. The miner-supply loop

Price rises -> miner margin rises -> fraction of production required for opex falls -> miner selling falls -> liquid coin supply falls -> active scarcity rises -> price rises.

The same amplifier runs backward on the descent - but only to a hard ceiling. As price falls, the fraction miners must sell for opex rises until it reaches 100%. It cannot rise further. Below that point, adjustment must come from machines switching off. Selling pressure has a ceiling; physical capacity becomes the next variable.

5. The hardware-liquidation loop

Profitability gap closes -> marginal miners become unprofitable -> machines switch off or are sold -> used ASIC supply rises -> ASIC prices fall -> capex compresses -> lower-cost entry becomes possible.

The wreckage of one expansion becomes the cheap infrastructure of the next.

6. The scarcity-and-recovery loop

Price approaches cost -> miners approach the selling ceiling -> patient holders increasingly refuse to sell -> willing supply contracts -> remaining demand crosses willing supply -> price rises -> miner selling requirement falls -> liquid supply contracts further -> price rises.

The bottom contains the conditions that make the next climb possible.

Exhaust and Transfer

A loop map needs one distinction the sequential story can hide: not every response to a profitability gap leaves the same residue.

Exhaust: holders sell coins into demand -> liquidity rises -> the pressure that lifted price is absorbed. When the pressure is gone, nothing physical has to remain.

Transfer: miners and manufacturers respond to the same opportunity by moving capital into machines -> the gap is competed away -> the machines remain after the revenue that justified them has cooled.

One response releases pressure. The other converts pressure into infrastructure. That asymmetry is one of the reasons a locally repeating cycle can leave a globally different system behind.

What Is Not a Loop

Engineering improvement -> joules per unit of work fall.

This belongs underneath the loops, not inside them. A better machine can become the workhorse and move the joule limit down. That movement can pause if nobody funds the next generation, but an already-achieved physical improvement does not reverse. At the same time, competition and falling issuance can push work per coin upward. The local variables cycle around a substrate that remembers.

The Engine, All at Once

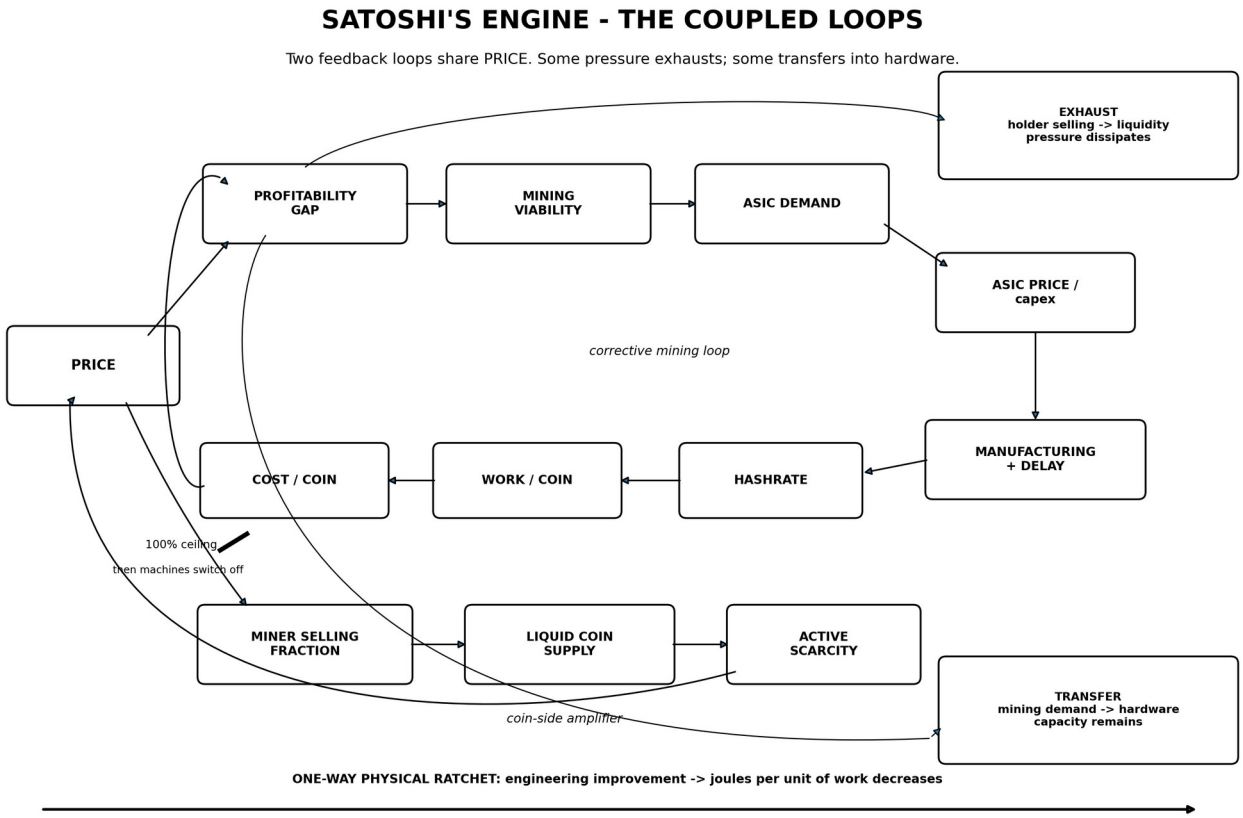

Figure 1. The coupled feedback loops of Satoshi's Engine.

Read the left-hand circle as the corrective mining loop: price opens the profitability gap; the gap broadens mining viability; demand for machines rises; capex and manufacturing respond; hashrate and work per coin rise; cost per coin follows; the loop closes back through the profitability gap.

Read the right-hand circle as the coin-side amplifier. Price changes how much miners must sell to meet the same operating bill. On the way down that fraction can rise only to 100%. The stop-bar marks that ceiling: once every newly mined coin is already being sold, further adjustment cannot come from a larger selling fraction; machines must switch off.

The two arrows leaving the profitability gap show the asymmetry between exhaust and transfer. Holder selling can absorb demand and exhaust pressure into liquidity. Mining investment can absorb pressure by transferring capital into hardware. The first can wash out with the cycle. The second leaves physical capacity behind.

The one-way physical ratchet is drawn separately beneath both loops. Transfer can leave physical capacity behind, while engineering can move the joule limit downward; neither relationship makes the ratchet another step in either feedback loop. The joule limit may stop advancing if the

next generation is not funded, but it does not retrace an engineering improvement already achieved.

The Engine in Motion

The loop map shows the causal architecture. This figure shows the characteristic output of that architecture through time.

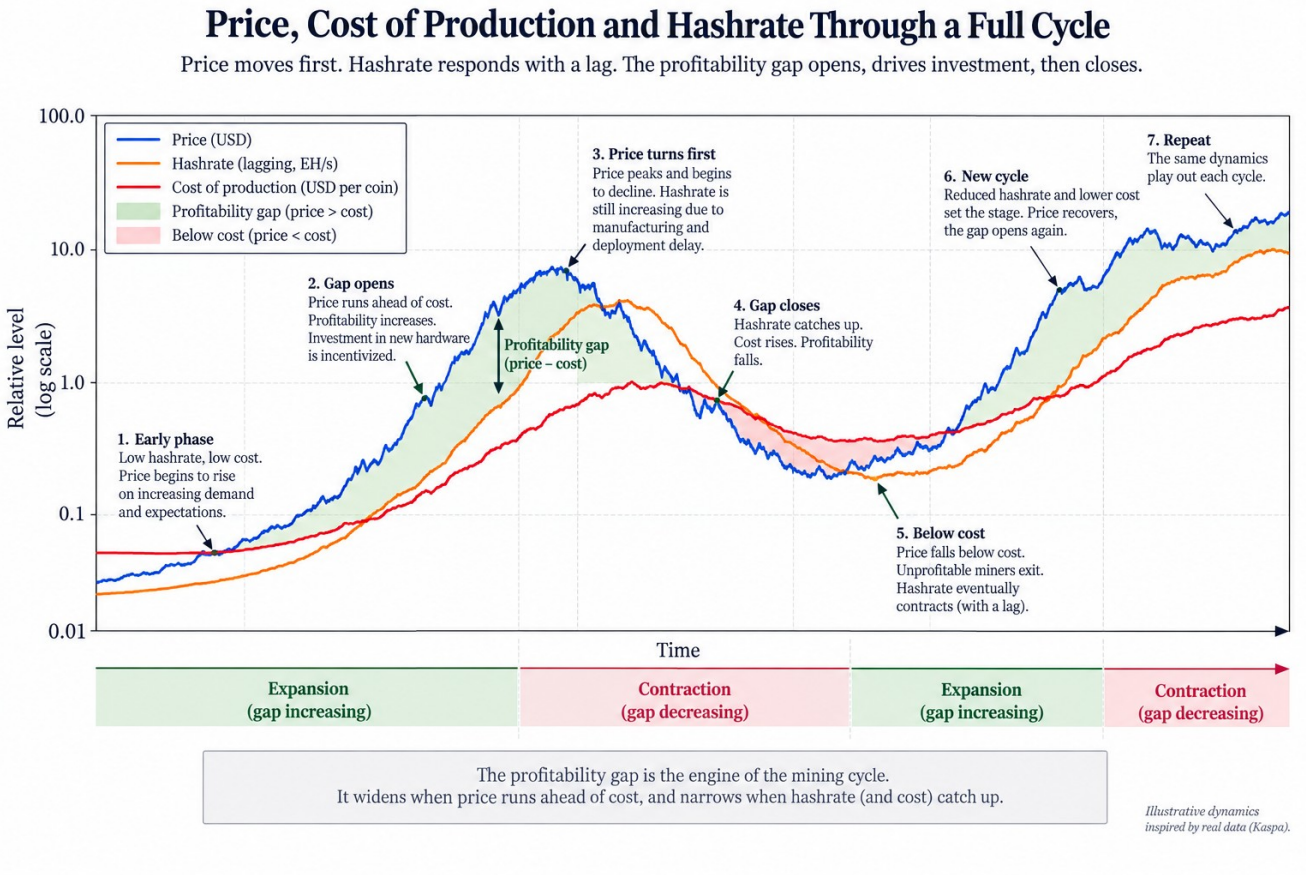

Figure 2. The engine in motion. Price can move before physical production responds. The resulting profitability gap calls machines into the network with a delay. Their arrival raises work per coin and pushes production cost toward price, consuming the opportunity that summoned them. Because the response is physical and delayed, hashrate can continue rising after price has already turned. The curves are illustrative; they show the mechanism developed in the book, not measured network data.

How to Read the Cycle

HOT COINS / HOT ASICs - Price and machinery are both hot. The profitability gap has called miners and manufacturers in; hardware is expensive, orders are flowing, and hashrate is still expanding.

COLD COINS / HOT ASICs - The coin turns before the hardware. Coins sold to fund machines add liquidity while machines ordered against the old gap keep arriving. Hashrate can continue rising as profitability deteriorates.

COLD COINS / COLD ASICs - Marginal miners leave. Used hardware undercuts new. capex compresses. Miner selling approaches its ceiling while patient holders become increasingly unwilling sellers.

HOT COINS / COLD ASICs - Price turns before manufacturing can. Idle machines return first; used supply dries up; the hardware pipeline is still cold. The reopened gap begins the next expansion.

The Local Cycle and the Global Ratchet

Locally, the system restores: gaps open and close; hardware becomes scarce and abundant; miners enter and leave; price separates from cost and returns toward it.

Globally, the system does not fully reset. Machines were built. Engineering advanced. Issuance moved along its schedule. Work accumulated. The next cycle therefore begins around conditions partly produced by the previous one.

Carnot local: the loops return.
Brownian global: what they leave behind does not.

A Note on Scope

This companion is a map of the mechanism developed in Satoshi's Engine, not a replacement for the argument. The arrows compress timing, heterogeneous miners, changing issuance, fees, power costs, hardware generations and market depth into a readable causal skeleton. The book supplies the qualifications; this file supplies the view from above.