

ETHEREUM: WHAT TO EXPECT AFTER THE MERGE

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1. INTRODUCTION

The growing demand for information regarding pre- and post-merge has been a problem since it will be the first time in history that a blockchain will transition from one consensus to another. We have collated this information for our investors to understand better what will happen to Ethereum.

Ethereum is a decentralised, open-source blockchain with smart contract functionality. It currently uses a proof-of-work consensus to secure the network. Ethereum has also been a dominant smart contract infrastructure for decentralised applications, with over 60% of its transactions coming from Decentralised Finance (DeFi) and the Non-Fungible Tokens (NFT). Ethereum uses an Ethereum Virtual Machine, which allows anyone to execute a code in a trustless ecosystem.

Ethereum is closing in on one of the most significant events in crypto history, where it moves an active blockchain from PoW to PoS. The upgrade is named “The Merge”, wherein the high energy consuming proof-of-work mining will be switched off, and the environmental friendly consensus proof-of-stake will be launched. This process has been underway since the launch of the PoS Beacon chain in 2020 and requires absolute precision.

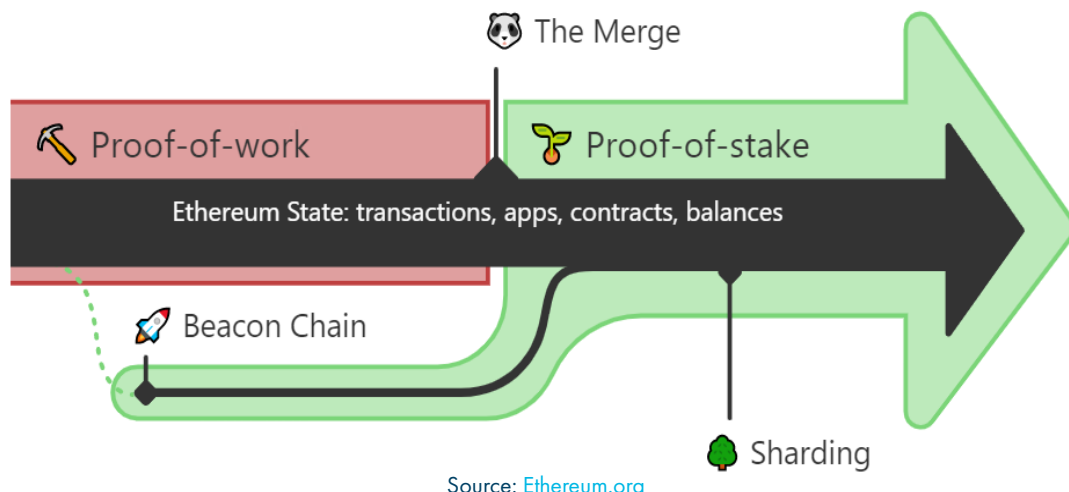
Currently, the Merge on Ethereum testnets Ropsten and Sepolia successfully transitioned to proof-of-stake and are producing blocks without instance. The remaining testnet to be merged will be the Goerli, before the mainnet on 19 September 2022. This transition is part of the five stages of the roadmap, namely The Merge, Surge, Verge, Purge, and Splurge.

In this report, we explore the details around the Merge and its resulting investment opportunities. The source information is referenced at the end of the document, with the major source of information from www.ethereum.org. Ethereum.org is a public, open-source resource for the Ethereum community that anyone can contribute to. Ethereum.org has a small team dedicated to maintaining and developing the site which is funded by the [Ethereum Foundation](#).



2. THE MERGE

Definition. The Merge represents the joining of the existing execution layer of Ethereum with its new proof-of-stake (PoS) consensus layer, the Beacon Chain. It eliminates the need for energy-intensive mining and instead secures the network using staked ETH.



Process. The beacon chain is a fully independent network which has a PoS consensus layer. It is running in parallel to the current Ethereum mainnet, where the consensus layer currently remains proof-of-work (PoW). By keeping the PoS chain isolated from the main network a ready-to-ship solution is being perfected without risking the flourishing decentralised application platform of the Ethereum PoW chain.

Ethereum developers ensure that the Merge will be a smooth transition by doing shadow forks for the Merge process. As of this writing, [ten shadow forks](#) were created, and most of them have successfully transitioned with little to no problem. The shadow forks copied the mainnet data to a test environment network and then merge its consensus mechanism to proof-of-stake. The merging of shadow forks starts by increasing the difficulty (Terminal Total Difficulty/TTD), rendering proof-of-work block production to almost zero.

The testnets for Ethereum will undergo the Merge too. This will ensure the Merge is battle tested before deploying to the Ethereum Mainnet. The Merge on the Ropsten network and Sepolia network seemed completed and were producing blocks successfully. The final testnet to be merged will be the Goerli network.

The merge for the [Ropsten](#) experienced short hiccups with some nodes unable to synchronise but was quickly rectified within the day. [Sepolia testnet merge](#) was also successful, with no significant glitches reported. With the final testnet merge approaching, Ethereum developers managed to set up the final date for the mainnet Merge.

At the moment of the merge, Ethereum's proof-of-work mining will be switched off, proof-of-stake consensus will take over, and the energy consumed by the network will drop to <0.05% of its pre-merge amount.

Ethereum's "difficulty bomb" refers to a sudden increase in mining difficulty to discourage miners from opting to stay with the proof-of-work mechanism after its transition to proof-of-stake.

Risk. There are always risks when making a large change to a protocol that is securing hundreds of billions of dollars of assets. **"The Merge" can be thought of as replacing the engine of an airplane while it is still flying.** Thankfully, the beacon chain — the current proof-of-stake (PoS) Ethereum chain - has been running since December 2020 without issues.

There are currently 4 unique client implementations PoS Ethereum nodes. **This means that if a PoS node operator experiences issues with a given implementation they will have the ability to switch to different client.** Participants can rest assured that before "The Merge" occurs the code in use will have been exhaustively checked, battle tested, and checked again.



2. STRENGTHS & WEAKNESSES

Proof of Stake. Proof-of-stake is a type of consensus mechanism used by blockchains to achieve distributed consensus. Validators explicitly stake capital in the form of **ether** into a smart contract on Ethereum. This **staked ether** then acts as collateral that can be **destroyed if the validator behaves dishonestly or lazily**. The validator is then responsible for checking that new blocks propagated over the network are valid and occasionally creating and propagating new blocks themselves.

PoS Advantages. Proof-of-stake comes with a number of improvements to the proof-of-work system:

- *better energy efficiency* – there is no need to use lots of energy on proof-of-work computations
- *lower barriers to entry, reduced hardware requirements* – there is no need for elite hardware to stand a chance of creating new blocks
- *reduced centralisation risk* – proof-of-stake should lead to more nodes securing the network because of the low energy requirement less ETH issuance is required to incentivise participation
- *economic penalties* for misbehaviour make 51% style attacks exponentially more costly for an attacker compared to proof-of-work
- the community can resort to *social recovery* of an honest chain if a 51% attack were to overcome the crypto-economic defenses

Pros	Cons
Staking makes it easier for individuals to participate in securing the network, promoting decentralisation. validator node can be run on a normal laptop. Staking pools allow users to stake without having 32 ETH.	Proof-of-stake is younger and less battle-tested compared to proof-of-work
Staking is more decentralised. Economies of scale do not apply in the same way that they do for PoW mining.	Proof-of-stake is more complex to implement than proof-of-work
Proof-of-stake offers greater crypto-economic security than proof-of-work	Users need to run three pieces of software to participate in Ethereum's proof-of-stake.
Less issuance of new ether is required to incentivise network participants	

Source: [Ethereum.org](https://ethereum.org)

In general, a proof of stake algorithm looks as follows. The blockchain keeps track of a set of validators, and anyone who holds the blockchain's base cryptocurrency (in Ethereum's case, ether) can become a validator by sending a special type of transaction that locks up their ether into a deposit. The process of creating and agreeing to new blocks is then done through a consensus algorithm that all current validators can participate in.

Risk. From a centralisation perspective, in both Bitcoin and Ethereum it's the case that roughly three pools are needed to coordinate on a 51% attack (4 in Bitcoin, 3 in Ethereum at the time of this writing). In PoS, if we assume 30% participation including all exchanges, then **three exchanges would be enough to make a 51% attack**; if participation goes up to 40% then the required number goes up to eight. **However, exchanges will not be able to participate with all of their ether; the reason is that they need to accommodate withdrawals.**

Additionally, pooling in PoS is discouraged because it has a much higher trust requirement - **a proof of stake pool can pretend to be hacked, destroy its participants' deposits and claim a reward for it**. On the other hand, the ability to earn interest on one's coins without oneself running a node, even if trust is required, is something that many may find attractive; all in all, the centralisation balance is an empirical question for which the answer is unclear until the system is actually running for a substantial period of time.

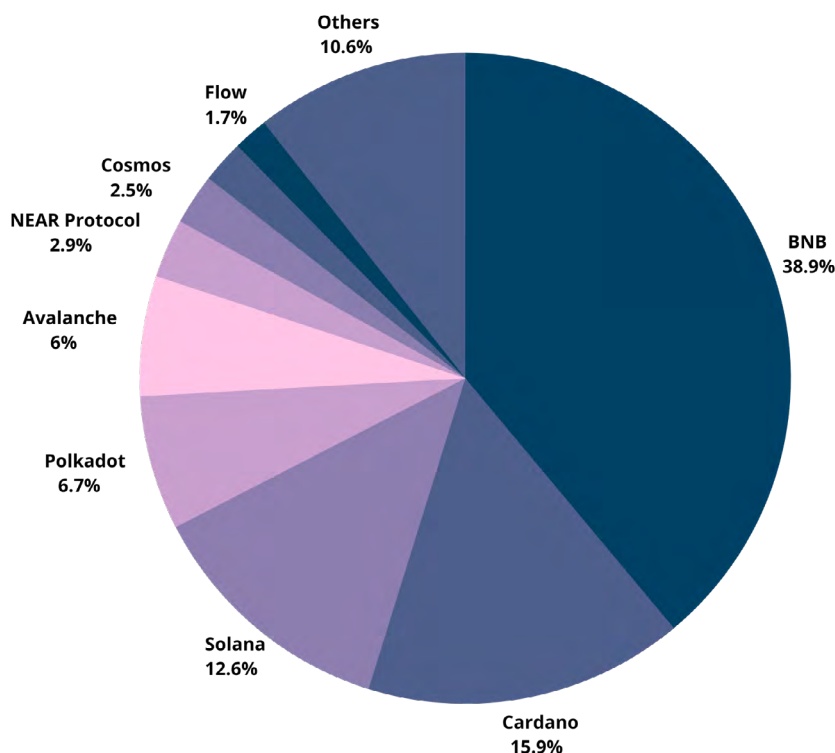
With sharding, we expect pooling incentives to reduce further, as (i) there is even less concern about variance, and (ii) in a sharded model, transaction verification load is proportional to the amount of capital that one puts in, and so there are no direct infrastructure savings from pooling.



2. STRENGTHS & WEAKNESSES

COMPETITIVE ANALYSIS

The layer-1 proof of stake blockchains has a total market capitalisation of US\$107.01 billion, led by BNB Chain and Cardano networks. According to DeFillama, the TVL in BNB Chain is around US\$7.63 billion, followed by Avalanche's US\$3.61 billion and Solana's US\$2.69 billion. It can be noted that the total value locked in PoW Ethereum dApps is significantly higher than all chains, which may hint that the eco-friendly PoS Ethereum will likely gain greater market dominance from the so-called "Ethereum killers".



Source data from [Cryptoslate](#)

The competition of Layer 1 PoS networks may increase as the dominant smart contract infrastructure enters the sector. The Ethereum Merge, however, will not result in lower gas fees and transaction speed as the network capacity did not expand. This means that only the consensus mechanism was upgraded, and its competitive stance (lower fees and increased speed and transaction throughput) will not happen until after the Shanghai hard fork and the introduction of Sharding. The ability for 32ETH validator stakers to withdraw will not occur until the [Shanghai upgrade](#), which has a fixed rate of 43,200ETH withdrawals per day out of the 13.11 million staked. The Ethereum PoS competition will likely remain neutral but is expected to gain traction after the Shanghai upgrade and the exit of pre Merge validators.

Network	Transaction per Seconds (Max)	Transaction Finality	Market Cap at 25 July 2022
BNB Chain	130	75 sec.	US\$41.18 billion
Cardano	250	2 min.	US\$16.78 billion
Solana	50,000	13 sec.	US\$13.37 billion
Polkadot	1,000	6 sec.	US\$7.03 billion
Ethereum PoS	?	?	US\$183 billion



2. STRENGTHS & WEAKNESSES

Ethereum Co-Founder Vitalik Buterin said

“At the end of this road map, Ethereum will be a much more scalable system.

“By the end, Ethereum will be able to process 100,000 transactions per second.”

Emission and Burn Rate. The Ethereum’s issuance rate with the PoW model is around 4.3%, emitting 2 ETH per block or 13,500 ETH per day. The emission rate seems high compared to Bitcoin’s PoW, but it is needed to incentivise miners to secure the network. With the transition to the PoS model, the issuance rate can be lowered in line with the reduction of energy consumption. This means that validators operating costs to secure the network are significantly lower than the PoW. The table below shows the possible emission rate post-merge.

ETH validating	Max annual issuance	Max annual network issuance %	Max annual return rate (for validators)
1,000,000	181,019	0.17%	18.10%
3,000,000	313,534	0.30%	10.45%
10,000,000	527,433	0.54%	5.72%
30,000,000	991,483	0.94%	3.30%
100,000,000	1,810,193	1.71%	1.81%

Source: [Ethhub](#)

The EIP-1559 or the London Hard Fork will also slow down the emission rate. With the current PoW model, the emission rate slowed from a 4.3% inflation rate to 0.54% due to the EIP-1559 or the burning mechanism for transaction fees. There are also times that the emission rate reaches a deflationary stage, especially during a high period of activity within the network. So after the transition to PoS, we expect the London Hard Fork to decrease the emission rate significantly or even deflate the network, making its token economics attractive as a store of value.



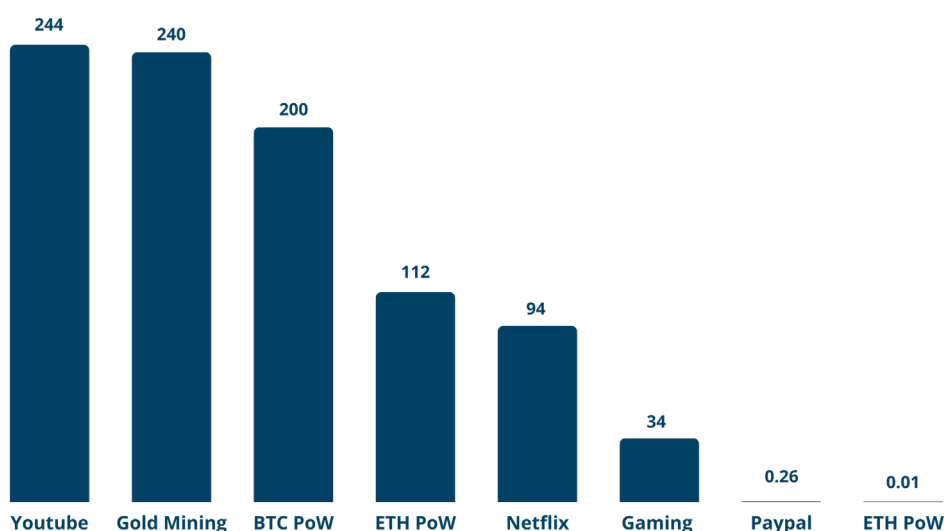
3. OPPORTUNITIES & THREATS

According to [JP Morgan](#), there are five reasons why Environmental, Social and Governance (ESG) investing is much more than a short-term fad.

1. Demand is led by investors.
 - Over \$500 billion flowed into ESG-integrated funds in 2021, contributing to a 55% growth in assets under management in ESG-integrated products. We expect growth in ESG investing to continue through 2022, and well beyond.
 - The shift to sustainable investing is so powerful because it's being driven by demand from the bottom up. Quite simply, investors – from individual savers through to large institutions – are directing an ever-increasing proportion of their portfolios towards sustainable strategies as they look to use their capital to help create a more sustainable world.
2. Technology is driving product innovation
 - New technology is helping fund managers keep pace with this sharp rise in demand for sustainable investments. The internet transformed the way information is captured, documented and disseminated, providing investors with access to more data than ever before. However, it's only now, with the development of artificial intelligence (AI), that investors have the ability to analyse it all.
3. Companies are being encouraged to take action
 - The good news is that many companies around the world already understand the need to take action on ESG issues—not least because they recognise that they can only deliver sustainable long-term growth if they manage the Earth's resources prudently, treat their workers with respect and look after the natural environment in which they operate.
4. Investment research is increasingly focused on sustainable outcomes
 - ESG research frameworks are being developed and refined to support the growth in sustainable investment management.
5. The energy transition is creating new risks and opportunities
 - Competitiveness is about the commitment of governments to deliver a transformation in their economies so that businesses are not left behind by higher carbon prices globally. Cutting carbon emissions will require significant growth in carbon markets, and this growth will be a key influence on competitiveness. Countries that are able to take advantage of the advances in technology needed to reach net zero carbon emissions will be best positioned to flourish in this environment.

Ethereum's proof of stake transition will likely attract new investors from an ESG perspective compared to Bitcoin's proof of work. Ethereum's PoW total energy consumption is ~112 TWh/yr, comparable to that of the Netherlands, with a Carbon emission equivalent to that of Singapore (53 MT/yr). For comparison, Bitcoin currently expends about 200 TWh/yr of energy and emits about 100 MT/yr C, while generating about 32,000 T of electrical waste from obsolete hardware annually. Switching off Ethereum's proof-of-work in favour of proof-of-stake will reduce this energy expenditure by more than 99.95%, implying that the total energy expenditure for securing Ethereum is closer to **0.01 TWh/yr**.

ENERGY CONSUMPTION IN TWH/YR



Source: [Ethereum.org](#)



3. OPPORTUNITIES & THREATS

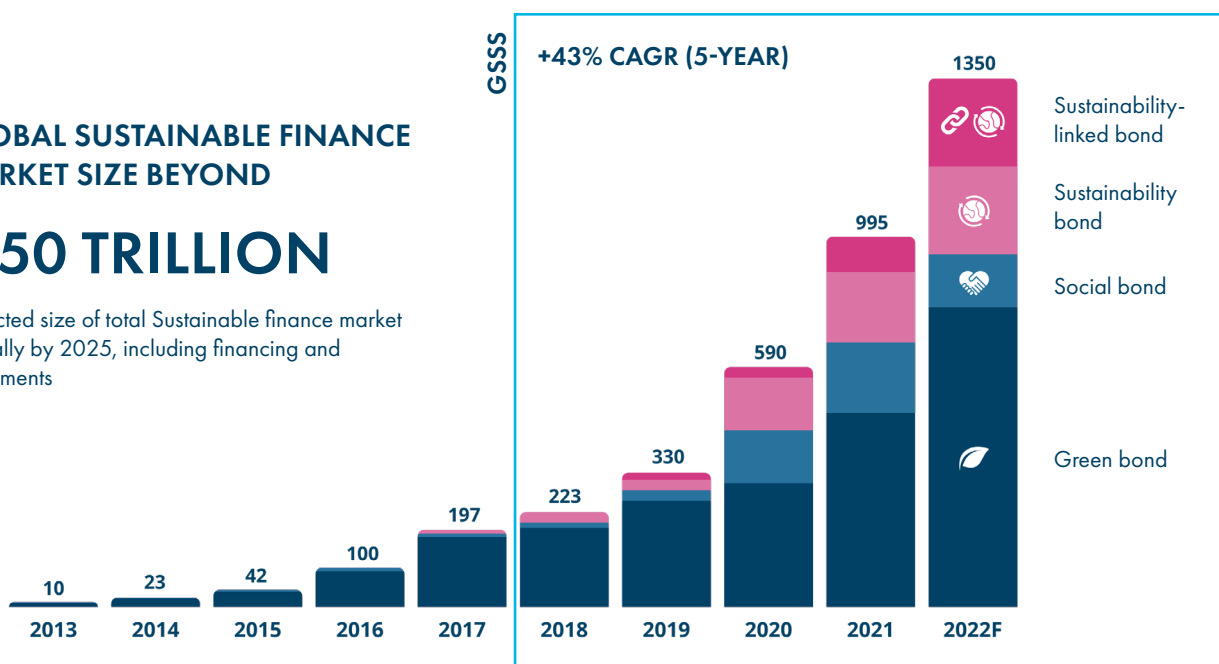
Demonstrating the rise of ESG is one metric: the sheer volume of money being pumped into the ESG-linked bond market (also known as green and social bonds). Analysis from Whiteshield (based on data from Bloomberg and Sustainalytics, among others) shows that the market is expected to hit \$1.3 trillion by the end of this year, up from just \$100 billion in 2016.

By 2050, the ESG financing and investment market is predicted to boom to a massive \$50 trillion or more. Somma: "We expect that emerging business opportunities based on ESG products and services will increasingly dominate the scene in the years to come."

GLOBAL SUSTAINABLE FINANCE MARKET SIZE BEYOND

\$ 50 TRILLION

Expected size of total Sustainable finance market globally by 2025, including financing and investments



Source: Whiteshield, Bloomberg, Sustainalytics, Moody's, S&P Global Ratings. Values are approximate and rounded.

"Looking at the ESG principles, Bitcoin and Ethereum and other leading cryptocurrencies already address the 'S' and the 'G' pretty well...the evolution from proof of work to proof of stake and less energy-intensive consensus algorithms will bring blockchain into compliance with the 'E,'" said Charlie Morris, co-founder and managing partner at CMCC Global.

Risks. Macroeconomic factors significantly affected the performance of the crypto sector, including Ethereum. With the upcoming Merge, these factors should be included in the short-term price valuation as the risk-off sentiment continues to persist. The correlation of Ethereum to traditional assets is also high during this cycle, so if traditional assets fail to sustain their prices, we may expect it to drag the Ethereum price in the post Merge.

There have also been rumours about Ethereum PoW forks that may take a market share after the completion of the Merge. Some centralised exchanges offered an IOU for a future Ethereum PoW fork, which will airdrop 1 ETHPoW token to every 1 ETH token held after the merge. The idea is to attract developers to fork the network and inherits its name and reputation. Since we cannot find evidence for a permanent fork, the IOUs from centralised exchanges will affect the post-merge price slightly negative.



4. CONCLUSION

The transition of Ethereum to Proof-of-Stake consensus will reduce the network's energy consumption by 99.95%, thus reducing the carbon footprint. This move will open new opportunities for emerging ESG investments, which are projected to be a US\$50 trillion market in 2050. The so-called Ethereum-killers will have to maintain their competitive advantage or improve more as the innovation in the Ethereum network continues to grow despite the market risks. The ETH issuance rate will also decrease to 0.3%-0.4% per annum and has a chance to become deflationary as network congestion occurs.

Broadly, our assessment of the events and activities around the Merge and subsequent Shanghai upgrade will impact the price of ETH and the Ethereum blockchain as follows:

Item	Description	Price Impact
Staking	Decrease circulating supply of ETH which should have a positive price increase.	Positive
ESG	Increased demand from Investors,	Positive
Transaction Speed	Increased usage of network for dApp's resulting in increased demand for ETH.	Positive
Speculation	Speculators looking for opportunity to profit from sentiment and confusion around the Ethereum merge events. Expecting speculation pre merge to increase the price followed by a sell off immediately afterwards on the successful merge. Long term valuation expected to rise significantly.	Mixed however long term positive
Deflationary: PoS rewards vs ETH burnt	Expecting net deflationary impact on circulating supply at times.	Positive
Sharding	Reduces benefits of rewards generated from pooling for staking.	Neutral
Shanghai Release	Expected 6 months post merge this may see some Ethereum holders who supported the Beacon chain unlock their ETH and sell. This is limited to 43,200ETH per day which will dampen the majority of price impact.	Slightly negative
Permanent Fork	Current Ethereum miners could move to create their own fork of the current Ethereum chain which may result in a division of value between both chains which is accumulatively is less than the current chain. In order for these chains to be successful they need to have sufficient network size to avoid vulnerabilities of 51% attacks. It would be a significant task for a fork of Ethereum to achieve a larger network size than the resulting Ethereum 2.0 using Proof-of-Stake. Therefore this is considered a likely event however the severity of the event and the community and network that follow an alternative fork is considered small.	Negative
Merge Delay	The Merge has been delayed multiple times previously. The closeness of the proposed merge date is encouraging and has resulted in a price rally. Failure to meet the targeted date of 19 September 2022 will impact short term market confidence.	Significant negative

Should the merge be delayed we see this as a short term delay only as the road map and future direction of Ethereum is firmly focused on transitioning to a PoS model.

Overall, we view the post Merge will positively impact the network and its ecosystem from an environmental perspective. The security features are said to be better than the proof-of-work, but since the PoS is newly created and less battle-tested, the risk can be viewed as similar. The staking process will reduce the circulating supply, so if there's a significant demand for ETH, the price may rise accordingly. The token economics for the post-merge are improved; therefore, the potential upside for Ethereum is considered significant.



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