Authored by:
Christian Hazim
Research Analyst

Date: September xx, 2022
Topic: Digital Assets

GLOBAL X ETFs RESEARCH

The Merge: Supercharging Ethereum

Editor's Note: Please see the glossary at the end for all terms highlighted in **sea green** found in the order that they appear.

The Merge is the most significant upgrade in the history of Ethereum, and perhaps any blockchain. Ethereum's rapid growth can be attributed to its **composable-driven** ecosystem that creates network effects that attract developers and users. With demand for Ethereum's limited **block space** increasing, so too has the cost to transact and the need to scale. In its current state, the network is not suited to absorb this demand, nor achieve its sustainability and scalability goals.

The Merge, which refers to the shift in Ethereum's **consensus mechanism** from energy-intensive mining operations under Proof-of-Work (PoW) to the more energy-efficient Proof-of-Stake (PoS), will not solve for high transaction fees or alter **block times**. But it sets the foundation to solve for these issues while improving the monetary properties of ether (ETH), Ethereum's native asset.

In this report, we break down how this long-planned transition represents an exciting step in executing Ethereum's vision for achieving optimal scalability, sustainability, decentralization, and security.

Key Takeaways

- Ethereum's shift to PoS is a critical step toward increasing the network's scalability, while simultaneously improving its sustainably. PoS reduces the network's energy consumption by 99%.
- The economies of scale associated with PoW mining disappear under PoS. Lower barriers to entry attract more users to the network, and because of the lack of mining infrastructure, the security cost around block rewards can be reduced, democratizing network security and reducing new ETH supply.
- PoS makes ETH a stronger, more diverse asset that can generate yield through network security and blockchain value creation. Also, with stronger supply and demand mechanisms, ETH has the potential to be a deflationary asset.

The Merge Was Always Part of the Ethereum Plan

Vitalik Buterin, the programmer who introduced Ethereum's novel **Turing-complete** blockchain ecosystem with **smart contract** integration, always envisioned a change in its consensus mechanism. While PoW was seen as critical to bootstrapping the network's growth in the early days, PoS would provide the infrastructure required to turn Ethereum into the world's supercomputer.

Prior to the Merge, two independent blockchains are running Ethereum code in parallel: the current PoW Ethereum chain (the "Execution Layer") and the Beacon Chain (the "Consensus Layer"). Launched on December 1, 2020, the Beacon Chain was Ethereum's first step towards adopting PoS. The Beacon Chain established a new system that relies on staking ETH rather than PoW mining to prevent sybil attacks and support consensus on the state of the network. While the Beacon Chain does not coordinate transactions, it represents the PoS engine that will drive the Ethereum network following the Merge. Up

until the Merge, all economic activity, including the ecosystem of **decentralized applications (dapps),** occurs in Ethereum's PoW execution layer.

The Merge represents the junction of Ethereum's current execution layer with the PoS Beacon Chain, preserving the network's economic ecosystem and historical data while setting the foundation for improved infrastructure.

The Merge: The Impact on the Ethereum Network

The Shift to PoS Is a Massive Sustainability Upgrade for Ethereum

In comparison to the energy-intensive and operationally challenging mining process used in PoW, PoS systems require minimal energy consumption. The reason for this is simple: PoW obliges network validators to tie up capital in hardware and electricity expenses to disincentivize malicious behavior when validating transactions whereas PoS achieves this by requiring participants to post ETH as collateral, a practice called **staking**. By simply changing the cost borne by network validators from capital expenditures on electricity to the opportunity cost associated with locking up capital, it is estimated that PoS reduces Ethereum's energy footprint by at least 99%, a key feature in today's energy-conscious world.[1]

PoS Facilitates Ethereum's Decentralization

PoW's reliance on electricity consumption and advanced hardware introduces significant economies of scale that benefit the industry's largest participants. As the mining industry becomes more competitive, these economies of scale make it less feasible for individuals to operate profitable mining rigs and participate competitively in network validation. Ultimately, this has the potential to concentrate control of the network into the hands of the participants capable of setting up such infrastructure.

With PoS, these economies of scale cease to exist as all that is required to participate in network validation is purchasing and staking ETH. While large institutional players will likely benefit from the cost efficiencies of prime broker relationships, large block purchases also incur implicit transaction costs. The result is that neither individuals nor institutions have a significant cost advantage in acquiring ETH and becoming network validators. Moreover, because the opportunity to add new blocks and earn ETH rewards is assigned to all participants in proportion to their share of the network's staked tokens, PoS democratizes network participation as all users are equally compensated for their contributions. This design promotes Ethereum's long-term decentralization by incentivizing a geographically and operationally diverse group of participants to support the network.

Ethereum Becomes More Economically Secure Under PoS

With lower barriers to entry, more users can participate in validating the Ethereum network. And with more staked capital and diverse users, the safer and more decentralized the network becomes. We can quantify security by analyzing the current staking status. Today, roughly 13 million ETH is locked in the Beacon Chain staking contract, which means that about 9% of the circulating supply is securing the network via PoS.[2] As PoS requires an attacker to control 51% of the staked assets to conduct an attack, current staking numbers indicate that an attacker would need to spend over $10 billion to hijack the network, a strong barrier to break.

Slashing is another prominent security feature of PoS. Slashing empowers the network to respond to validators who act in a provably malicious manner by seizing a portion of their staked assets or by removing them from the chain entirely. The risk of slashing incentivizes validators to follow the protocol rules and act in the network's best interest. It also provides the network with a precise tool to punish bad actors not possible in a PoW system.

Ethereum Issues Fewer Block Rewards in Exchange for Increased Economic Security

Smart contract blockchains must compensate validators for expending resources to secure the network. This compensation comes in the form of **block rewards** — newly minted tokens issued by the blockchain. Because these blockchains are forced to continually mint new tokens, inflationary monetary policies are common across blockchain ecosystems.

As previously discussed, PoW requires miners to continuously spend capital on electricity, advanced hardware, overhead expenses, and more. Because the costs imposed on network validators in a PoS system are much lower, Ethereum will be able to pay validators less rewards for providing the same level of network security post-Merge. The Merge thus represents an inflection point in Ethereum's monetary policy, as the daily issuance of new tokens used to pay for network security will decline by about 90% from roughly 13,000 ETH/day to 1,600 ETH/day. The result is a drastic shift in annualized token inflation from about 4% today to less than 0.5% following the Merge.[3]

PoS Unlocks a Path for Ethereum to Scale

The Merge enables a path toward Ethereum's long-term scalability goals: **shard chains** that support scalability initiatives.

Shard chains increase base layer scalability for Ethereum by splitting the network horizontally into smaller component pieces. This structure reduces the computational burden on the network's nodes. Instead of storing all blockchain data and validating transactions across the entirety of the network, sharded chains allow nodes to store and access data specific to a small component of the network. Reducing data retention in this way means that validating nodes will be able to be run on cheap consumer hardware, promoting more global participation and network decentralization.

Sharding also facilitates significant improvements to the network's transactional throughput. In its current state, the Ethereum network's base layer is only able to process ~10-15 transactions per second. By splitting the network into many component shards, the transactional throughput of the network will grow by multiples. Together, with innovations in areas such as data compression and **layer 2 rollup solutions**, sharding has the potential to grow Ethereum's transactional capacity to over 100,000 transactions per second.

According to core developers, however, sharding can only be safely implemented using PoS-based consensus, as sharding a PoW blockchain would significantly decrease the amount of computational power needed to successfully attack the network.

With shard chains made possible with the transition to PoS, the successful completion of the Merge marks the true beginning of Ethereum's long-term scalability plans.

The Merge Will Evolve ETH into a Better Asset

Money is a system of value that facilitates trade within an economy.[4] The strongest forms of money serve as a store of value, a unit of account with an ecosystem that depends on its utility, a widely trusted and accepted medium of exchange, and an asset capable of generating real yield derived from its demand.

In our view, Ethereum's transition to PoS helps ETH check all these boxes, and then some. With PoS, ETH becomes stronger because it can act as:

- A store of value asset due to its supply and demand mechanisms

- A unit of account and strong commodity within its digital economy
- A strongly adopted medium of exchange within its ecosystem
- A multi-functional yield-generating asset

Below, we highlight what we view as some of the most important advancements to ETH that could define its evolution as a unique digital asset.

The Merge Gives ETH the Potential to be a Unique Deflationary Commodity

In order to prevent the network from being spammed, Ethereum and many other blockchains require users to pay a fee in order to consume block space. These transaction fees are referred to as "gas fees." In Ethereum's case, ETH is used to pay these fees which apply to all transactions on the network, whether a peer-to-peer transfer or an interaction with a smart contract. Because of this, demand for ETH as a form of transaction settlement increases as activity on the network grows.

Transactions are important because they correlate with the supply and demand mechanics of ETH. In Ethereum: The Basics, we discuss a prominent Ethereum Improvement Proposal (EIP) that can promote deflationary behavior. EIPs outline new features and processes for the Ethereum community. Implemented in August 2021, EIP-1559 introduced a mechanism that eliminates or "burns" a portion of each transaction's gas fees from circulation. In effect, as more transactions are conducted on-chain, more gas is burned, and more ETH is permanently removed from circulation.

The burning effect of EIP-1559 combined with the reduction in new token issuance under PoS has the potential to fully eliminate the dilutive effect of new issuance from block rewards if network demand is above a threshold. Today, Ethereum burns anywhere between 700 and 2,500 ETH daily depending on network activity. With 1,600 ETH expected to be issued per day following the Merge, ETH has the potential to become deflationary over the long run.[5,6]

The Merge Turns ETH into a Globally Accessible, Yield-generating Asset

While ETH acts as the money for its native ecosystem, it also allows users to earn yield for providing network security. Following the transition to PoS, generating yield will become a more attractive feature of ETH.

Block rewards, cash flows from block tips, and on-chain arbitrage activity including **MEV value extraction** will all accrue to staked ETH tokens following the Merge and will be paid to staking participants in the form of a real yield.

The Merge Is the Initial Step Towards Ethereum's Long-Term Goals and Transforms ETH as Its Network Money

The Merge lays the foundation to increase Ethereum's scalability and evolve the current chain into a stronger, more sustainable, and more secure network of applications. Powering this growing network is ETH the asset, which will become a more multi-faceted form of money following the transition to PoS.

Footnotes

1. Beekhiuzen, C. (2021, May 18). Ethereum's energy usage will soon decrease by ~99.95% [Blog post]. *Ethereum Foundation Blog.* https://blog.ethereum.org/2021/05/18/country-power-no-more/

2. Etherscan. (n.d.). *Contract 0x00000000219ab540356cBB839Cbe05303d7705Fa*. Accessed on September 13, 2022 from https://etherscan.io/address/0x00000000219ab540356cbb839cbe05303d7705fa
3. Ethereum. (2022, September 9). *How The Merge impacts ETH supply*. https://ethereum.org/en/upgrades/merge/issuance/
4. The Investopedia Team. (2022, July 4). Understanding money: Its properties, types, and uses. *Investopedia.* https://www.investopedia.com/terms/m/money.asp
5. Watch the Burn. (n.d.). *Insights.* Accessed on September 13, 2022 from https://watchtheburn.com/insights
6. Ultra Sound Money. (n.d.). *Merge soon.* Accessed on September 13, 2022 from https://ultrasound.money/

Glossary

Composability: Refers to the ability to interact, build on, and improve on open-source applications and layers, including like-kind assets.

Block space: Blocks in a blockchain are limited in capacity due to the nature of blockchain technology. These blocks host batches of network data and get added to the network of blocks (blockchain) continually.

Consensus mechanism: Consensus is how the majority of the network agrees on its correct state. Consensus is crucial to the network's infrastructure because it allows participants to agree on the correct state of the network's past, present, and future block production.

Block times: The time it takes to generate a new block. Often, blocks are fixed in order to control the amount of data that gets included in the blockchain.

Turing-complete: Programing language that can perform any computational operation.

Smart contracts: Smart contracts are programs that automate the execution of an agreement so that all participants can be immediately sure of the outcome without any intermediary's involvement or time delay. Smart contracts remove trust concerns in transactions, without the need for third parties. Data feeds, conditions, and rules embedded in the contract trigger a pre-defined outcome executing the agreed-upon terms.

Decentralized applications (dapps): Decentralized applications built on top of smart contract platforms. Dapps use the infrastructure of distributed ledger networks and are composable with each other.

Staking: The process of locking up funds to secure a Proof-of-Stake network. As a reward for securing the network, cryptocurrencies are distributed to users who participate in staking when a block is validated.

Slashing: Validator penalties under a Proof-of-Stake consensus mechanism where all staked assets or a portion of the staked assets are seized. Slashing is a mechanism used to discourage bad actors and harmful activities. Because Proof-of-Stake requires staked assets to secure the network, bad behavior is penalized by the full or partial removal of the actor's staked assets.

Block rewards: Native rewards allocated to blocks as a financial incentive for validating blocks.

Shard chains: A data architecture solution that consists of two or more chains of blocks. The computational and storage load of a network with shard chains is spread between the shards, processing transactions in parallel, which results in higher transaction throughput.

Layer 2 rollup solutions: Scaling solutions implemented outside of the layer 1 blockchain. Layer 2s solutions ultimately derive security from the mainnet (layer 1). These applications generally process individual transactions in a separate state, and they communicate with layer 1 for settlement in various ways, depending on the type of solution.

Sybil resistance mechanism: The implementation of incentivizing techniques under a consensus mechanism that allows for network protection against bad actors. Proof-of-work and Proof-of-stake are consensus mechanisms with Sybil resistance implementations using energy and staked assets as security barriers.

MEV (maximal extractable value: MEV represents the ability to extract value from the privilege of accessing the pending transaction pool by organizing transactions for arbitrage purposes and front-running opportunities. Generally speaking, when users submit transactions into a blockchain, these transactions remain in a pending state until included in a validated block. Because transactions generally go through this process flow, block producers have access to valuable information. MEV is a powerful source of revenue due to the rise of decentralized finance (DeFi) and the monetary size of its transactions