What Is EIP-1559?

The upgrade that rebuilt how Ethereum prices a transaction — and quietly turned the network's fees into a monetary policy.

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AT A GLANCE

EIP NUMBER	LIVE SINCE	FEE SPLIT
1559	**London · Aug 2021**	**Base (burned) + Tip**
BASE FEE CAP	BLOCK TARGET / MAX	ETH BURNED
±12.5% / block	**15M / 30M gas**	**~4M+ (approx)**

01

The Problem It Was Built to Solve

Before EIP-1559, paying for an Ethereum transaction meant playing a guessing game. The network ran a **first-price auction** — a bidding system where every user attached a single gas price to their transaction, and miners simply picked the highest bids. If you bid too low, your transaction sat unconfirmed, sometimes for hours. If you bid too high, you overpaid, and there was no refund for guessing wrong.

First-price auctions are notoriously inefficient: every winner pays exactly what they bid rather than what they needed to bid, so the safe move is to overshoot. The result was chronic overpayment, wallets that struggled to estimate the right number, and fees that lurched violently from block to block. EIP-1559 — the Ethereum Improvement Proposal first drafted by Vitalik Buterin in 2019 and co-authored with Eric Conner, Rick Dudley, Matthew Slipper, Ian Norden, and Abdelhamid Bakhta — was designed to replace that guessing game with something closer to a posted price. This report examines the mechanism itself and the monetary policy it created; for the day-to-day, wallet-level view, our report on why gas fees get so high is the natural companion.

02

The Two-Part Fee

EIP-1559 split the old single gas price into two distinct components. The first is the **base fee** — a mandatory, per-unit price set not by any miner or bidder but by the protocol itself, algorithmically, based on how congested the network is. Every transaction in a block pays the same base fee. The second is the **priority fee**, commonly called a **tip** — an optional extra the user adds to incentivize a validator to include their transaction sooner when blocks are full.

The division cleanly separates two questions that the old auction had tangled together: what is the fair market rate for block space right now, and how much am I willing to add to jump the queue? The base fee answers the first; the tip answers the second. To protect against overpaying, EIP-1559 also introduced a **max fee** (maxFeePerGas) — the total ceiling a user is willing to pay per unit of gas. The user is charged the base fee plus their tip, and if that sum comes in under their max fee, the difference is refunded. For the first time, setting a generous ceiling no longer meant actually paying it.

03

How the Base Fee Moves

The elegance of EIP-1559 lives in how the base fee adjusts. The protocol targets blocks that are half full: the **target** is 15 million gas, while the hard **maximum** is 30 million gas — an elastic design where blocks can stretch to twice their target when demand spikes, then settle back. Gas is the unit that measures computational work, and these limits cap how much work each block can carry.

After every block, the protocol compares how full it was to that 15-million target and nudges the next block's base fee accordingly. If the prior block ran above target, the base fee rises; if below, it falls. The critical detail is the ceiling on that movement: the base fee can change by at most **12.5% per block**, and the actual change is proportional to how far the block strayed from target — a perfectly full block triggers the full 12.5% rise, a half-full block leaves the fee unchanged. Because the next block's price is mathematically bounded by the current one, wallets can predict it with near certainty. To make it concrete: if the current base fee is 20 gwei — a gwei being a billionth of an ether — the next block's base fee cannot exceed roughly 22.5 gwei or fall below about 17.5 gwei, no matter what happens. A wallet can therefore quote a confident estimate a block ahead. The guessing game largely disappears; users mostly just choose a tip.

> **A common misreading:** the base fee is not set by validators, and it does not go to them. The protocol sets it by formula, and — as the next section explains — it is destroyed. Validators earn only the tip. That single design choice is what turned a fee reform into a monetary one.

04

The Burn

Here is the change that made EIP-1559 far more than a user-experience upgrade: the base fee is **burned**. Rather than being paid to the validator who produces the block, it is sent to an address from which it can never be recovered — permanently removed from circulation. Only the optional tip reaches the validator. Every transaction on Ethereum now quietly destroys a small amount of ether.

Why burn perfectly good fees instead of paying them out? Two reasons drove the design. The first is anti-manipulation: if validators collected the base fee, they would have an incentive to game block fullness — stuffing or starving blocks — to inflate their own revenue. Burning the base fee removes any gain from manipulating it. The second is fairness: destroying the base fee is effectively a pro-rata rebate to every holder of the currency, since a smaller supply makes each remaining unit represent a larger share of the whole. Value flows to all holders rather than concentrating with block producers. What began as a fee-estimation fix became, almost as a side effect, a supply policy.

05

“Ultrasound Money” and Its Limits

The burn gave rise to a memorable slogan: **ultrasound money**, a playful escalation of Bitcoin’s “sound money” branding. The idea, floated by Vitalik Buterin and popularized by researcher Justin Drake in 2020 — before EIP-1559 even shipped — was that if the network burned more ether than it issued, the total supply could actually shrink over time. When Ethereum switched to proof of stake in The Merge of September 2022, new issuance fell by roughly 88 to 90 percent, from around 13,000 ether a day to under 2,000. With issuance that low, the EIP-1559 burn was frequently enough to tip the balance, and for stretches between late 2022 and early 2024 Ethereum’s supply genuinely contracted.

Intellectual honesty requires noting what happened next. The Dencun upgrade of March 2024 moved rollup data onto cheap “blobs,” which sharply reduced the base fees those

rollups had been burning. Since then, ether has drifted back to being mildly net-inflationary, growing on the order of a few tenths of a percent a year. The ultrasound-money thesis was never a law of nature; it was always contingent on activity, and today it is not holding. Cumulatively, EIP-1559 has still burned an enormous amount — on the order of four million ether or more — but whether the supply shrinks in any given month depends entirely on demand.

06

The London Hard Fork

EIP-1559 went live on August 5, 2021, as the centerpiece of the **London** hard fork — a coordinated, backward-incompatible upgrade to the network. It did not arrive uncontested. Because the change stripped the base fee out of miner revenue by burning it, the miners who then secured Ethereum under proof of work stood to lose a meaningful slice of income, with some estimates putting the hit near half of fee revenue on busy days.

That opposition briefly turned into organized protest. In April 2021, ahead of the fork, a group of miners planned a roughly fifty-one-hour "show of force," redirecting their computing power to a mining pool that opposed the proposal, in an attempt to demonstrate their leverage. The demonstration fizzled — it drew limited participation and changed nothing — and London activated on schedule months later. The episode is a useful reminder that protocol upgrades are as much social negotiations as technical ones, and that the parties losing revenue rarely endorse their own reduction quietly.

07

Predictable, Not Cheaper

One misconception has clung to EIP-1559 since launch: that it was supposed to make Ethereum cheaper. It was not, and it did not. Gas fees are ultimately a function of demand for a scarce resource — space in each block — and no fee-formula reshuffle can conjure more of that space. When demand for Ethereum block space is high, fees are high, EIP-1559 or not.

What the upgrade actually delivered was **predictability**. By making the next block's base fee a knowable quantity rather than a blind auction, it let wallets quote reliable prices and all but eliminated the wild overpayments of the earlier era. Users stopped needing to outguess a chaotic market and started paying something close to a fair, posted rate plus a modest tip. The genuine reductions in transaction cost that Ethereum users have enjoyed came later and

from a different direction — the layer-2 rollups and the blob data lane — not from EIP-1559 itself. Conflating the two obscures what each was designed to do.

08

The Standard It Set

EIP-1559 has proven influential well beyond Ethereum's own base layer. Its base-fee-plus-tip structure was adopted by Polygon in January 2022, complete with its own token burn, and variations of the model now run across major layer-2 networks and other chains that borrowed its approach to fee estimation. A design that began as a fix for one network's auction problem became a template for how programmable blockchains price their block space.

It is worth being clear about the risk record, too. In the years since launch, there has been no exploit or catastrophic failure of the EIP-1559 mechanism itself; the only documented concerns are theoretical papers on subtle base-fee manipulation under contrived conditions, not real-world losses. What EIP-1559 leaves behind is a quiet reengineering of something users touch every single day — the price of a transaction — and a demonstration that a fee market, carefully designed, can double as a monetary policy. That dual nature, predictable pricing on one side and a deflationary lever on the other, remains its lasting signature.

"The fire shall ever be burning upon the altar; it shall never go out."

LEVITICUS 6:13

METHODOLOGY & SOURCES

This report was compiled from the official EIP-1559 specification and corroborating primary and secondary sources, cross-checked by a multi-agent research review. Core mechanics — the base-fee/priority-fee split, the base fee being burned while only the tip reaches validators, the 15M-gas target against a 30M-gas maximum (elastic blocks up to 2× target), and the ±12.5%-per-block base-fee adjustment cap (proportional to deviation from target) — follow the specification directly. The London hard-fork activation (August 5, 2021) and the author set (Vitalik Buterin, Eric Conner, Rick Dudley, Matthew Slipper, Ian Norden, Abdelhamid Bakhta) are verified. Monetary-policy figures are directional: post-Merge issuance fell roughly 88–90% (~13,000 to under 2,000 ETH/day); ETH was net-deflationary across stretches of late 2022–early 2024 but has been mildly net-inflationary since the Dencun upgrade (March 2024) reduced rollup base-fee burn; cumulative burn is on the order of ~4 million+ ETH (approximate — see a live tracker such as ultrasound.money for current figures). The "ultrasound money" term predates EIP-1559 (coined ~2020). No real core-protocol exploit of the fee mechanism exists; documented base-fee-manipulation concerns are academic only. See

eips.ethereum.org/EIPS/eip-1559 and ethereum.org/roadmap/merge/issuance. Educational only; not financial advice.

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