



STBL

STBL Whitepaper

Protocol Overview, Token Dynamics, Value Accrual, and Governance

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Part 1: STBL Protocol Overview

1. Protocol Introduction

Stable and Yield Token

STBL is a decentralized protocol that converts yield-bearing real-world-assets (RWAs) into flexible on-chain stable tokens by separating and repackaging their principal and yield. Users deposit tokenized, yield-generating High Quality Liquid Assets (HQLA) e.g., government bonds, money markets, private credit or crypto assets etc, and the protocol splits them into two onchain tokens – both denominated in the underlying asset’s currency e.g. USD, EUR etc:

- **USST:** a fungible stable token representing the principal value of the underlying RWA. USST is transferable and composable, designed for use as a medium of exchange and in DeFi as collateral and settlement token.
- **YLD:** A yield-accruing NFT directly linked to the underlying RWA, representing future coupon payments or income. YLD may be held only by whitelisted participants at an address associated with the specific underlying assets held in reserve, enabling regulatory-compliant yield exposure.

This clean separation unlocks broad composability of principal while ring-fencing yield for compliant distribution and management. USST can circulate freely on-chain and within DeFi ecosystems as a stable asset backed by HQLA collateral, while YLD ensures that yield rights are preserved for eligible holders. This model has been structured to ensure maximum utility and alignment with regulations, including frameworks such as the GENIUS Act in the US.

To enable this principle and yield separation to generate a stable and yielding asset, the protocol also manages:

- **Minting Haircuts:** Automatically adjusting the amount of USST minted per RWAs to reflect market-based discounts and collateral risk i.e. based on the RWA risk.
- **Peg Stability:** Through dynamic minting and burning interest rates, the protocol incentivizes user behaviour that keeps USST tightly pegged to the underlying currency.

Simple Programmable Capital

STBL’s initial focus is on whitelisting USD-denominated RWAs to be used as reserves; accordingly, USST will be the minted stable asset, pegged to the U.S. dollar. The protocol is not an RWA originator – it’s built to interoperate with existing tokenized instruments to mint stablecoins or other stable assets and manage yield. By isolating principal for utility and yield for compliant returns, STBL turns traditionally passive instruments into active, programmable capital. This architecture unlocks liquidity without sacrificing yield: entitlements remain claimable and transferable among whitelisted holders via YLD.

STBL does not maintain a separate whitelist. Parties that lock RWAs are already KYC/AML-approved and whitelisted by the underlying issuer, custodian, or RWA protocols. STBL simply indexes those approved addresses per underlying reserve and enforces an asset-scoped allowlist at the YLD token level. Consequently, YLD is transferable only among the addresses that

locked the corresponding RWA (or are subsequently approved on the same list), while USST remains freely transferable across DeFi.

As whitelisted RWAs are locked into the STBL protocol, locked AUM rises – expanding USST supply and increasing YLD accruals. USST remains freely transferable; however, only whitelisted YLD holders can remove USST from circulation by burning USST and YLD to redeem the underlying RWAs. To deliver seamless redemption liquidity for all users, STBL enables minting counterparties to act as Converters: they lock their YLD into a vault, allowing those reserves to underwrite immediate USST redemptions. In return, Converters earn a share of the redemption-spread fees and receive boosted native governance-token rewards – details below.

STBL Governance Token

In addition to USST and YLD, **STBL** is the protocol's governance and network-security token.

- **Governance and security:** STBL's primary function is governance and protocol security: holders can propose and vote on changes (e.g., onboarding new RWAs), parameter updates, and treasury actions.
- **Revenue and treasury:** The protocol captures fees on USST mints/burns and an ongoing protocol fee on YLD. These revenues accrue to an on-chain treasury and are recycled via buybacks, burns, staking rewards, and governance incentives.
- **Staking and premium buybacks:** Holders can stake STBL to earn additional STBL rewards, with higher rewards available for longer lockups. The protocol can also run premium buybacks, where staked/locked STBL is eligible to be repurchased at a premium to market; premiums may scale with lock duration and aggregate staked supply, subject to treasury capacity and policy.
- **Flywheel:** More locked RWAs → higher protocol AUM → larger USST supply and YLD balances → higher protocol revenue → greater capacity for buybacks/burns/rewards → increased scarcity and utility for STBL → further adoption.

Ecosystem Overview

1. RWA platforms issue tokenised assets, **A**, to whitelisted parties, **B**
2. **A** is a yield generating HQLA and is denominated in USD e.g. cash or cash equivalents such as money markets (or for non-GENIUS compliant vaults including private credit and potentially other pure crypto assets such as Ethena)
3. Assets are purchased on chain by any whitelisted party e.g. individuals or organisations such as foundations, exchanges, market makers etc, **B**
4. **B** can keep tokenized assets, **A**, in a wallet or lock in **STBL** protocol
5. As **B** is whitelisted to hold tokenised asset **A**, they are then also able to lock the asset into a **STBL** vault, in which case their wallet address is indexed as legal owner
6. Assets, **A**, is split into a Principal (P) and the stripped Yield (Y) Pools
7. Principal pool issues an LP token, **USST**, that is a stable asset, structured to have a backing of USD1 and zero returns, and can be held at any address
8. Yield pool issues an LP token, **YLD**, which is an accumulating yield generating NFT asset, that is only allowed to be held by whitelist indexed parties i.e. minters
9. Principal pool LP token, **USST**, is issued and can be transferred, held and openly used in DeFi as a stable asset

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- ```

graph TD
 1((1)) --> RWA_Issuer[RWA Issuer]
 RWA_Issuer --> 2((2))
 2 --> A_USD[A - USD Denominated RWA]
 A_USD --> 3((3))
 3 --> B_Market[B - Digital Asset Market Makers or Exchanges]
 3 --> B_Individuals[B - Individuals]
 3 --> B_Converters[B - Converters - Stake STBL and Lock YLD for Redemption Rewards]
 B_Market --> 4((4))
 B_Individuals --> 4((4))
 B_Converters --> 17((17))
 4 --> 5((5))
 5 --> AV[Asset Vault for A, and B indexed for access]
 AV --> PP[Principal Pool]
 AV --> YP[Yield Pool]
 PP --> 6((6))
 YP --> 6((6))
 6 --> 7((7))
 7 --> PBST[Principal Based Stable Token, USST.]
 6 --> 8((8))
 8 --> YBAT[Yield Bearing Accumulating Yield Tokens, YLD.]
 PBST --> 9((9))
 9 --> DFL[DeFi Lending e.g. AAVE]
 9 --> DFD[DeFi DeX e.g. Curve]
 YBAT --> 12((12))
 12 --> 13((13))
 13 --> 11((11))
 11 --> 10((10))
 10 --> 11((11))
 11 --> 17((17))
 17 --> 16((16))
 16 --> PFA[Protocol Fee Accrual]
 PFA --> 15((15))
 15 --> HD[Haircut Deposits]
 HD --> TR[Treasury / Loss Reserve]

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## Market Scenarios

- **Redemption Process:** Whitelisted holders of a specific vault i.e., addresses indexed by the protocol, can redeem their underlying RWA by burning the matched YLD and the corresponding amount of USST. Upon burn, the protocol releases the RWA (or redemption proceeds) to the same whitelisted address. Converters may fulfil redemptions instantly for a fee by using pre-locked YLD that are in the shared pool.
- **USST<USD1:** When USST trades below USD1, whitelisted YLD holders are incentivized to buy discounted USST, pair it with their YLD, and redeem. This reduces circulating USST supply and captures the spread to par (net of fees), pushing the price up toward USD1.
- **USST>USD1:** When USST trades above USD1, participants are incentivized to lock RWAs and mint USST (subject to haircuts), then sell into the market. The increased supply drives the price down toward USD1. Existing vault owners may still unwind and redeem their RWAs; for such redemption accounting, USST is valued at face USD1, even if the secondary market price is above par. This model also incentivises users to not take supply out of the market.
- **Minting Rates:** Beyond natural arbitrage, the protocol applies a minting interest rate that adjusts with price deviation: if  $USST < USD1$ , the minting rate increases - making new issuance more expensive; if  $USST > USD1$ , it decreases toward a minimum - making issuance more attractive.
- **Burning Rates:** The protocol also applies a burn-incentive rate that strengthens for negative deviations: when  $USST < USD1$ , users receive a fee rebate/credit on burns, increasing the incentive to retire USST and restore the peg.
- **Examples:** Full peg mechanics, parameters, and simulations are provided in the Pegging Technical Specification paper, and a snapshot provided in Figure 2.

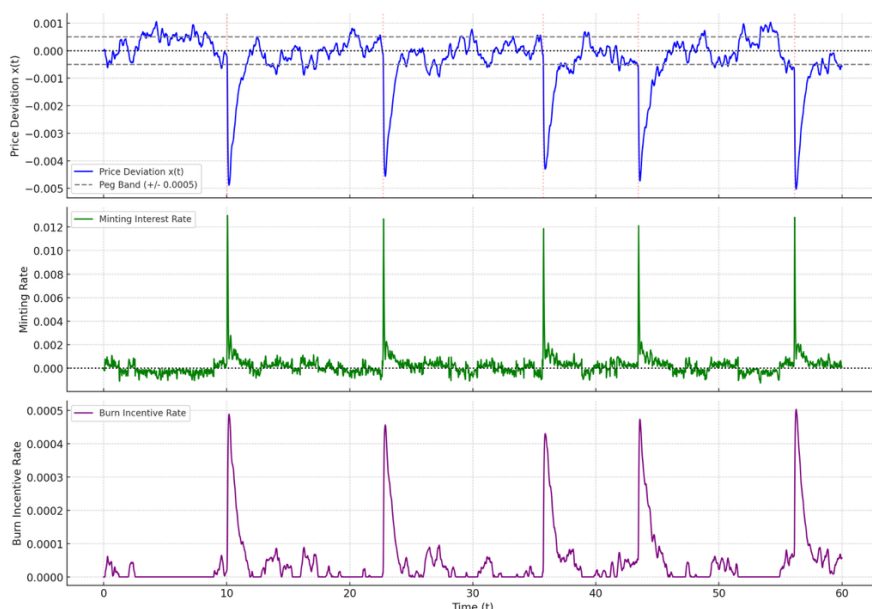


Figure 2. Snapshot of the pegging mechanism simulations.

## Vision for Ecosystem Specific Stable-assets (ESS)

STBL is purpose-built to power ESS's, such as stablecoins, collateral receipts or other stable-assets issued by a specific ecosystem for purposes of utility, with governance controlled by the host community. The Stable Wrapping & Routing Interface (SWRI) contracts on the STBL protocol enables branded stable-assets to be minted against the USST reserve token (which can be considered as the principal LP token that references the reserve vault), while yield allocation in the branded ecosystem can be governed via the YLD token.

STBL protocol can be used to deploy and mint a branded stablecoin or another form of stable asset, such as USD[X]. These have dedicated vaults backed by cash and cash equivalents such as money-market reserves to enable GENIUS Act alignment. Furthermore, as the USD[X] underlying vaults are ringfenced from the core supply of USST, the dedicated vaults can be constructed to align with the host ecosystem's requirements e.g. basket vaults can consist of private credit or crypto delta-neutral strategies e.g. Ethena to enhance yields. Furthermore, the rules related to yield allocation from the YLD token in the branded stable-asset can also be modified.

This model is conceptualised in Figure 3, where cash or cash equivalent RWA are locked in public vaults 1-3, which then mints USST + YLD. Vault 4 uses similar RWAs but the minted USST + YLD is now used to mint a branded stable asset with its own yield sharing rules. Furthermore, vaults 5-7 are specific ecosystem vaults with a custom asset allocation basket, such as adding private credit and delta neutral strategies. These custom vaults generate USS + YLD tokens that underpin specific branded stable-assets for those ecosystems, which can also be setup with their own yield management rules.

Each branded ecosystem can control various issuance, reserve and yield management requirements i.e. minting rules, how much yield to be shared between the minter and to be allocated to the branded stable asset treasury etc. Protocol parameters (fees, haircuts, redemption spreads, buyback routing) are governable in each ESS, enabling the community to direct treasury revenue as required.

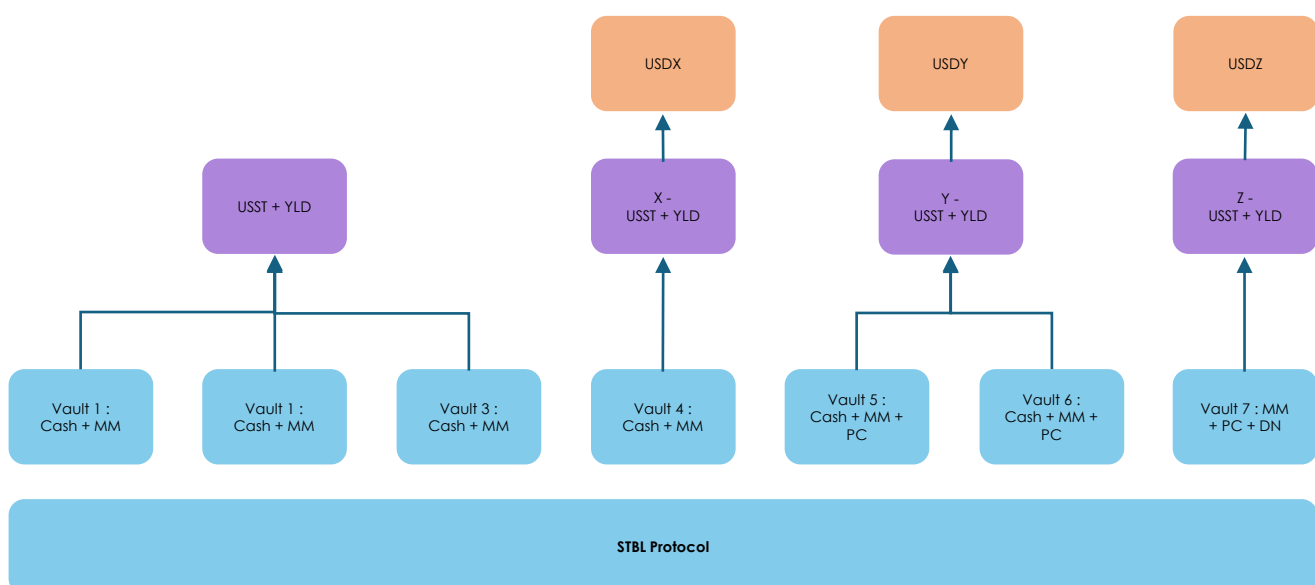


Figure 3. Conceptual model of Ecosystem Specific Stable-assts.

## STBL Vision and Long-term Objectives

- Position USST as a fully programmatic and borderless medium of exchange and a permissionless reserve asset backed by high-quality, yield-bearing assets - including longer-duration exposures - supported by institutional-grade autonomous risk management.
- Provide a modular, compliant yield layer that remains fully open and decentralised, but seamlessly accessible and composable with DeFi or CeFi, but always ensuring the core USST is strictly a payment stable-asset (stablecoin) and not a yield instrument.
- Enable USST minting against any yield-bearing RWA e.g., sovereign debt, money market funds, credit funds, and yield-bearing crypto tokens e.g. Ethena or DeFi locked UDSC/USDT etc, with transparent risk management and reserves.
- Over time, and through governance enable the protocol to autonomously support multi-currency stablecoins or other forms of stable-assets by leveraging RWAs denominated in EUR, GBP, JPY, and other currencies (e.g., issuer of **EUST**, **GBST**, **JPST** etc).
- Establish STBL as an on-demand programmable capital stack to empower the setup and deployment of branded ecosystem specific stable-assets.
- As the protocol is fully decentralised, the focus will be to ensure all decisions and ecosystem incentives are driven through the native network token, STBL.

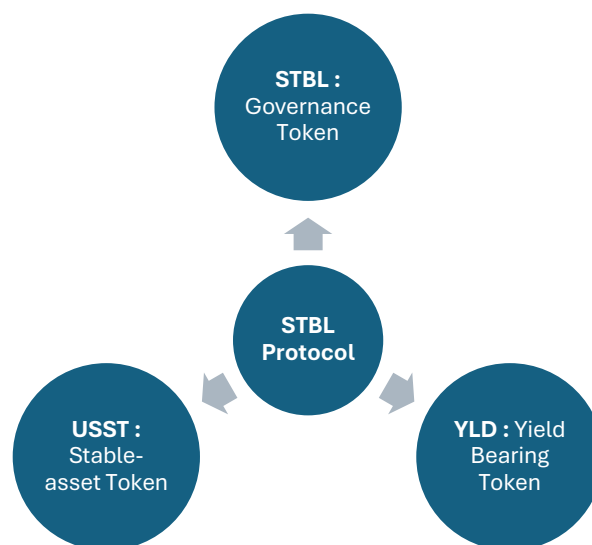


Figure 4. Three token model for STBL Protocol

## 2. RWA Vaults and Protocol Revenue Generation

STBL measures capital held in the protocol at two levels: per-user **Vault AUM** and system-wide **Protocol TVL**. Vault AUM tracks the value of assets a user has locked in their vault, which is also used to calculate the USST minting, haircut and fees; and Protocol TVL is the sum of all vaults' AUM across the network, which indicates the overall protocol value and scale. An overview of the key aspects is as follows:

### Initial Asset Mix and Caps



- **Launch configuration.** Vaults initially accept money market products as the core collateral, which ensures compliance with key stablecoin regulations. Following launch, as the protocol has been fully tested other reserve allocations may be tested for different use cases e.g. private credit or other crypto assets like Ethena for vaults that where stable asset is solely used for trading collateral etc. So each vault may include up to 10% private credit, with  $\geq 90\%$  in money market assets.
- **Per-asset parameters.** Each asset type carries its own vault parameters e.g., minting haircut, protocol fee rate, concentration/cap, which are discussed in the technical paper.
- **Governance-led expansion.** Additional assets can be onboarded via governance, subject to regulatory alignment and conservative caps (e.g., up to 5% per vault for assets such as Ethena or USDC/USDT deployed in DeFi yield protocols), each with distinct risk/fee settings.

## User Vaults and AUM

- **User Vaults:** Users open a Vault and deposit eligible RWAs into STBL.
- **Vault Parameters:** vault enforces allocation caps and per-asset parameters at deposit/mint time.
- **Vault AUM:** The measured value of all assets locked in that vault (by underlying currency) is the vault AUM, and is the base for protocol calculations e.g., fees.
- **RWA NAV:** The value of the eligible assets is sourced from independent oracles e.g., Chainlink, that provide on-chain price/NAV feeds appropriate to the asset.
- **Token Minting:** USST minted may be less than Vault AUM due to per-asset haircuts; and YLD tracks the vault's eligible yield stream under its parameters.

## Protocol TVL

- **Protocol TVL:** The sum of all AUM across all user vaults provides the protocol TVL.
- **Protocol Scale:** TVL reflects the STBL protocol scale and capacity; it grows as more RWAs are locked and correlates with USST supply (subject to haircuts) and aggregate YLD accruals.

## Protocol Fees

- **Fee Generation:** The protocol fees accrue on AUM locked in a vault, and function like a management fee on the YLD-accruing collateral.
- **Accrual and Settlement:** Fees accrue pro rata based on the value of RWAs locked in a vault and settle on a periodic basis – aligned to asset characteristics – or at redemption, whichever occurs first.
- **Payment:** Fees may be paid in USST or USDC directly to the vault, keeping the vault in good standing; and the fees then captured in the treasury.
- **Delinquency:** If fees are not paid, late penalties accrue.
- **Penalties & forced redemption:** After a defined period, the protocol may initiate forced redemption with the underlying issuer. The vault then becomes backed by the redemption proceeds; the vault owner may redeem this net of fees and penalties, and the associated YLD ceases to accrue – the vault becomes a static, non-yielding vault.
- **Governance:** Fee rates and payment cadence are asset-specific and administered via on-chain governance.

### **3. STBL Protocol Token and Value Accrual**

As STBL transitions toward full decentralization – first as a decentralized application (dApp) on Ethereum, and later as a sovereign Layer 1 AppChain – it will introduce the STBL token to govern and secure the protocol.

Initially, the STBL token will serve as the governance token for the STBL dApp on Ethereum, enabling token holders to vote on protocol parameters, updates, and key decisions. It is designed to protect against hostile governance takeovers and to align long-term incentives that preserve the economic and functional integrity of the system.

In the next phases of STBL’s evolution, as the protocol migrates to its own sovereign Layer 1 AppChain, the STBL token will become the native token of the network. In this role, it will extend beyond governance to support network security—rewarding and incentivizing validators who propose and confirm blocks, thereby maintaining consensus and securing the chain infrastructure.

Beyond its governance and security roles, the STBL token is structured around a value accrual flywheel. As more RWAs are onboarded and TVL or assets under management (AUM) increase, the protocol collects fees, which are then used to buyback tokens from the open market and, uniquely, at a premium from staked token holders. This buyback mechanism incentivizes staking, by giving priority buybacks to stakers at a premium to the market, deepening participation in both governance and network security.

The result of STBL’s unique governance model is a self-reinforcing cycle: greater protocol usage leads to more locked RWAs, which leads to more fees, which drives buybacks, increasing token and staking demand, reducing circulating supply, and ultimately enhancing the token’s long-term value appreciation.

In summary, the STBL token serves as a multi-functional asset: a governance mechanism, a network security instrument, and a vehicle for capturing and compounding the economic value generated by the protocol.

### **4. USST vs GENIUS Act Alignment**

USST is non-interest-bearing, USD-pegged, redeemable at par subject to fees, and backed by HQLA reserves. Accordingly, it can qualify as a compliant U.S. payment stablecoin so long as issuance to U.S. persons is conducted by or through a Permitted Payment Stablecoin Issuer (PPSI). To satisfy this requirement, STBL will partner with existing U.S. PPSIs that leverage the Stable Wrapping & Routing Interface (SWRI) to access and use USST for payment services. In the future, STBL may establish a U.S. issuing entity and seek PPSI authorization to enable a direct go-to-market route.

A high-level overview of GENIUS Act compliance is shown in Figure 5.

| <b>GENIUS requirement</b>                    | <b>Description</b>                                                                                                                                                                                   | <b>USST/STBL alignment</b>                                                                                                                                     | <b>Controls / actions to ensure compliance</b>                                                                                               |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Permitted issuer only (PPSI)                 | Only a Permitted Payment Stablecoin Issuer may issue payment stablecoins in the U.S.; after transition, U.S. platforms list PPSI-issued coins.                                                       | USST is issued against whitelisted RWA collateral via STBL. U.S. issuance requires a PPSI entity (or partner), including when using SWRI for branded wrappers. | Partnering with PPSI in the US to ensure early compliance.                                                                                   |
| 1:1 High-Quality Reserves                    | Reserves must be cash/insured deposits, short-term U.S. Treasuries, overnight (reverse) repo in Treasuries, or MMFs invested solely in those; no rehypothecation; monthly public reserve breakdowns. | STBL vaults target HQLA (money markets, T-bills). Governance enforces eligible-asset lists and concentration caps per vault; no-reuse policy.                  | Codify eligible-asset schedules; custodial no-rehypothecation covenants; publish monthly reserve reports and exposures.                      |
| Non-interest-bearing coin                    | Issuer may not pay interest/yield to holders for simply holding the payment stablecoin.                                                                                                              | USST is payment-only (zero return). Yield is ring-fenced to YLD (allow-listed).                                                                                | Maintain zero-APR economics and marketing for USST; keep all yield strictly in YLD.                                                          |
| Par redemption / fixed value                 | Redeemable/repurchasable at a fixed monetary amount (e.g., \$1); publish redemption policy & timelines.                                                                                              | Redemption burns value matched USST + YLD to release underlying/proceeds. Converters can offer instant redemptions to any user for a disclosed fee.            | Publish par-value redemption policy/SLA; maintain Converter liquidity through incentives; disclose redemption fees and caps.                 |
| Disclosures & attestations                   | Monthly reserve composition with officer certification; independent accountant exams; audits for large issuers.                                                                                      | Reserves/exposures can be reported via on-chain metrics; cadence mandated by governance.                                                                       | Stand up monthly attestations; engage independent examiners; trigger audits once thresholds are met.                                         |
| BSA/AML & sanctions                          | Issuer must operate a full BSA/AML/OFAC program (KYC, sanctions screening, SARs, Travel Rule, recordkeeping).                                                                                        | STBL indexes issuer/custodian allow-lists; YLD transfers restricted per reserve. Issuer contract supports freeze/blocklist where legally required.             | Implement issuer-level BSA/AML program; maintain sanctions blocklist/freeze tooling; map allow-listing to compliance controls.               |
| Custody & segregation                        | Reserves held at supervised/qualified custodians; segregated; no commingling/encumbrances.                                                                                                           | Vault design anticipates qualified custody for off-chain HQLA with segregation and audit rights.                                                               | Ensure only HQLA that are used are ones with U.S. qualified custodians; also embed segregation periodic reconciliations at vault level.      |
| Marketing & government-insurance disclaimers | No implication of FDIC/NCUA insurance or government backing; standardized consumer disclosures.                                                                                                      | No conflicting claims in STBL docs and online regarding such claims.                                                                                           | Adopt standardized disclaimers across app/docs/web; marketing compliance reviews.                                                            |
| Bankruptcy priority                          | Stablecoin holders have first-priority claim to reserve assets in issuer insolvency.                                                                                                                 | USST reserves are ring-fenced, and YLD holders can only redeem the underlying by burning USST, so first-priority claims to USST holders.                       | Adopt explicit priority language on docs and protocol interface regarding                                                                    |
| Foreign issuer path                          | Foreign issuers may serve U.S. persons if OCC-registered under a comparable regime and hold reserves with U.S. institutions.                                                                         | Available if STBL's issuer is non-U.S.                                                                                                                         | Choose U.S. PPSI or OCC-registered foreign route; satisfy U.S. custody/reporting. Done independently of STBL but would need to be validated. |
| Scope of activities                          | PPSI limited to issuing / redeeming / custodizing the stablecoin and managing reserves; no unrelated activities.                                                                                     | Protocol governance/treasury sit outside issuer perimeter; PPSI remains narrowly scoped.                                                                       | Maintain strict corporate separation; keep STBL staking/governance outside the PPSI entity.                                                  |

Figure 5. STBL USST vs GENIUS Act Alignment Overview

## 5. Vertically Integrated Roadmap

STBL is architected as a vertically integrated RWA infrastructure, organized into three independent layers: the Protocol Layer, the Interface Layer, and the Settlement Layer.

### Protocol Layer

The Protocol Layer governs on-chain issuance, redemption, and risk management for stable-assets and yield access. It provides a modular framework for locking RWAs and enforcing risk controls when minting USST (stable-asset) and YLD (yield token). Tokens issued at this layer are fully composable across DeFi, and the ecosystem is self-governed via the native STBL token.

Using the STBL Cross-Chain Transfer Protocol (SCTP), USST and YLD can be minted and transferred natively across multiple chains – enabling an omni-chain financial system. Current focus is on Ethereum and the SCTP bridge to Solana.

STBL will also implement the Stable Wrapping & Routing Interface (SWRI) that allows third-party stablecoin issuers to mint their own branded stable asset backed by USST pointing to the custom vaults. As described above third-party minters can send eligible RWAs to (or purchase RWAs through a partner organisation which enables minting via) the SWRI contract, which routes user RWAs to the STBL protocol to lock the assets and mint relevant USST + YLD pursuant to the branded vault parameters. USST + YLD remain locked in the routing contract, where the USST serves as 1:1 backing token for the branded stable-asset, while YLD remains restricted to the reserve's allowlisted addresses, which in this case is the routing contract, and yield can be allocated as per the ecosystem requirements. The routing contract then mints the branded stable-asset to the third party's users or systems. Yield handling is configurable – third party issuers may pass through yield to eligible holders or aggregate it for their own program – subject to compliance and governance constraints.

### Interface Layer

The Interface Layer offers a lightweight web client for interacting with the on-chain STBL protocol: users connect wallets and deploy eligible RWAs through STBL interface to mint and directly hold USST and YLD in their connected wallet.

While the current interface is optimized for DeFi usability, the roadmap includes a richer, modular interface with APIs/SDKs so Web2 applications and enterprise platforms can integrate payments and savings functionality seamlessly and compliantly into their applications through STBL.

The API/SDK interface will enable interaction with the SWRI contract without any Web3 expertise or support. This ensure traditional Web2 payments and financial service providers can easily integrate and mint a branded stablecoin for their ecosystem.

## Settlement Layer

On launch the STBL protocol is deployed and settles on Ethereum. Longer term, STBL aims to launch an appchain to simplify multichain connectivity, increase throughput, and deliver fast finality.

When the transition to the appchain takes place the transaction fees can be abstracted and covered by the protocol's fee model, enabling a near-zero-gas user experience. In this phase, the STBL token's role expands from governance to network security with validator staking – and associated incentive/slashing mechanics – securing the chain.

Furthermore, this sovereign settlement infrastructure would enable development of additional third party supporting dapps for USST e.g. efficient and or privacy focused lending and trading services.

## Roadmap

1. **2025:** Testnet deployment, protocol validation and Ethereum mainnet launch.
2. **2026:** Release of a fully functional SWRI and Web2 API/SDK services.
3. **2027-2028:** Migration to a sovereign Layer-1 appchain.

## Part 2: Value Accrual and Governance

### 6. Vault AUM & Protocol Fee Model

Tokenized RWAs locked on STBL collectively form on-chain TVL, and the assets in in each vault are classified as vault AUM. The AUM in each vault is denoted  $A(t)$ , which changes over time,  $t$ .  $A(t)$  grows as new RWAs are locked and declines as redemptions occur. So, over a full year (measuring  $t$  in years), the total AUM in a vault is given by:

$$A = \int_0^1 A(t) dt$$

The sum of AUM across all individual vaults,  $i$ , is then classified as the protocol TVL:

$$TVL = \sum_i A_i$$

Where  $i$  is summed over all indiviual vaults, and  $TVL$  is the total AUM across the protocol.

Furthermore, STBL protocol captures a protocol fee from each vault, which accrues as protocol revenues. This fee is a percentage of  $A(t)$  held over the year. The protocol then channels these fee revenues back into the ecosystem through buybacks, burns, staking rewards, and governance incentives. Over time, this creates a self-reinforcing loop, which will be further discussed below. STBL governance is used to determine and implement a protocol fee, which is based on the type of the underlying asset and the level of management fees that issuers charge on that asset.

#### Protocol Fee Calculation

Every RWA that is locked on STBL results in an on-chain AUM balance  $A(t)$  representing the current notional asset value under management in the vault. RWA issuers may enforce a standard annual management fee at rate  $m_{man}$  e.g. 1% p.a., on the notional, typically collected monthly, quarterly or annually. At each instant,  $t$ , the gross management fee accrues at:

$$F_g(t) = m_{man} A(t)$$

To ensure appropriate economic and risk alignment the STBL protocol calculates the protocol fee based on a fixed fraction  $\alpha$  of the management fee. So, if the total management fees,  $m_{man}$ , is 1%, and the protocol fee,  $\alpha$ , is calculated as 20% of this, then the protocol fee would be 20bps of the AUM. Then the continuous protocol revenue becomes:

$$R(t) = \alpha F_g(t) = \alpha m_{man} A(t).$$

There are alternative models of how the protocol fee can be charged, but this approach ensures maximum flexibility and STBL can leverage risk insights and expertise of the underlying issuers. Furthermore, this also enables STBL to provision their own money market RWA's with the STBL protocol fee directly built into the management fee. Under this model after charging

the protocol fee the remainder  $(1 - \alpha) m_{man} A(t)$  is remitted to the asset manager as part of their ongoing charge.

Because AUM in a vault can fluctuate day-to-day, STBL protocol calculates fees pro-rata for each vault on a continuous basis for each asset type. Therefore, if a minter redeems halfway through a period, fees are only collected on the days their RWAs were locked in the vault. This alignment ensures fairness and precise revenue linkage to actual time assets are locked in the protocol.

Over a full year (measuring  $t$  in years), the total gross fees collected are:

$$Total\ Gross\ Fees\ Collected = \int_0^1 F_g(t) dt = \int_0^1 m_{man} A(t) dt$$

and the total protocol revenue is:

$$\begin{aligned} Total\ Protocol\ Fees &= \int_0^1 R(t) dt = \int_0^1 \alpha m_{man} A(t) dt \\ &= \alpha m_{man} \int_0^1 A(t) dt \end{aligned}$$

## Discrete-Time (Periodic) Payments

In practice, management fees are paid periodically – say monthly or quarterly into the protocol either automatically or by the asset manager depending on how the fund is setup<sup>1</sup>. We start by partitioning the year into  $N$  periods as:

$$0 = t_0 < t_1 < \dots < t_N = 1, \quad \Delta t_k = t_k - t_{k-1}$$

Gross fees in period  $[t_k - t_{k-1}]$ :

$$F_{g_k} = \int_{t_{k-1}}^{t_k} F_g(t) dt = \int_{t_{k-1}}^{t_k} m_{man} A(t) dt = m_{man} \Delta t_k \bar{A}_k$$

For convenience, as fees will mostly be paid retrospectively so  $A(t)$  will be known, we can write  $\bar{A}_k$  as the time-weighted average AUM for the period  $k$  given by:

$$\bar{A}_k = \frac{1}{\Delta t_k} \int_{t_{k-1}}^{t_k} A(t) dt$$

Then protocol revenue in period  $[t_k - t_{k-1}]$ :

$$R_k = \alpha F_{g_k} = \alpha m_{man} \Delta t_k \bar{A}_k$$

---

<sup>1</sup> Over the longer term all fees will be cut on subscriptions and stored in a fund reserve, and paid to the protocol automatically on a periodic basis from this reserve.

If the protocol fee is paid monthly,  $N = 12$ ,  $\Delta t_k = 1/12$ , then this simplifies to:

$$F_{g_k} = \frac{m_{man}}{12} \bar{A}_k \quad R_k = \alpha \frac{m_{man}}{12} \bar{A}_k$$

which is the monthly gross fee for the asset manager,  $F_{g_k}$  and the fraction allocated to the protocol,  $R_k$ .

## Monthly Periodic Payment Example

Example of a Monthly Management & Protocol Fee Calculation is as follows:

- Assets Under Management,  $A(t)$ , is constant for the year at \$50,000,000
- Annual management fee  $m_{man} = 1\%$
- Protocol fee share  $\alpha = 20\%$
- Protocol fee payment period is monthly,  $\Delta t_k = 1/12$
- Time-weighted average AUM over the month:

$$\bar{A}_k = \frac{1}{\Delta t_k} \int_{t_{k-1}}^{t_k} A(t) dt = \$50,000,000$$

- Gross monthly management fee:

$$F_{g_k} = \frac{m_{man}}{12} \bar{A}_k = 0.01 \cdot \frac{1}{12} \cdot 50,000,000 = 41,666.67$$

- Total gross management fee charged to the fund over the month is \$41,666.67.
- Protocol Fee from Gross:

$$R_k = \alpha \frac{m_{man}}{12} \bar{A}_k = 0.2 \cdot 41,666.67 = 8,333.33$$

- Protocol fee payable to STBL Protocol is \$8,333.33, and the remaining \$33,333.34 goes to the asset manager.
- If AUM stays constant, the annualized protocol revenue is:

$$R_{annual} = \alpha m_{man} A_k = 0.2 \cdot 0.01 \cdot 50,000,000 = 100,000$$

## 7. Token Supply Dynamics

STBL's native token supply evolves through two forces: deliberate emissions  $E(t)$  and protocol-driven burns  $B(t)$ .

- **Emissions**  $E(t)$  are scheduled token emission (mints) designed primarily for staking rewards, enabling bootstrapping liquidity, rewarding early participants, and supporting ecosystem growth. Emissions are governed by an issuance schedule as described in Part 2.
- **Burns**  $B(t)$  occur when the protocol uses fee revenue to repurchase tokens and remove them from circulation<sup>2</sup>.

---

<sup>2</sup> All token buybacks will be locked in a vault, and burnt based on governance.



The net change in circulating supply  $S(t)$  is governed by:

$$dS = E(t) + B(t),$$

where  $B(t)$  is negative whenever tokens are burned. An initial supply  $S(0)$  is set at genesis, and a hard cap  $S_{\max}$  may constrain total supply. Over time, if burns exceed emissions, the supply falls, reinforcing scarcity.

## 8. Buyback & Burn Mechanism

Over time the STBL on-chain treasury accumulates protocol fees, and at time  $t$  the total protocol revenue is:  $R^T(t)$ . STBL allocates a portion  $\theta$  of the total protocol revenue  $R^T(t)$  for market buybacks. The instantaneous buyback volume,  $Q(t)$ , is:

$$Q(t) = \frac{\theta R^T(t)}{P(t)},$$

where  $P(t)$  is the market price of STBL. Of the tokens repurchased, fraction  $\beta$  is irrevocably burned, so the burn rate,  $B(t)$ , is:

$$B(t) = -\beta \times Q(t) = -\beta \times \frac{\theta R^T(t)}{P(t)}.$$

By adjusting  $\theta$  and  $\beta$  via governance, STBL controls how aggressively it converts fees into token scarcity. Higher burn rates accelerate supply contraction and support price, while moderate rates balance scarcity with liquidity.

### Token Price Support vs Buyback and Burn Example

Example of how the STBL token price varies as a function of buyback and burn using assumption of constant demand model during time from  $t = 0$  to  $t = \Delta t$ :

- Protocol revenue held in reserve,  $R^T(t)$ : \$1,000,000
- Market price per token,  $P(t)$ : \$0.50
- Emission rate,  $E(t)$ : 500,000 STBL
- Buyback allocation,  $\theta$ : 60%
- Burn fraction,  $\beta$ : 80%
- Buyback amount,  $\theta R^T(t)$ : \$600,000
- Token purchased,  $Q(t) = \theta \frac{R^T(t)}{P}$ : 1,200,000 STBL
- Token burnt,  $B(t) = -\beta \theta \frac{R^T(t)}{P}$ : -960,000 STBL
- Net supply change during time interval  $\Delta t$ :

$$dS = E(t) + B(t) : -460,000 \text{ STBL}$$

- Initial supply in circulation,  $S(0)$ : 10,000,000 STBL
- Total supply in circulation,  $S(t) = S(0) + dS$ : 9,540,000 STBL
- Using the constant demand model:

$$Price(t) = \frac{Demand}{Initial\ Supply}$$

where  $demand = \$0.50 \cdot 10,000,000\ STBL = 5,000,000\ STBL$

- Therefore, using this constant demand, the price after emissions and burning is given as:

$$Price(t) = \frac{Demand}{Final\ Supply} = \frac{5,000,000}{9,540,000} = 0.5241$$

- Therefore, due to burning as supply decreased from 10m to 9.45m, the token price increases due to deflationary pressure under constant demand from 0.5 to 0.5241.
- The chart in Figure 6 gives an overview of how token price changes under the constant demand model with varying  $\theta$  and  $\beta$ .

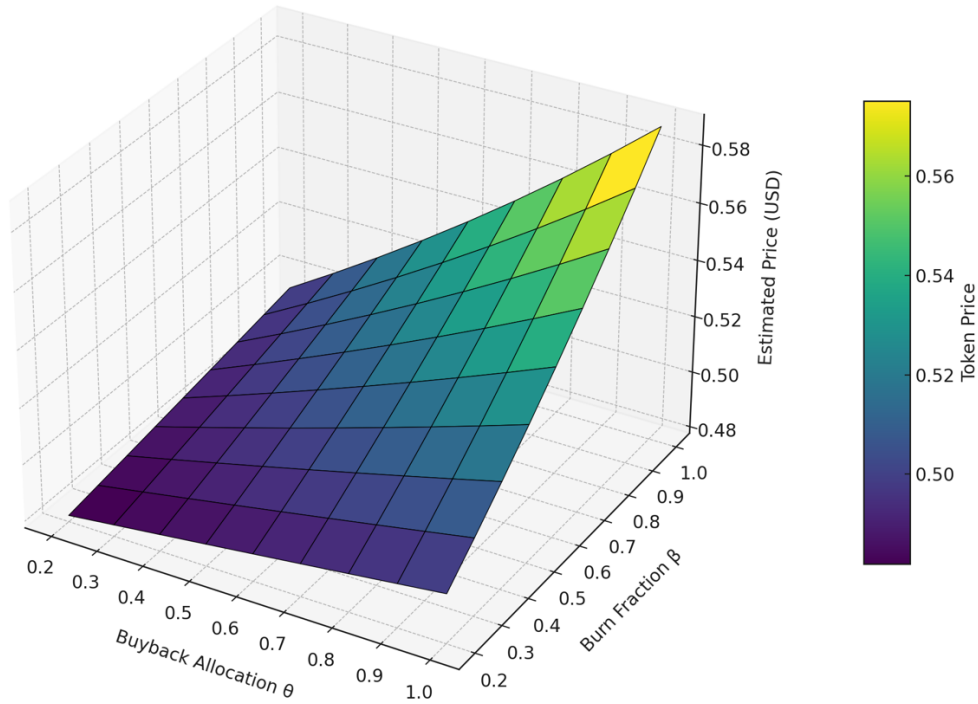


Figure 6. STBL Token Price vs  $\theta$  and  $\beta$  based on constant demand model

## 9. Staking, Time-Lock Boosts & Incentives

Holders may stake their STBL tokens in time-locked contracts to earn additional emissions and participate in governance. For each staker  $i$ :

- $s_i$ : tokens staked
- $\tau_i$ : lock duration (in months)
- $\kappa$ : time-lock boost curvature parameter

The **boost function** is:

$$\psi(\tau_i) = 1 + \kappa \ln(1 + \tau_i),$$

providing diminishing returns on very long locks. The staker's **effective balance** for reward allocation and voting power is:

$$S_i^{eff} = s_i \psi(\tau_i).$$

Over each reward epoch  $\Delta t$ , total emissions  $E_{total} = \int_t^{t+\Delta t} E(t) dt$  are distributed pro-rata:

$$a_i = \frac{S_i^{eff}}{\sum_j S_j^{eff}} E_{total}$$

where  $a_i$  is the prorata allocation of emitted tokens to staker  $i$ .

## Staking Time-Lock Example

Example of three stakers time-locking their holdings for different durations, shown in Figure 7:

- Staked Tokens,  $s_{1,2,3}$ : 10,000, 20,000, 30000
- Lock durations,  $\tau_{1,2,3}$ : 1, 0, 6 months
- Boost Curvature,  $\kappa$ : 0.25

| Staked Amount | Lock Duration (Months) | Boost Factor | Effective Stake | Pro-Rata Effective Stake |
|---------------|------------------------|--------------|-----------------|--------------------------|
| 10,000        | 1                      | 1.173        | 11,733          | 15%                      |
| 20,000        | 0                      | 1.000        | 20,000          | 26%                      |
| 30,000        | 6                      | 1.487        | 44,594          | 58%                      |
|               |                        | Total        | 76,327          | 100%                     |

Figure 7. Three stakers time-locked for different durations

Example of how time-lock,  $\psi(\tau_i)$ , varies with boost curvature and duration shown in Figure 8, and a calculation of  $a_i$  as follows:

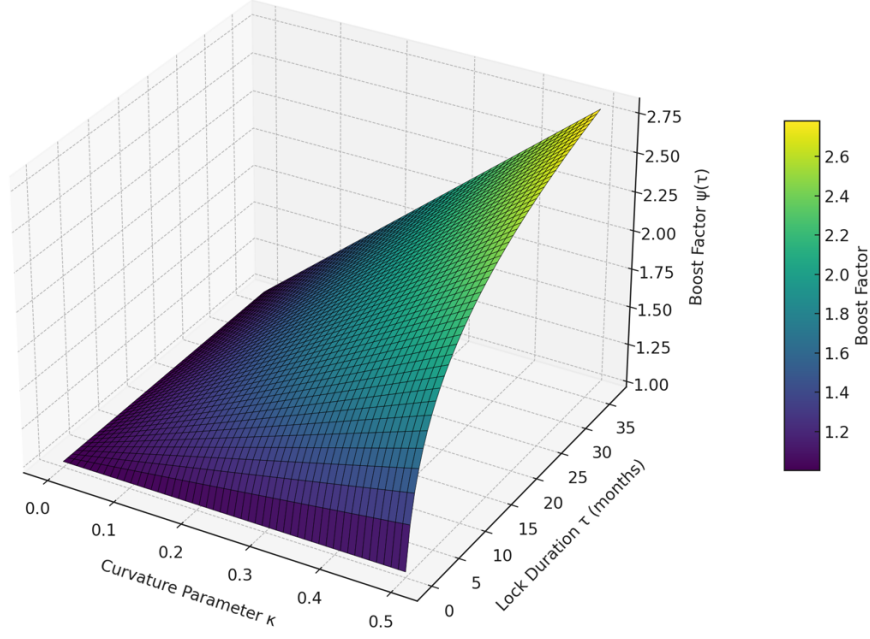


Figure 8. STBL time-lock boost factor vs curvature and lock duration

## 10. Governance Framework

Governance is fully on-chain and token-based. Each staker's voting pro-rata power  $v_i$  is:

$$v_i = \frac{S_i^{eff}}{\sum_j S_j^{eff}}, \quad \sum_i v_i = 1.$$

Proposals can adjust:

- Protocol fee share  $\alpha$
- Buyback allocation  $\theta$
- Burn fraction  $\beta$
- Emission schedule  $M(t)$
- Time-lock boost curvature  $\kappa$
- Airdrop staker allocation  $\rho$
- Buyback staker allocation  $\theta_{staked}$
- Buy-back premium  $\sigma$
- Whitelisting issuers/distributors
- As well as the token emission parameters discussed in part 2

Through periodic votes, token holders steer STBL's economic levers, aligning protocol parameters with community goals.

## 11. Demand Drivers: Airdrops & Buyback Priority

## Partnership Airdrops

When RWAs are minted for certain ecosystems, external ecosystems may airdrop bonus tokens  $D_{gross}(t)$  to the vault holders. This  $D_{gross}(t)$  incentive is distributed through a STBL incentive contract, where STBL captures a protocol share  $\gamma$ , adding  $\gamma D_{gross}$  to the treasury, and distributes  $(1 - \gamma) D_{gross}$  to the relevant vault holders. A share of the incentive tokens,  $\rho$ , in the treasury,  $\rho \gamma D_{gross}$  are distributed to stakers pro-rata based on  $S_i^{eff}$ .

## Staker Premium Buyback Priority

A dedicated portion  $\theta_{staked} \leq \theta$  of buyback funds is reserved for opt-in stakers, where they can have bought or all of their staked tokens purchased at a premium to the market price:

$$P(t)(1 + \sigma),$$

where  $\sigma$  is a percentage premium above the market price,  $P(t)$ . Therefore, participating stakers in the buyback pool receive bonus premium buyback allocated pro-rata:

$$\text{Bonus}_i = \frac{S_i^{eff}}{\sum_{\text{opt-in } j} S_j^{eff}} \times \frac{\theta_{staked} R(t)}{P(t)}.$$

Where the  $\text{Bonus}_i$  is the quantity of token bought back from the staker,  $i$ 's, vault at market price,  $P(t)$ , then the quantity,  $Q_i$ , bought back at the premium  $P(t)(1 + \sigma)$  is:

$$Q_i = \frac{\text{Bonus}_i}{1 + \sigma}$$

The premium buyback rewards larger and longer-duration stakes and lets stakers designate a portion of their position for premium execution. Stakers can “round-trip” proceeds – sell to the treasury at  $P(t)(1 - \sigma)$  and, if desired, repurchase on the open market at  $P(t)$  – to compound holdings while directing buyback flow toward aligned participants. This strengthens alignment between stakers and protocol governance/security and helps reduce unstaked circulating supply when purchased tokens are retired.

## Premium Buyback Example

- Protocol revenue this period:  $R(t) = \$400,000$
- Fraction reserved for stakers:  $\theta_{staked} = 25\% \rightarrow \text{staker pool budget} = \$100,000$
- Market price:  $P(t) = \$1.00$
- Premium:  $\sigma = 10\% \rightarrow \text{premium price} = \$1.10$
- Three opt-in stakers with effective stakes (after time-lock boosts):
  - $A^{eff} = 100,000$
  - $B^{eff} = 50,000$
  - $C^{eff} = 150,000$
  - $Total = 300,000 \rightarrow \text{weights } w_A = 33.33\%, w_B = 16.67\%, w_C = 50\%$

Bonus tokens (market-price equivalent):

$$\text{Total market} - \text{equivalent tokens funded} = \frac{\theta_{\text{staked}} R}{P} = 100,000 \text{ tokens}$$

- $A_{\text{Bonus}} = 33,333.33$
- $B_{\text{Bonus}} = 16,666.67$
- $C_{\text{Bonus}} = 50,000.00$

Tokens bought at the premium:

Divide by  $1 + \sigma = 1.10$

- $Q_A = 30,303.03$  tokens sold to treasury at \$1.10  $\rightarrow$  cash to A = \$33,333.33
- $Q_B = 15,151.52$  tokens  $\rightarrow$  \$16,666.67
- $Q_C = 45,454.55$  tokens  $\rightarrow$  \$50,000.00
- **Total: 90,909.09 tokens purchased; \$100,000 spent (matches budget).**

If stakers rebuy immediately at market:

At \$1.00, each can buy back exactly their “Bonus” tokens. Net token change per staker:

- $A = +3,030.30$  tokens
- $B = +1,515.15$  tokens
- $C = +4,545.45$  tokens
- **Total net token gain to stakers if they round – trip: 9,090.91 tokens**
- That is  $\frac{\sigma}{1+\sigma} = \frac{0.10}{1.10} \approx 9.09\%$  of the 100,000 market – equivalent tokens.

An overview of this example with varying  $\theta_{\text{staked}}$  and  $\sigma$  is shown in Figure 3.

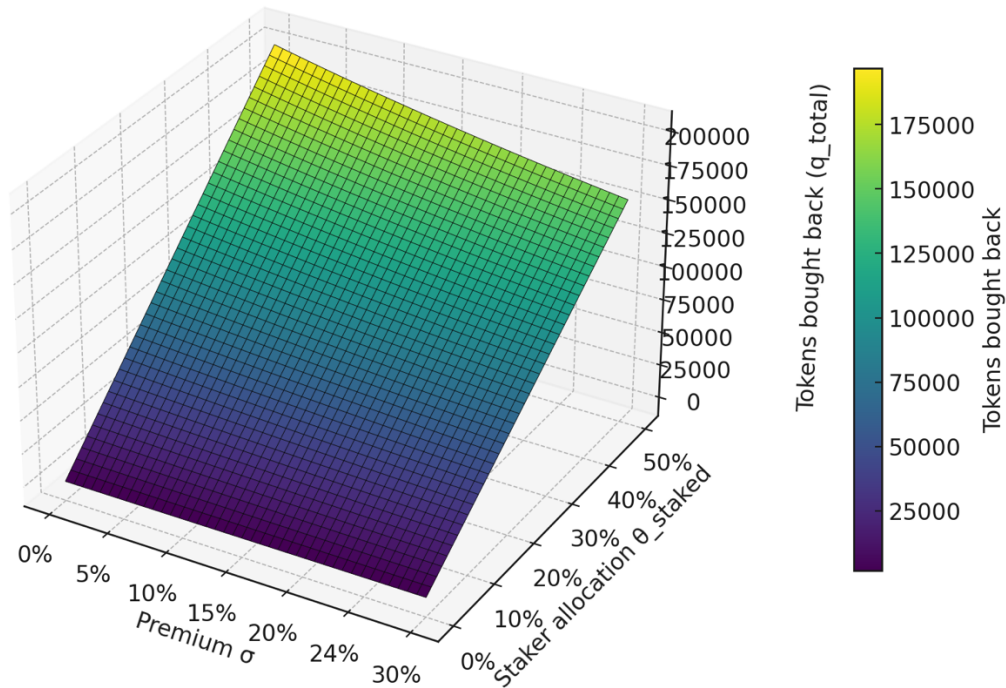


Figure 9. Tokens bought back in above example with varying  $\theta_{\text{staked}}$  and  $\sigma$ .

The premium parameter  $\sigma$  can be set by governance, but the preferred design is to make it dynamic, increasing with the share of circulating supply that is unstaked. When unstaked supply is high, a higher  $\sigma$  strengthens incentives to stake and time-lock, which removes supply from the market. Stakers who earn the premium can then replenish positions by buying additional STBL on the market and re-staking, further reducing unstaked circulating supply.

While Figure 9 shows that – holding other parameters fixed – lower premiums retire more tokens since  $Q_{total} = \theta_{staked} R / (P(1 + \sigma))$ , the larger lever is the staker allocation  $\theta_{staked}$  and, crucially, the size of the staked base opting in. Premium buybacks primarily function to grow that base, enabling larger staker-allocated buybacks and amplifying the total tokens taken out of the market.

## 12. Value-Accrual Flywheel

1. **TVL Growth:** New RWAs increase on-chain vault AUM, which leads to higher stable, USST, and yield generated on the locked AUM provided via the YLD tokens.
2. **Fee Capture:** On-chain locked AUM drives protocol revenue  $R_k = \alpha m_{man} A_k$
3. **Buybacks & Burns:** Allocate  $\theta R^T$  of total protocol revenues,  $R^T$ , to buybacks tokens, and with a strong burn fraction  $\beta$ , enable shrinking of supply  $S(t)$ .
4. **Price Support:** Reduced supply against steady demand drives price  $P(t)$  upward.
5. **Increased Demand:** Demand to hold STBL token to access rewards and incentives:
  - Increasing scarcity through public buybacks
  - Staking rewards and boosts
  - Staking bonus buybacks from protocol fees
  - Staking airdrop reward allocation
6. **Governance Tuning:** token holders vote to adjust protocol parameters  $\{\alpha, \theta, \beta, M, \kappa, \rho, \sigma\}$ , optimising the fly wheel. Some of these parameters can also be autotuned using market data e.g. buyback premiums.

This cyclic interaction ensures that growth in real-world assets directly accelerates token value, fostering a sustainable, stakeholder-aligned ecosystem. In summary the flywheel can be represented as:

$$TVL \rightarrow AUM \rightarrow F_g(t) \rightarrow R(t) \rightarrow \theta R(t)/P(t) \rightarrow burn(\beta) \rightarrow \downarrow S(t) \rightarrow \uparrow P(t)$$

Where:

- $F_g(t)$  = Total management fees
- $R(t)$  = Protocol revenue from management fees
- $\theta$  = Fraction of protocol revenue allocated to buybacks
- $\beta$  = Fraction of repurchased tokens burned

- $S(t)$  = Circulating supply of STBL token
- $P(t)$  = Market price of the STBL token

### 13. Value Accrual Parameter Glossary

| Symbol              | Description                                                                  |
|---------------------|------------------------------------------------------------------------------|
| $t$                 | Continuous time                                                              |
| $A(t)$              | On-chain AUM at time $t$                                                     |
| $\mathbf{A}(t)$     | Total AUM at time $t$ : $\int_0^1 A(t) dt$                                   |
| $m_{man}$           | Annual management fee rate                                                   |
| $F_g(t)$            | Total management fees cut by the asset manager: $m_{man} A(t)$               |
| $\alpha$            | Protocol's share of management fees                                          |
| $R(t)$              | Protocol revenue: $\alpha m_{man} A(t)$                                      |
| $\mathbf{R}^T(t)$   | Total protocol revenue in reserve                                            |
| $A_k, F_{g_k}, R_k$ | Discrete time AUM, management fees and protocol revenues over period $k$     |
| $S(t)$              | Circulating token supply                                                     |
| $E(t)$              | Emission (mint) rate                                                         |
| $E_{total}$         | Total emissions over reward epoch $\Delta t$ : $\int_t^{t+\Delta t} E(t) dt$ |
| $\theta$            | Fraction of revenue used for buybacks                                        |
| $\beta$             | Fraction of repurchased tokens burned                                        |
| $P(t)$              | Token price                                                                  |
| $s_i, \tau_i$       | Staked tokens and lock duration (months) for user $i$                        |
| $\kappa$            | Time-lock boost curvature parameter                                          |
| $\psi(\tau)$        | Boost function: $1 + \kappa \ln(1 + \tau)$                                   |
| $S_i^{eff}$         | Effective stake: $s_i \psi(\tau_i)$                                          |
| $v_i$               | Governance weight: $S_i^{eff} / \sum_j S_j^{eff}$                            |
| $\gamma$            | Protocol share of external airdrops                                          |
| $D_{gross}(t)$      | Gross airdrop flow                                                           |
| $\rho$              | Share of protocol incentives allocated to stakers, $\rho \gamma D_{gross}$   |
| $\theta_{staked}$   | Portion of buybacks reserved for opt-in stakers                              |
| $\sigma$            | Premium for opt-in staking buyback $P(t)(1 + \sigma)$                        |





# Part 3: Token Emission Dynamics

## 14. Emission Model Components

The STBL protocol will mint exactly 10 billion STBL at genesis, a fixed cap that anchors the economic design. Twenty percent (2 billion) is reserved for staking emissions over the first 20 years. The remaining 80 percent (8 billion) is allocated to other purposes - team, foundation, partners, and future investors etc - under separate vesting and lock-up schedules. These allocations will be locked in smart contracts and released according to their schedules. Where appropriate (e.g., ecosystem, treasury, and liquidity allocations), locked tokens may be irreversibly burned at any time to reduce total supply, without affecting the staking emission schedule. Figure 10 shows the current token allocation categories.

| Allocations                           | Token%  | Tokens         | Cliff             | Vesting                                            |
|---------------------------------------|---------|----------------|-------------------|----------------------------------------------------|
| Private Sale 1 (Previous Round)       | 12%     | 1,200,000,000  | 12 month from TGE | 5% after cliff and linear over following 18 months |
| Private Sale 2 (Current Round)        | 3%      | 300,000,000    | 6 month from TGE  | 0 after cliff and linear over following 12 months  |
| Public Distribution                   | 4%      | 400,000,000    | 3 month from TGE  | linear over 6 months after cliff                   |
| Team                                  | 20%     | 2,000,000,000  | 12 month from TGE | 5% after cliff and linear over following 18 months |
| Advisors                              | 5%      | 500,000,000    | 12 month from TGE | 5% after cliff and linear over following 18 months |
| Ecosystem Development                 | 11%     | 1,100,000,000  | None              | 10% on TGE and linear over following 12 months     |
| Staking                               | 20%     | 2,000,000,000  | 6 months from TGE | linear over 18 months                              |
| Liquidity & MM                        | 10%     | 1,000,000,000  | None              | 4% on TGE and linear over following 12 months      |
| Treasury (+ tokens for future rounds) | 15%     | 1,500,000,000  | None              | 45% on TGE and linear over following 12 months     |
| Total                                 | 100.00% | 10,000,000,000 |                   |                                                    |

Figure 10. Token Economics

The staking allocation will be released through a three-part emission schedule, with rewards drawn from the dedicated token emission pool, which consists of the following components:

### 1. Bootstrap Emissions

The bootstrap component allocates and delivers a share of rewards immediately after launch to attract validators and liquidity. It then tapers off smoothly over time, so that early participants see high yields but later emissions from this source become negligible. This jumpstart is important for providing the right incentives early on for governance and securing the protocol when the token has lower market value or when staking ratios are still low.

### 2. Staking-Driven Emissions

The staking-driven component allocates most of the emission pool over the first 20 years but varies daily based on how many tokens are staked. If a smaller share of tokens is

staked, daily emissions increase to entice participation. As the staking ratio rises, emissions decrease, preserving token supply.

### 3. Terminal (Perpetual) Emissions

After the 20-year period, a small perpetual emission maintains ongoing protocol security. It targets a fixed annual inflation (e.g. 0.5% per year) but still adjusts dynamically: when fewer tokens are staked, inflation rises slightly to incentivize staking; when staking is high, inflation is suppressed to limit dilution.

All emitted tokens, part of the emission pool, flow through the staking-reward contract and are distributed pro-rata to stakers based on their individual effective stake.

## 15. Bootstrap Emissions

### Purpose

- Kick-start network security with high early rewards.
- Decay exponentially so later emissions are dominated by staking incentives.
- In the bootstrap phase, we want very high rewards at launch that gradually taper off, so they don't overwhelm long-term incentives and drive oversupply of STBL.

### Definitions & Key Equations

- Total emission pool:

$$S_{pool} = \chi S_{total}$$

where  $S_{total}$  is the total supply and  $\chi$  is fraction of the total supply to be set aside for staking emissions e.g. planned to be 20% as part of the initial setup.

- Bootstrap allocation:

$$S_{boot} = F S_{pool}, \quad 0 < F < 1$$

where  $F$  is the fraction of the emission pool set aside for boot strapping the protocol and enabling sufficient incentives early in the life of the protocol.

- Bootstrap emission model:

$$E_{boot}(t) = B_0 e^{-t/\tau}$$

where:

- $B_0$  is the initial daily emission rate chosen so the total emitted over the bootstrap window exactly equals the allocated bootstrap budget.
- $t$  is time in days since launch.
- $\tau$  sets the speed of the taper and is measured in days. A larger  $\tau$  means the high-reward period lasts longer; a smaller  $\tau$  causes the rewards to fall off more quickly.

- When  $t = \tau$ , gives the factor  $\exp(-1) \approx 0.37$ . In other words, after  $\tau$  days, the daily bootstrap emission has fallen to about 37% of its initial value  $B_0$ .
- The half-life of the bootstrap schedule (the time it takes to fall to 50% of  $B_0$ ) is

$$t_{1/2} = \tau \ln(2) \approx \tau 0.69$$

- $\tau$  can be tuned through governance:
  - **Too large** a  $\tau \rightarrow$  bootstrap rewards linger, undermining the long-term emission balance and inflating supply unnecessarily.
  - **Too small** a  $\tau \rightarrow$  rewards vanish too quickly, making it hard to recruit early validators when network security is weakest.
  - In practice, a  $\tau$  on the order of a year (e.g. 365) would provide a smooth, year-long bootstrap curve with a half-life of around 8–9 months—enough to secure launch without overwhelming later incentives.
- We can set  $B_0$  so that exactly  $S_{boot}$  is emitted over the 20-year horizon,  $T$ :

$$\int_0^T E_{boot}(t) dt = S_{boot}$$

Then using  $S_{boot}$ , we can determine  $B_0$ :

$$B_0 = \frac{S_{boot}}{\int_0^T e^{-t/\tau} dt} = \frac{S_{boot}}{\tau(1 - e^{-T/\tau})}$$

Using  $S_{boot} = F S_{pool}$  we obtain:

$$B_0 = \frac{F S_{pool}}{\tau(1 - e^{-T/\tau})}$$

## 16. Staking-Driven Emissions

### Purpose

- Provide ongoing rewards that align incentives with actual network security needs
- Increase emissions when a lower fraction of tokens is staked, encouraging new participants to lock up their holdings
- Decrease emissions when staking participation is high, conserving token supply once the network is well secured
- Smoothly distribute the bulk of the 20-year emission budget in proportion to real-time staking ratios
- Discourage “lazy” staking (no or short time-locks, no governance or buyback participation etc) by making rewards sensitive to the overall staking ratio (more stake  $\rightarrow$  less reward per token)

- Maintain predictable, long-term emission levels while dynamically adapting to participation fluctuations
- Ensure that token dilution primarily occurs when it most strengthens protocol security, rather than on a fixed schedule

## Definitions & Key Equations

- Staking driven incentive pool,  $S_{incentive}$  is given by:

$$S_{incentive} = (1 - b) S_{pool}$$

where  $b$  is proportion of the emission pool set-aside for the bootstrapping which is emitted over  $T$  days e.g. 20 years.

- Staking ratio,  $s(t)$  is the ratio at time  $t$  of the total supply staked to the total supply in circulation:

$$s(t) = \frac{S_{staked}(t)}{S_{circ}(t)}, \quad 0 \leq s(t) \leq 1$$

where

- $S_{staked}(t)$ : total tokens locked at time  $t$ .
- $S_{circ}(t)$ : total circulating supply at time  $t$ .
- $s(t)$  drives the staking-driven emissions to be higher when fewer tokens are staked (to attract more stakers) and lower when many tokens are staked (to conserve supply).
- Provides a direct feedback loop: as  $s(t)$  rises, protocol emissions taper off automatically, whereas a drop in  $s(t)$  ramps up rewards.
- The staking emission model, of how the main staking incentive pool is emitted over time  $t$  is provided by:

$$E_{stake}(t) = C \exp(-\lambda s(t))$$

where

- $\lambda$  is the staking sensitivity exponent and  $\lambda > 0$ ,
- It governs how sharply the staking-driven emission responds to changes in  $s(t)$ .
- A larger  $\lambda$  means emissions fall off more abruptly as staking increases; a smaller  $\lambda$  produces a gentler response.
- For example, if  $\lambda$  is large e.g. 5, then even a moderately high staking ratio of say  $s = 0.5$  yields  $\exp(-5 \times 0.5) = \exp(-2.5) \approx 0.08$ , i.e. emissions drop to 8% of their maximum.
- On the other hand, if  $\lambda$  is small e.g. 1, then  $\exp(-1 \times 0.5) \approx 0.61$ , so emissions only fall to 61% when half the supply is staked.
- $\lambda$  is important as it controls the elasticity of rewards and how aggressively the protocol conserves tokens as staking grows
- Balances between over-rewarding at low participation (if  $\lambda$  too high) and under-rewarding at high participation (if  $\lambda$  too low).

- It can be tuned by governance to match desired security incentives.

and where  $C$  sets the overall magnitude of the staking-driven reward schedule, and we can choose  $C$  so that:

$$\int_0^T E_{stake}(t) dt = S_{incentive} = (1 - b) S_{pool}$$

This then gives us  $C$ :

$$C = \frac{(1 - b) S_{pool}}{\int_0^T \exp(-\lambda s(t)) dt}$$

- This ensures that over the 20-year emission window  $T$ , the total tokens emitted by the staking-driven component exactly matches its budget  $S_{incentive}$ .
- While  $\lambda$  or  $b$  may not change over  $T$ , the staking ratio  $s(t)$  would vary as stakers come and go, and as the circulating supply increases. Therefore the parameter  $A$  would need to calibrate periodically so the total staking incentive emissions still sum to the intended total.

## 17. Terminal (Perpetual) Emissions

### Purpose

- Guarantee that stakers continue to receive rewards even after the 20-year finite emission window closes
- Prevent emissions from dropping to zero, if transaction volumes are too low, which would avoid a “reward cliff” that could risk protocol security
- Dynamically adjust ongoing inflation based on staking ratio (higher inflation when participation dips, lower when participation is strong)
- Offer continuous, modest yield that aligns staker compensation with opportunity costs and long-term network health

### Definitions & Key Equations

- The target annual inflation rate (for example 0.5% per year) is converted into a daily rate and then adjusted up or down according to real-time staking participation. If fewer tokens are staked, daily inflation increases to attract more staking; if many tokens are staked, inflation is suppressed to prevent oversupply.
- The perpetual emission model provides the base daily perpetual emission rate:

$$i_{base}^{day} = \frac{i_{base}}{365}$$

where  $i_{base}$  is the target annual inflation rate e.g. 0.005 for 0.5% per annum.

- We can then define the perpetual terminal inflationary emission on day  $t$  as:

$$E_{term}(t) = i_{base}^{day} \cdot S_{circ}(t) \cdot \frac{1}{1 + \beta_{term} s(t)}$$

Where, as above,  $S_{circ}$  is the total circulating supply at time  $t$ , which is used as the basis for the daily inflationary emission, and the final factor tunes the inflation based on staking i.e. high staking leads to suppression of inflation. In this  $\beta_{term}$  is a sensitivity parameter, where:

- $\beta_{term} > 0$  terminal emission sensitivity
- A larger  $\beta_{term}$  means stronger suppression of inflation
- For the same  $\beta_{term}$ :
  - if  $s(t)$  low  $\Rightarrow$  higher inflation
  - if  $s(t)$  high  $\Rightarrow$  lower inflation.
- Because  $S_{circ}(t)$  grows slowly under small perpetual inflation, this regime preserves token value by keeping annual inflation near the chosen target, while still adapting to participation in real time.

## 18. Total Emission & Allocation

The aggregate emission rate,  $E(t)$  is the sum of all three streams:

$$E(t) = E_{boot}(t) + E_{stake}(t) + E_{term}(t)$$

All emitted tokens flow through the staking reward contract and are distributed pro rata to stakers based on their individual effective stake. This combined schedule enables:

- **Bootstraps** security when the network is young,
- **Adapts** rewards as participation grows, and
- **Sustains** validator incentives forever.

By layering these three mechanisms, the protocol balances rapid early growth, efficient long-term emission, and perpetual security, all while giving governance the levers to fine-tune each component.

As highlighted in Part 1 the emission model is fully parameterizable via governance (e.g.  $\tau, \lambda, \beta_{term}, i_{base}$ ), enabling the ecosystem to fine-tune emission incentives over time.

## 19. Why Each Component Matters

1. **Bootstrap** ( $E_{boot}$ ):

- High early yield attracts initial stakers to drive governance/security.
  - Exponential decay ( $\tau$ ) prevents overwhelming later incentives.
2. **Staking-Driven** ( $E_{stake}$ ):
- Aligns ongoing incentives with actual governance/security needs
  - Raises rewards when staking dips, reduces rewards when staking peaks.
3. **Terminal** ( $E_{term}$ ):
- Ensures ongoing, capped inflation (e.g.  $\sim 0.5\%$  p.a.) for perpetual network security/incentives.
  - Dynamically adjusts by staking ratio.

## 20. Staking Emission Modelling

In Figure 11 there are example parameters and values for modelling the various token emission components. Figure 12 shows the simulation plots of each emission component, which highlights how each one contributes to the total emitted supply over a 30-year period. The final chart, in Figure 13 shows the cumulative emitted supply over 30 years.

| Category       | Parameter                         | Value                                  |
|----------------|-----------------------------------|----------------------------------------|
| General        | Total Token Supply                | 10,000,000,000 tokens                  |
| General        | Staking Emission Allocation       | 20% of total supply (2 billion tokens) |
| General        | Emission Horizon (Years)          | 30 (20 staking + 10 terminal)          |
| Bootstrap      | Bootstrap Fraction                | 5% of staking pool                     |
| Bootstrap      | Bootstrap Emission Budget         | 100,000,000 tokens                     |
| Bootstrap      | Decay Constant ( $\tau$ )         | 365 days                               |
| Bootstrap      | Initial Emission Rate ( $B_0$ )   | $\approx 273,598$ tokens/day           |
| Bootstrap      | Bootstrap Formula                 | $E_{boot}(t) = B_0 e^{-t/\tau}$        |
| Staking-Driven | Staking Emission Budget           | 1,900,000,000 tokens                   |
| Staking-Driven | Staking Ratio Simulation          | Linear from 0 to 1 over 20 years       |
| Staking-Driven | Staking Sensitivity ( $\lambda$ ) | 5                                      |
| Staking-Driven | Scaling Constant ( $C$ )          | Scaled so total = 1.9billion Tokens    |
| Staking-Driven | Staking Formula                   | $E_{stake}(t) = C \exp(-\lambda s(t))$ |
| Terminal       | Start Day                         | Day 7,300 (Year 20)                    |
| Terminal       | Daily Terminal Emission (start)   | 8,831.07 tokens/day                    |



|              |                                        |                                                                                        |
|--------------|----------------------------------------|----------------------------------------------------------------------------------------|
| Terminal     | Circulating at Terminal Start          | 2,000,000,000 token                                                                    |
| Terminal     | Target Annual Inflation ( $i_{base}$ ) | $\approx 0.161167\%$                                                                   |
| Terminal     | Initial Annual Inflation               | $\approx 0.032233\%$                                                                   |
| Terminal     | Daily Rate                             | 0.0000044155                                                                           |
| Terminal     | Sensitivity ( $\beta_{term}$ )         | 0 (fixed daily emission independent of staking)                                        |
| Terminal     | Staking Ratio Simulation               | Constant from final staking ratio at 1.0                                               |
| Terminal     | Terminal Formula                       | $E_{term}(t) = i_{base}^{day} \cdot S_{circ}(t) \cdot \frac{1}{1 + \beta_{term} s(t)}$ |
| Total        | Total Emission Formula                 | $E(t) = E_{boot}(t) + E_{stake}(t) + E_{term}(t)$                                      |
| Sanity Check | Bootstrap Emitted (20y)                | 100,000,000 tokens                                                                     |
| Sanity Check | Staking Driven Emitted (20y)           | 1,900,000,000 tokens                                                                   |
| Sanity Check | Terminal Emitted (20y-30y)             | 32,494,477 tokens                                                                      |
| Sanity Check | Total Emitted (30y no burning)         | 2,032,494,477 tokens                                                                   |

Figure 11. Emission simulation parameters

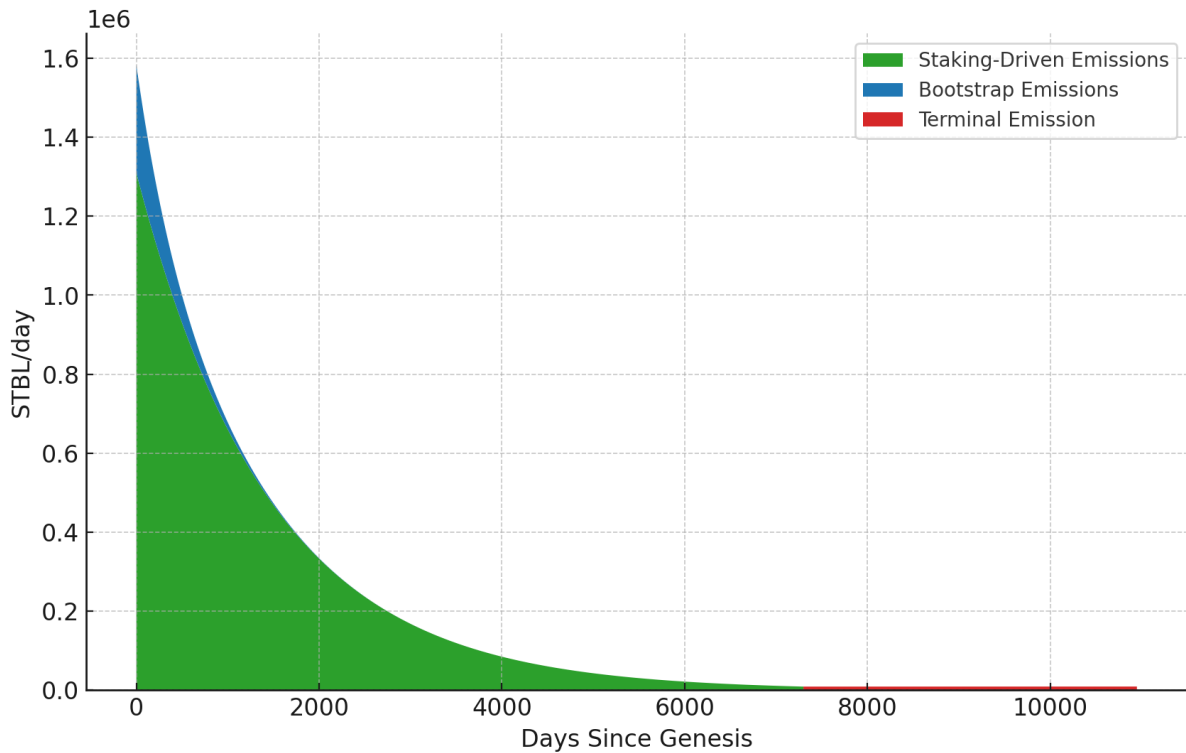


Figure 12a. Stacked charts of the total emissions showing tokens/day

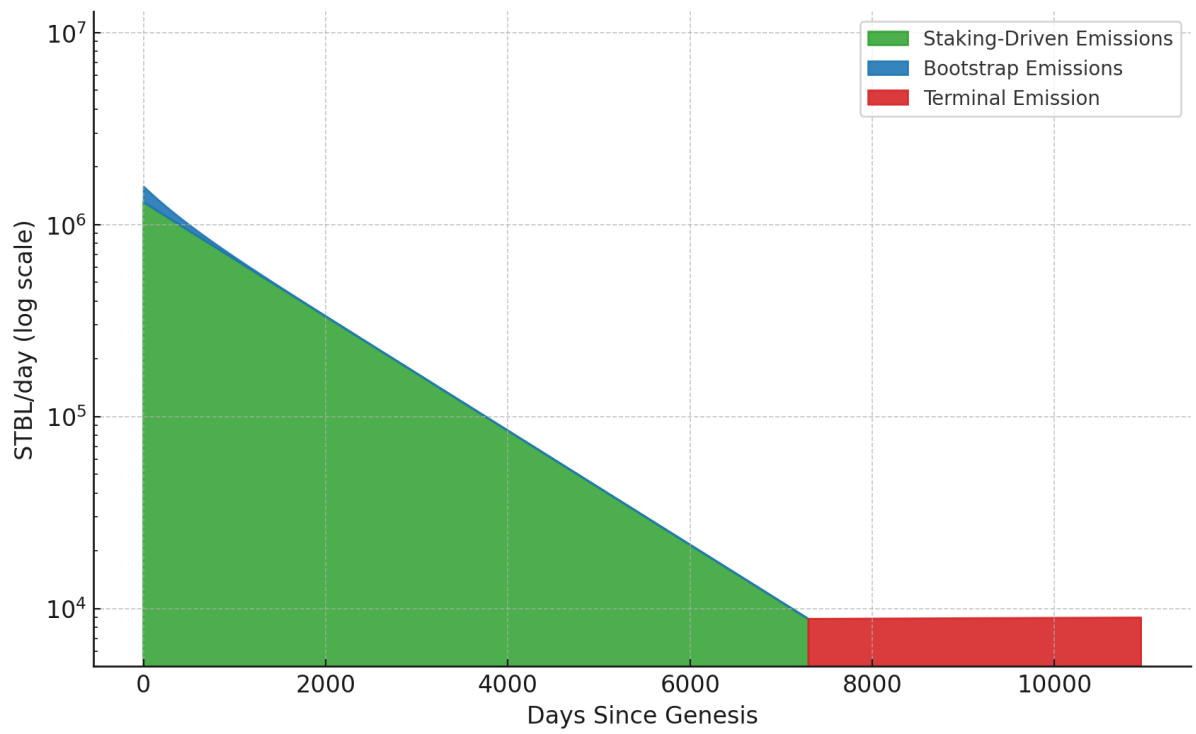


Figure 12b. Stacked charts of the Log total emissions tokens/day

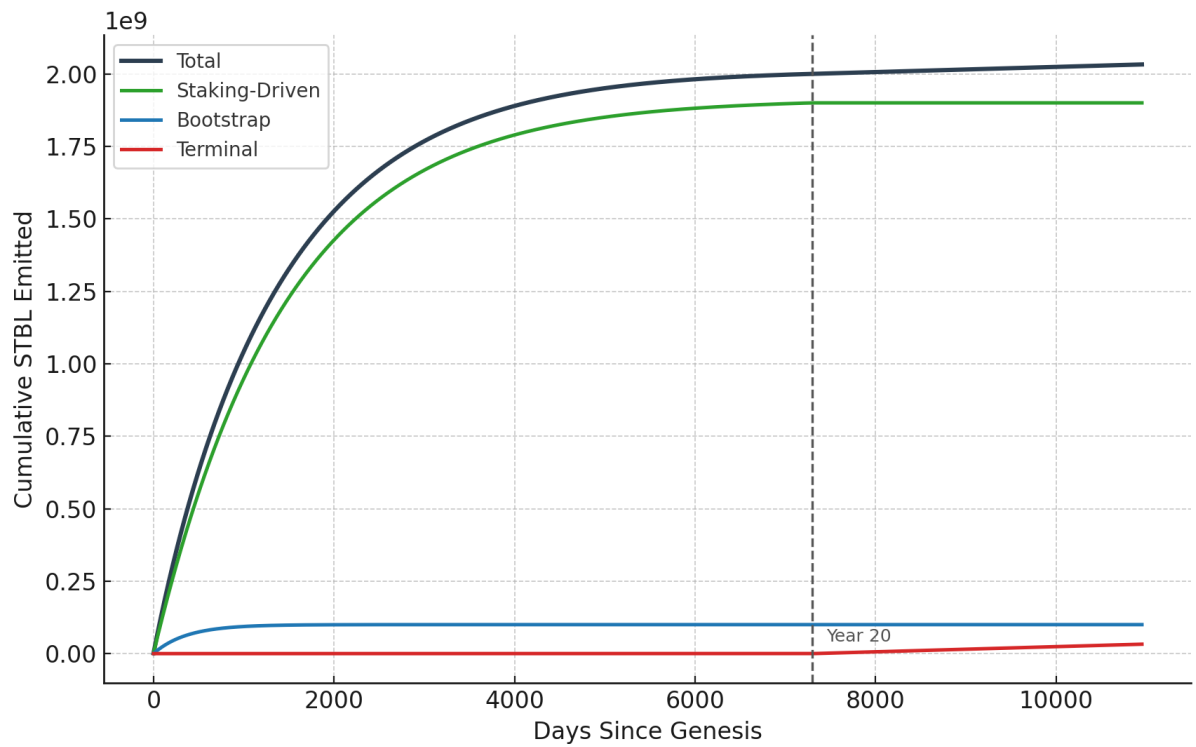


Figure 13a. Emission supply,  $E(t)$ , over 30 years not considering burning

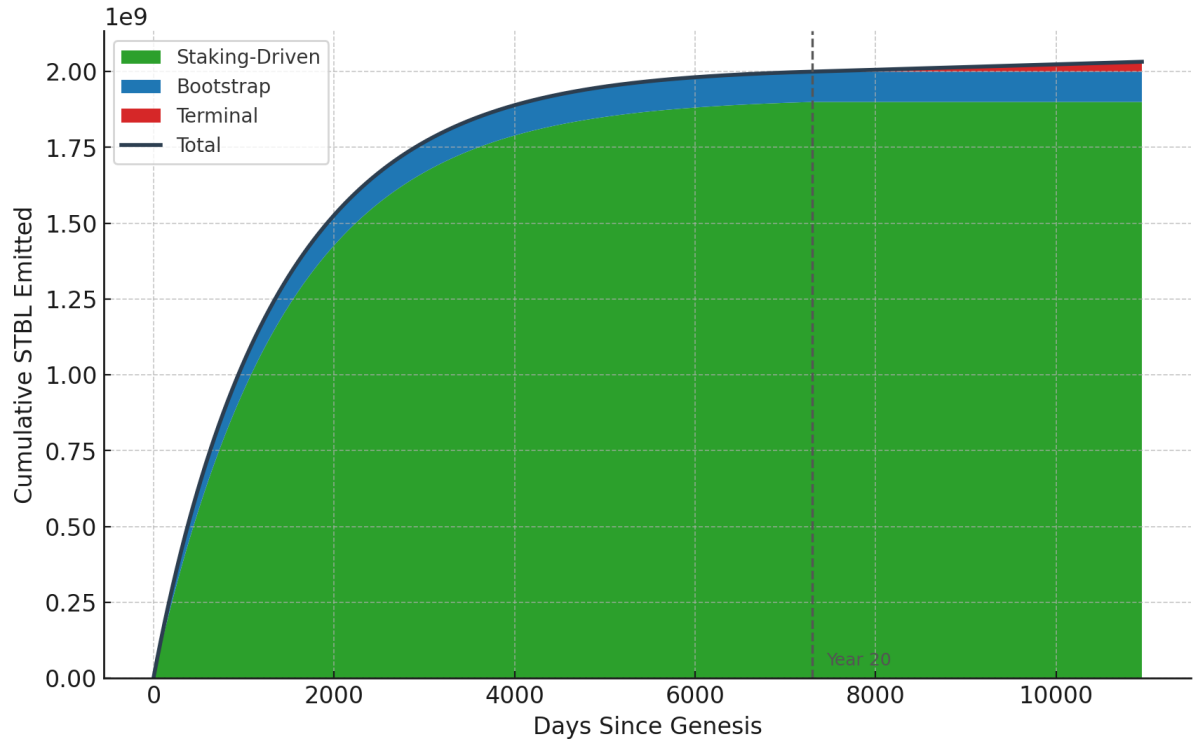


Figure 13b. Stacked Total Emission supply,  $E(t)$ , over 30 years not considering burning

## 21. Token Emission Parameter Glossary

| Symbol          | Meaning                                                            |
|-----------------|--------------------------------------------------------------------|
| $S_{total}$     | Total token supply (10 billion tokens)                             |
| $\chi$          | Percentage of total supply for staking emissions                   |
| $S_{pool}$      | $\chi \times S_{total}$ allocated for staking emissions            |
| $b$             | Bootstrap fraction of $S_{pool}$ (e.g. 0.05)                       |
| $S_{boot}$      | $F \cdot S_{pool}$ : tokens for bootstrap                          |
| $\tau$          | Bootstrap decay constant (days)                                    |
| $B_0$           | Initial bootstrap emission rate (tokens/day)                       |
| $T$             | Emission horizon (20 yrs = $20 \times 365$ days)                   |
| $S_{staked}(t)$ | Total tokens locked in staking at time $t$                         |
| $S_{circ}(t)$   | Total circulating supply at time $t$                               |
| $s(t)$          | Staking ratio = $S_{staked}(t)/S_{circ}(t)$                        |
| $\lambda$       | Sensitivity exponent for staking-driven emissions                  |
| $C$             | Scaling factor for $E_{stake}$ so its integral = $(1 - b)S_{pool}$ |
| $i_{base}$      | Target annual terminal inflation (e.g. 0.02 for 2%)                |

|                  |                                                                  |
|------------------|------------------------------------------------------------------|
| $i_{base}^{day}$ | Daily inflation rate = $i_{base}/365$                            |
| $\beta_{term}$   | Sensitivity multiplier for terminal emission adjustment          |
| $E_{boot}(t)$    | Bootstrap emission at day $t$                                    |
| $E_{stake}(t)$   | Staking-driven emission at day $t$                               |
| $E_{term}(t)$    | Terminal (perpetual) emission at day $t$                         |
| $E(t)$           | Aggregate emission per unit time (= sum of all three components) |