Klima 2.0

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Notice to Readers

This document describes a proposed technical and economic model developed by 01X as part of exploratory research conducted in connection with the Klima ecosystem. It reflects conceptual design work informed by prior learnings from KlimaDAO and related on-chain carbon market initiatives.
The model presented herein is illustrative only and is intended to explore one possible approach to scaling carbon market infrastructure using blockchain-based systems. It does not represent a commitment to implement any specific architecture, mechanism, parameter, or economic outcome.
The Klima Protocol is expected to deploy a production system for on-chain carbon market infrastructure in or around February 2026. At that time, a separate implementation whitepaper will be released describing the deployed system, and the corresponding smart contract code will be made publicly available as open-source software.
This document should not be relied upon as a description of the final protocol, its operation, or its economics. It does not constitute an offer, solicitation, investment advice, or a representation regarding the legal, regulatory, or economic characteristics of any future deployment.

KLIMAPROTOCOL

1 Prologue

Klima 2.0 is an autonomous, rules-based coordination protocol designed to support the retirement of carbon credits through continuous and transparent execution terms.

It is not a financial product, investment vehicle, or asset management system, but a piece of market infrastructure that enables carbon supply and retirement demand to interact under predefined conditions. While the protocol issues additional tokens to certain participants, these emissions are purely rule-based incentives for coordination and infrastructure provision, not a guarantee of financial return or claim on underlying assets.

The protocol operates through a dual-token architecture that facilitates coordination without discretionary control: **kVCM** functions as the internal unit of account and pricing reference for protocol-facilitated carbon, while **K2** provides signalling inputs related to capacity. Together, these tokens inform protocol parameters through deterministic smart-contract logic. This architecture enables the protocol to:

- define execution terms and intake eligibility for carbon credits against transparent, predefined rules;
- make acquired credits available exclusively for irreversible retirement;
- coordinate liquidity provision and participation incentives required for continuous operation.

Participant actions such as locking tokens, signalling preferences, or providing liquidity serves as inputs into a coordination mechanism that adjusts protocol parameters within predefined bounds. These inputs do not confer ownership rights, redemption rights, or claims on protocol-held carbon, nor do they constitute discretionary management of assets.

The protocol consists of three interdependent functional layers:

- a carbon inventory layer that holds credits solely for the purpose of facilitating retirement;
- a liquidity layer that supports access and withdrawal from the system through external markets; and
- a coordination layer that aggregates participant signals to inform protocol parameters.

These layers are designed to operate together as a self-contained system, adjusting to observable supply and retirement demand without reliance on external oracles, manual intervention, or fee-extractive intermediaries.

Klima 2.0 abstracts complex carbon market interactions into a transparent and auditable execution framework, enabling participants to interact with carbon retirement infrastructure directly, programmatically, and on equal terms.

Any economic effects arising from protocol activity result from predefined rules and market interaction, rather than from asset ownership, portfolio management, or profit extraction.

2 Klima 2.0

KlimaDAO launched in 2021 on the Polygon blockchain as an early experiment in applying tokenisation and onchain liquidity to voluntary carbon markets. The initial design centred on the KLIMA token and a treasury-based mechanism intended to bootstrap liquidity and participation in a nascent onchain carbon ecosystem.

That first iteration played a meaningful role in demonstrating that carbon credits could be represented, transferred, and retired using blockchain infrastructure. It also catalysed the development of a broader ecosystem of tools and services, including integrations with multiple carbon registries, marketplaces and point-of-sale interfaces, APIs for third-party applications, and direct onchain issuance by project developers.

Over time, it became clear that the original architecture was not well suited to serving large-scale, enterprise carbon buyers or to supporting continuous, rules-based market operation without manual intervention. In particular, treasury-centric designs introduced complexity, opacity, and governance challenges that limited scalability and operational clarity.

Klima 2.0 is a ground-up redesign informed by these lessons. Rather than relying on treasury management or discretionary allocation, the new protocol is structured as neutral, non-extractive market infrastructure focused exclusively on facilitating carbon retirement through transparency, programmatic settlement, and open participation.

The Klima 2.0 protocol replaces treasury-backed mechanisms with a rules-based coordination model that uses protocol-native tokens to parameterise execution terms, intake capacity, and participation incentives. Carbon credits handled by the protocol are acquired solely to fulfil retirement demand and are not held, traded, or managed for financial gain.

This shift reflects a deliberate move away from capital-centric designs toward infrastructure that prioritises auditability, predictability, and long-term operational resilience. Klima 2.0 is intended to function as a shared execution layer for carbon markets, enabling suppliers, buyers, and integrators to interact under predefined conditions without reliance on discretionary intermediaries.

2.1 High-Level Architecture

Klima 2.0 operates using two protocol-native tokens, **kVCM** and **K2**, which together enable rules-based coordination and participation within the system. These tokens do not confer ownership rights, redemption rights, or claims on protocol-handled carbon, and do not represent investment interests.

The **kVCM** and **K2** tokens are used in three interdependent functional layers that together support continuous, non-discretionary operation:

1. **Carbon Inventory Layer**:

   - Accumulates carbon credits by minting **kVCM**.
   - Sells carbon retirement certificates by burning **kVCM**.
   - Sets carbon execution terms based on predefined rules.

   Carbon credits handled by the protocol cannot be withdrawn, transferred, or resold. They may only be retired.

2. **Liquidity Layer**:

   - **kVCM** and **K2** token holders are able to pair their tokens together (or, in the case of **kVCM**, with USDC) in a standard liquidity pool to provide liquidity and generate fees on trades executed through the pool.
   - Liquidity providers may stake their liquidity provider tokens for a fixed time period of their choice, making them eligible to receive a share of the **kVCM** and **K2** incentives.

3. **Coordination Layer**:

   - **kVCM** holders may **time-lock** their **kVCM** for a fixed time period of their choice, making them eligible to receive **kVCM** base accrual, **K2** incentives, and to allocate their **kVCM** to carbon classes – which increases the comparative weighting of these carbon classes in the inventory.

- **K2** holders may **user-lock** their **K2** for at least 48 hours, making them eligible to receive **kVCM** and **K2** incentives, and to allocate their **K2** to carbon classes – which reduces the difference between the execution terms on carbon intake and retirements for these carbon classes.
- Time-locked **kVCM** holders participate in protocol coordination alongside liquidity providers with liquidity staked in the **kVCM/K2** liquidity pool.

These layers operate together as a self-contained system that responds only to its own observable state, without reliance on external oracles or centralised intervention.

2.2 Carbon Inventory

The protocol's carbon inventory accumulates and retires carbon. It is driven by parameters determined by its rules-based smart contracts, and user activities.

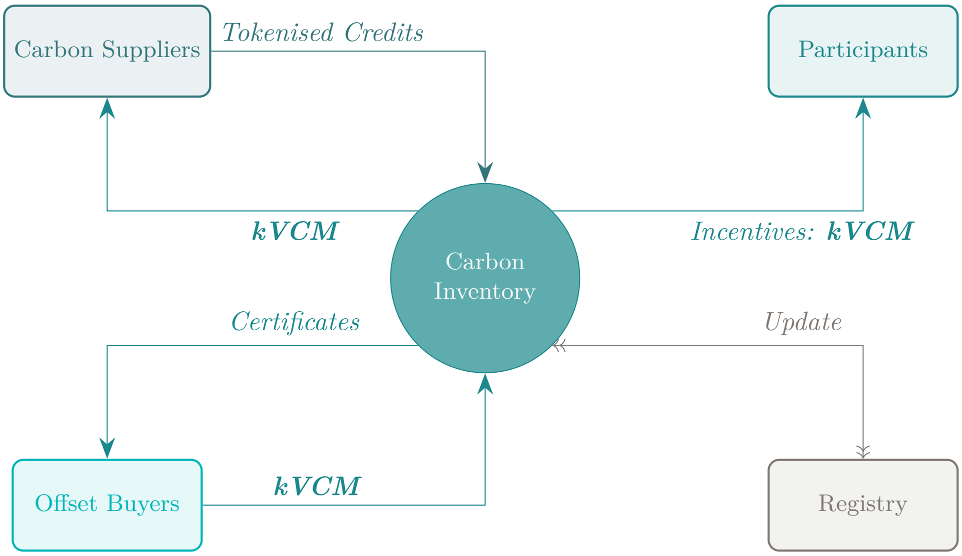


Figure 1: Klima 2.0 Carbon Inventory.

Carbon credits are acquired from suppliers, and consumed by retirement buyers. Carbon credits are grouped by predefined classifications called **carbon classes**.

Aggregate token holder allocations collectively set the parameters for the execution terms of **each class**, for both suppliers and retirees, by defining:

- Inventory weighting.
- Capacity.

Thus the protocol is driven by its own native token allocations, acting as rules-based carbon market infrastructure to connect available supply with retirement demand.

2.3 Tokens

Locking or staking the protocol's tokens allows participants to signal preferences within the system, and may make them eligible to receive protocol incentives.

Together, **kVCM** and **K2** enable the protocol to operate as neutral, non-extractive infrastructure, coordinating participation and execution without discretionary management.

2.3.1 kVCM

kVCM is the protocol's primary utility token. Its supply is not capped: it grows when new carbon is supplied to the protocol and via rule-based emissions (base accrual and incentives), and it contracts when carbon is retired.

- When **time-locked**:
  - It may be allocated to carbon classes for inventory weighting.
  - It receives **kVCM** base accrual and **K2** incentives.
  - In aggregate, time-locks determine the rate of incentive issuance.
- **Transactional** usage:
  - **Mint**: when suppliers deliver carbon to the protocol.
  - **Burn**: when credits are retired from the protocol.
- When **staked** in liquidity pools it is also eligible for **kVCM** and **K2** incentives, based on the duration of the stake and the position's relative share of the pool.

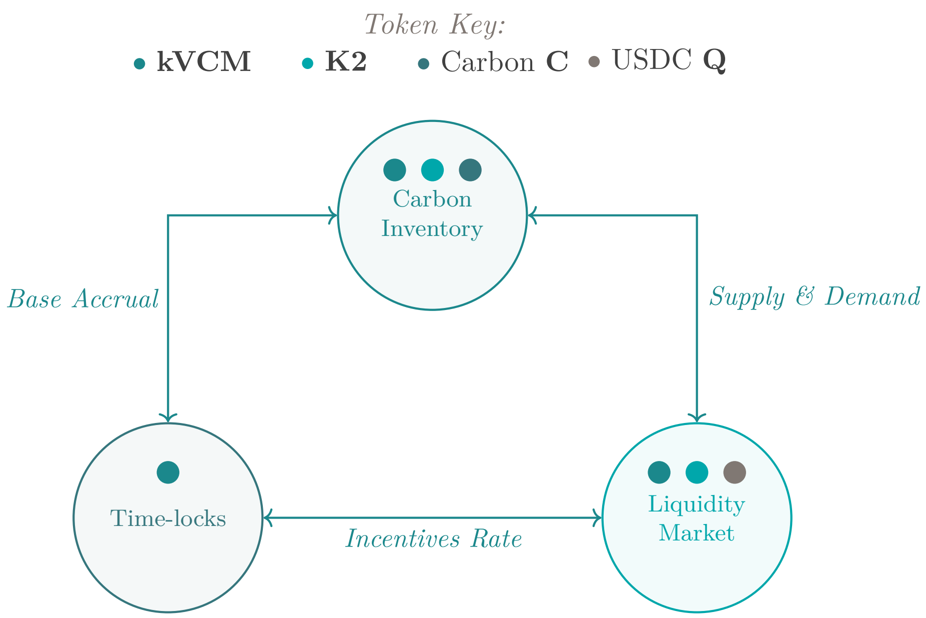


Figure 2: Token utility.

2.3.2 K2

K2 is a fixed-supply token distributed programmatically over time.

- When **user-locked**:
  - It may be allocated to carbon classes to reduce the difference between execution terms on carbon intake and retirements.
  - It receives **kVCM** and **K2** incentives.
  - In aggregate, user-locks influence the rates of incentive issuance.
- When **staked** in the **kVCM/K2** liquidity pool it is also eligible for **kVCM** and **K2** incentives, based on the duration of the stake and the position's relative share of the pool.

2.3.3 Utility Functions

The **kVCM** token has two utility functions which are not independent:

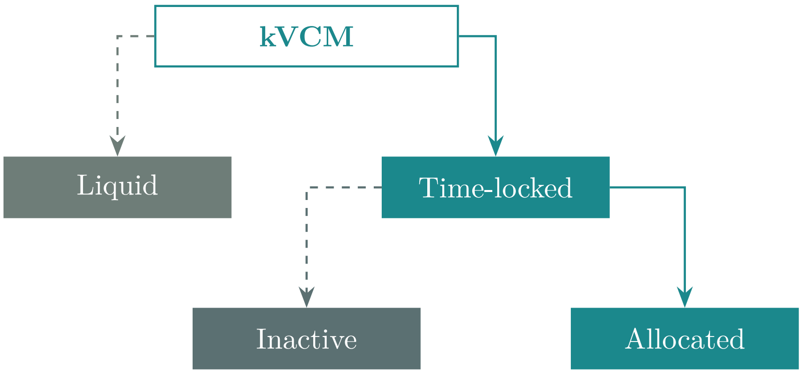


Figure 3: **kVCM** utility functions.

1. **Time lock**: The **kVCM** token is locked for a specific period of time which determines a **kVCM** 'base accrual' rate. This time period cannot be amended.
2. **Execution terms allocation**: Collective signalling of carbon classes via **kVCM** allocations determines the protocol's execution terms for carbon intake and retirement, expressed in **kVCM** units. These parameters govern how the protocol issues or burns **kVCM** when carbon is supplied or retired. Allocations may be updated over time.

The **K2** token also has two utility functions:

1. **User lock**: The **K2** token remains locked for at least 48 hours.
2. **Capacity allocation**: Collective selection of carbon classes via **K2** allocations determines the protocol's execution capacity for carbon intake and retirement operations for a given class. Higher capacity allocations increase the system's ability to process additional carbon activity without materially altering the execution terms, as defined by **kVCM** allocations.

Both tokens support the operation of the infrastructure, with **kVCM** informing execution terms, and the **K2** token modulating capacity.

2.3.4 Base Accrual and Incentives

The protocol issues tokens to participants who provide services necessary for system operation.

1. **kVCM Base Accrual**

   A base accrual of **kVCM** tokens is continuously emitted to:

   - Time-locked **kVCM** positions.

2. **kVCM Incentives**

   kVCM incentives are continuously emitted to:

   - User-locked **K2** poositions.
   - Both **kVCM** and **K2** liquidity providers.

   The number of **kVCM** tokens emitted as **kVCM** incentives is proportional to (but never higher than) the number of **kVCM** tokens emitted as base accrual.

3. **K2 Incentives**

   Depending on overall system balances, the supply of **K2** tokens is programmatically allocated at various rates to:

   - Time-locked **kVCM** positions.
   - User-locked **K2** positions.
   - Both **kVCM** and **K2** liquidity providers.

2.3.5 Token Initialisation

There is an initial issuance of tokens at the genesis of Klima 2.0. All future emissions are distributed autonomously via carbon swaps and incentives.

Token	Supply	Notes
kVCM	20 million	• Supply expands and contracts programmatically in response to carbon intake and retirement activity. • New tokens are emitted continuously as base accrual and incentives. • A portion of the initial supply is allocated to existing KLIMA holders.
K2	100 million	• Fixed supply. • Distributed programmatically over time, with a portion allocated to existing KLIMA holders.

Table 1: Token Summary

2.4 Participants

1. **Carbon Suppliers & Retirees**

   Participants may supply or retire eligible, tokenised carbon credits to the protocol at quoted execution terms. Supplied credits are handled solely for retirement and cannot be withdrawn, transferred, resold or otherwise arbitraged.

   Carbon inventory: Indicative execution terms for suppliers and retirees are continuously updated based on protocol state.

2. **Liquidity Providers**

   Participants may provide liquidity in supported token pairs to facilitate entry and exit from the system. Liquidity provision supports continuous execution and is incentivised according to predefined protocol rules.

   Staked liquidity: Protocol incentives may be issued for participants providing liquidity to support system operation.

3. **Coordinators**

   Participants may influence execution conditions by allocating **kVCM** and **K2** tokens within predefined protocol parameters.

   Time locks & user locks: Protocol incentives may be issued for those contributing activities that coordinate the protocol and signal long-term participation.

2.5 Protocol Design Principles

1. **Infrastructure, Not Extraction**:

   Klima 2.0 is designed as shared market infrastructure rather than an extractive financial product. The protocol does not charge fees, take hidden spreads, or operate profit-taking mechanisms for any sponsor, foundation, or investor. Standard trading fees charged by external automated market makers and venues are separate from, and not controlled by, the protocol.

   Design intent: Reduce opaque intermediation and hidden margins common in carbon markets, not replace them with a new rent-seeking intermediary.

2. **Consumption-only Carbon Access**:

   Carbon credits handled by the protocol are not exposed for resale, speculation, or secondary trading. Once accepted by the protocol, credits may only be accessed for irreversible retirement through protocol-defined processes.

   Design intent: Align the system with carbon's end use (retirement), rather than treating credits as financial instruments.

3. **Coordination Through Signalling**:

   Protocol tokens do not represent ownership of carbon, claims on protocol-held assets, or entitlement to surplus value. Instead, tokens function as signalling and coordination inputs that influence protocol parameters (such as execution conditions and capacity) within predefined bounds.

   Design intent: Enable decentralised coordination in a complex and competitive environment.

4. **Autonomous, Rules-based Operation**

   All core economic behaviour is governed by deterministic smart contracts. Once deployed, the system's day-to-day operations are autonomous and do not rely on discretionary decisions by any individual, committee, or organisation. Any material upgrades or migrations of the protocol implementation will be publicly disclosed and applied uniformly to all participants.

   Design intent: Build a trustless, auditable system, that is not based on subjective, opaque intervention.

5. **Equal Access and Uniform Treatment**

   All on-chain interactions with the protocol (carbon intake, retirement, locking, liquidity, incentives) occur on identical terms for all users. While initial token allocations differ by cohort (see Section 4), no cohort receives preferential execution, pricing, or fee treatment within the protocol.

   Design intent: Ensure credibility, neutrality, and resistance to capture.

6. **Market-driven Outcomes, Not Managed Returns**

   Any economic effects associated with protocol participation arise solely from predefined rules and participant interaction with the system. The protocol does not manage assets on behalf of users, target returns, or seek to optimise outcomes for any class of participant.

   Design intent: Enable transparent market coordination without positioning the protocol as an asset manager or investment vehicle.

3 Core Protocol Mechanics

From this section we refer to **kVCM** tokens as **A**, **K2** tokens as **G**, USDC tokens as **Q**, carbon credits as **C**, and carbon retirement certificates as **C***.

Three types of mechanics enable the Klima Protocol to find equilibrium through continuous, rule-based feedback mechanisms representing system state (supply, demand, coordinator allocations).

1. **Time-locking mechanics**: **A** token holders can time-lock their tokens until a set date to have the ability to select carbon classes for inventory weighting.

   - The collective time locks define the base accrual curve.

2. **Carbon inventory mechanics**: the protocol swaps **A** for carbon credits **C** (in) or carbon retirement certificates **C*** (out).

   - Both allocations of time-locked **A** tokens and user-locked **G** tokens are used in the protocol: allocations of **A** determine the execution terms of carbon, and allocations of **G** determine capacity.

3. **Liquidity mechanics**: External liquidity pools enable conversion between **kVCM** and supported settlement assets. Liquidity provision supports system availability and may make participants eligible for protocol incentives.

   - $\overline{\mathbf{AG}}$ liquidity pool: Native token swap **A** and **G**.

   - $\overline{\mathbf{AQ}}$ liquidity pool: The asset token **A** with USDC **Q**.

The Klima system enables each participant to contribute to various aspects of the model, according to their own interests and preferences. This, in conjunction with the autonomous model, enables the protocol to fulfil continuous carbon retirement activity within the carbon markets.

3.1 Time-locking Mechanics

Time-locking **A** tokens represents a commitment to protocol participation for a fixed duration. Lock durations are standardised at 90-day increments and expire on a rolling schedule. There are always 40 durations, extending out to approximately 10 years.

- **Discount curve**: Aggregate time-locking determines the shape of the discount curve of the **A** token.
- **Incentives**: Time-locked **A** tokens receive base accrual. Base accrual is calculated daily based on time-locked positions.
- **Locks**: Time-locked tokens and any associated base accrual are released only upon time-lock expiration. Early exit is not possible.

G tokens are not involved in the time-locking mechanics. The discount curve is agnostic to carbon class although only time-locked **A** token holders can allocate their tokens to carbon classes for inventory weighting.

3.1.1 Base Accrual

Defining:

- S: Total time-locked **A** tokens expressed as a proportion of the outstanding supply of **A**.
- S_t: Total **A** tokens time-locked in bucket t, expressed as a proportion of the outstanding supply of **A**, where $\sum S_t = S$, and t is the index of standard durations $t \in \{1, 2, 3, \ldots, 40\}$.
- E_t: Duration expressed in years.

Calculating curve parameters D and C:

$$D = \frac{1}{S} \sum_{t=1}^{40} S_t \, E_t \tag{1}$$

$$C = \frac{1}{S} \sum_{t=1}^{40} S_t \, E_t^2 \tag{2}$$

The shape of the base accrual curve is produced:

$$\gamma_t = \max \left(\frac{E_t}{D} - \frac{E_t^2}{2\,C}, 0 \right) \tag{3}$$

Normalising γ_t to $\hat{\gamma}_t$:

$$\hat{\gamma}_t = \frac{\gamma_t}{\sum_{t=1}^{40} \gamma_t} \tag{4}$$

With the cumulative sum of the normalised values expressed as Γ_t:

$$\Gamma_t = \sum_{i=1}^{t} \hat{\gamma}_i \quad \text{for } t = 1, \ldots, 40 \tag{5}$$

The base accrual curve Z_t is solved:

$$Z_t = (1 - S)\,\frac{\Gamma_t}{E_t} \tag{6}$$

Whereupon, the discount rate B_t that forms the discount curve is derived:

$$B_t = \exp(-Z_t\, E_t) \tag{7}$$

The accrual of time-locked **A** tokens is calculated daily and added to the locked balance, hence the daily accrual for each duration is calculated:

$$Y_t = \exp\left(\frac{Z_t}{365}\right) - 1 \tag{8}$$

Hence, any time-locked **A** stake S_t will increase daily by ΔS_t:

$$\Delta S_t = S_t\, Y_t \tag{9}$$

With the total **A** tokens created on a daily basis, or 'growth', as

$$R = \sum_{t=1}^{40} \Delta S_t \tag{10}$$

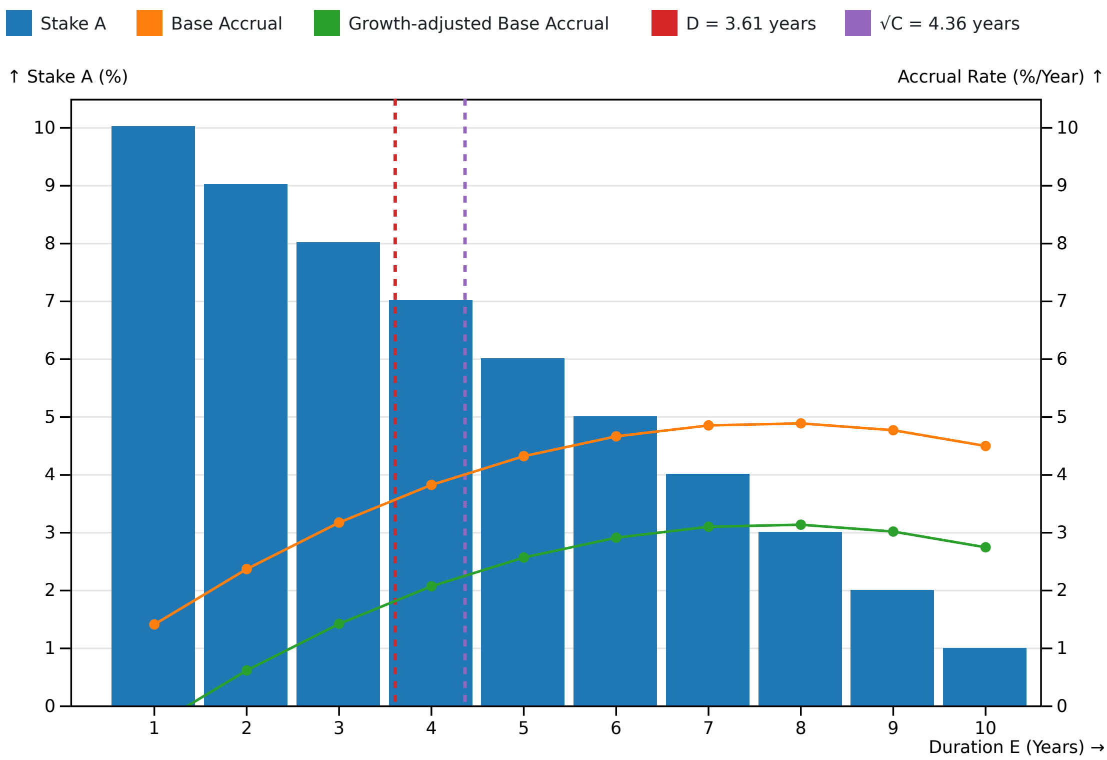
For visualising the sensitivity of overall **A** base accrual with respect to staking and duration, Figure 5 assumes a single duration over the staking range to provide an approximation of growth $\Delta S \approx Z\, S$.

3.1.2 Protocol Coordination Voting Power

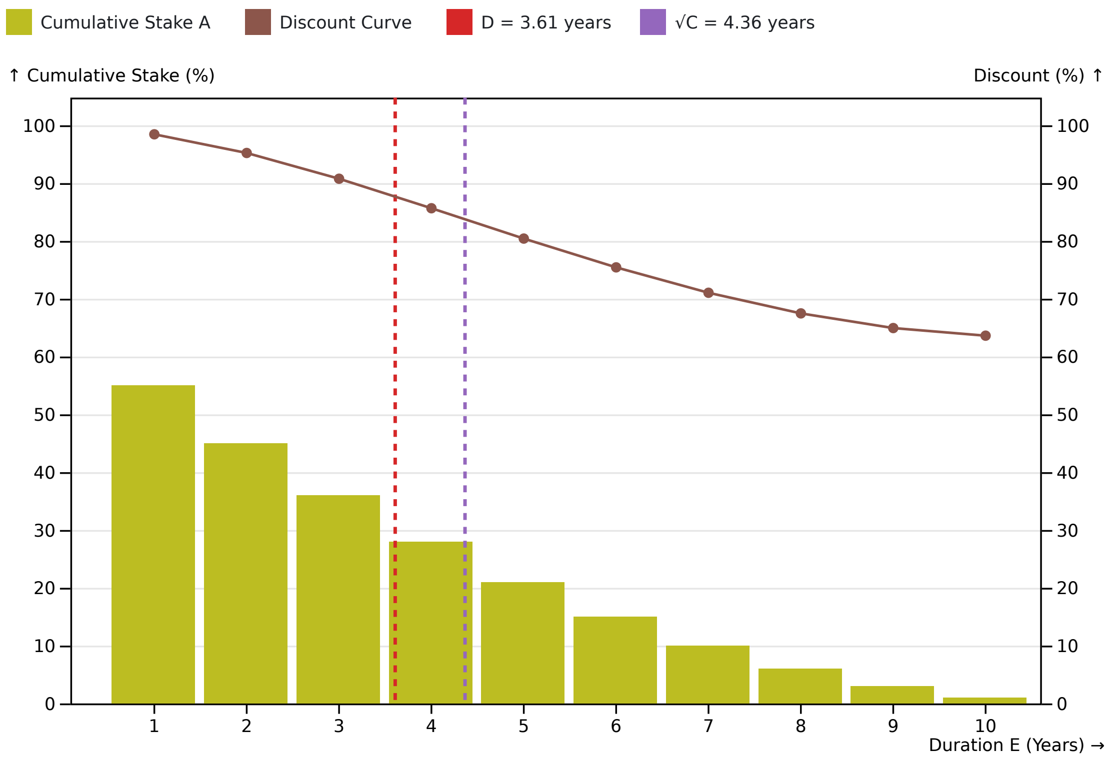
Protocol coordination voting power can be derived from two participation cohorts:

1. Time-locked **A** tokens: S_t
2. Staked liquidity in the **A**-**G** pair $\overline{\mathbf{AG}}$ (see Section 3.3), defined here as A_{Gt}, representing the quantity of **A** tokens held in the liquidity pool expressed as a proportion of circulating supply.

Voting power is allocated by lock or stake duration, and applied to the respective balance of **A** tokens:



(a) Base accrual (Total Stake = 55.00%, Growth = 1.75%/Year).



(b) Discount rates.

Figure 4: Example of base accrual.

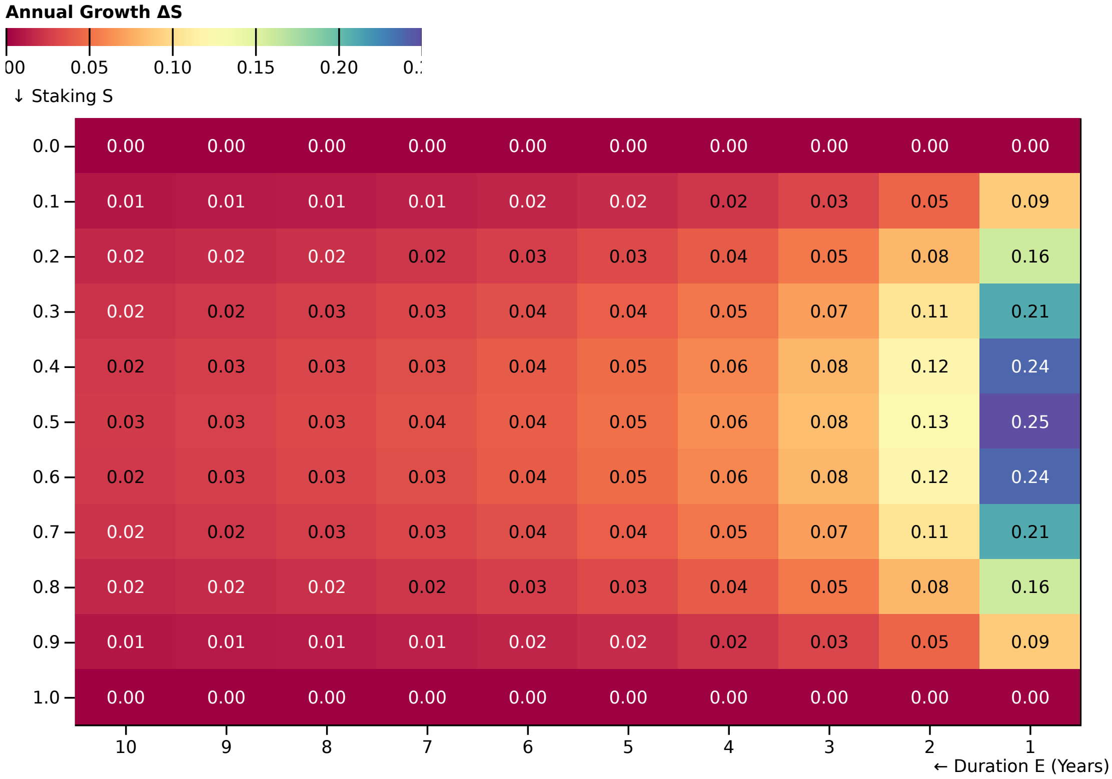


Figure 5: **A** annual growth rate ΔS from base accrual.

1. Voting weights for time-locked **A** tokens v_t:

$$v_t = Z_t\, S_t \tag{11}$$

2. Voting weights for staked liquidity w_t:

$$w_t = Z_t\, A_{Gt} \tag{12}$$

3. Voting power for time-locked **A** tokens V_t:

$$V_t = \frac{v_t}{\sum_{j=1}^{40}(v_j + 2w_j)} \tag{13}$$

4. Voting power for staked liquidity W_t:

$$W_t = \frac{w_t}{\sum_{j=1}^{40}\left(\frac{1}{2}v_j + w_j\right)} \tag{14}$$

3.2 Carbon Inventory Mechanics

The carbon inventory layer ultimately swaps carbon through a set of smart contracts, driven by carbon supply, demand, and user inputs. The combined allocations of **A** and **G** tokens create a dynamic real-time execution terms curve for each carbon class.

3.2.1 Carbon Supply

*User swaps carbon credits for **A** tokens.*

3.2.1.1 Existing Carbon in the Inventory

Both **A** tokens and **G** tokens may be allocated to specific carbon classes $i \in \{1, 2, 3, \ldots, n\}$ and these are independent allocations between the two tokens.

For a carbon class quantity to be supplied to the protocol, it must have a strictly positive quantity of **A** tokens allocated to that carbon class, otherwise there is no defined rate, and the carbon cannot be swapped.

Defining:

- C_i: Total tonnes of carbon class i currently held in the inventory.
- A_i: **A** tokens allocated to carbon class i expressed as a proportion of the outstanding supply of **A** tokens, where $\sum A_i = A$.
- G_i: **G** tokens allocated to carbon class i expressed as a proportion of the outstanding supply of **G** Tokens.

Where ΔC_i is expressed as the relative increment to its respective pool balance, the amount of **A** tokens issued for carbon, ΔA, expressed as a proportion of current supply, is determined as:

$$\ln(1 + \Delta A) = \left(A_i - \frac{A_i^2 \, (1 - G_i)^2}{2} \right) \ln(1 + \Delta C_i) \tag{15}$$

Denoting the expression on the right hand side of Equation 15 as RHS:

$$\Delta A = \exp(\mathsf{RHS}) - 1 \tag{16}$$

Finally, ΔA is applied to the outstanding supply of **A** to solve for token quantities.

Figure 8 illustrates the **G** token's capacity to maintain the initial execution terms of the **A** token. The data has been normalised in Figure 9 to $\Delta C_i \, A_i$.

Noting that the sensitivity to G_i increases as A_i increases and the effects become more pronounced as ΔC_i increases.

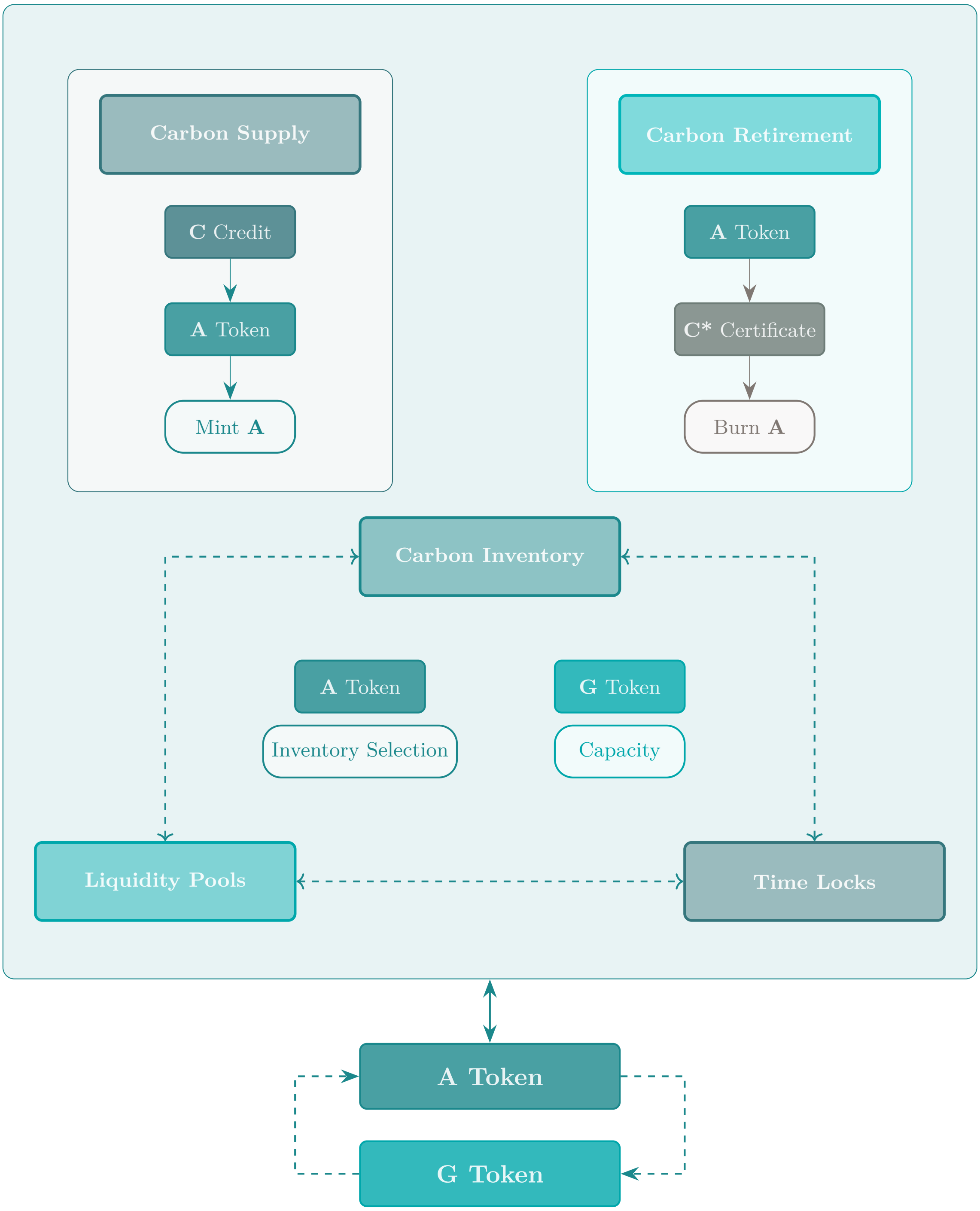


Figure 6: Klima 2.0 carbon inventory mechanics.

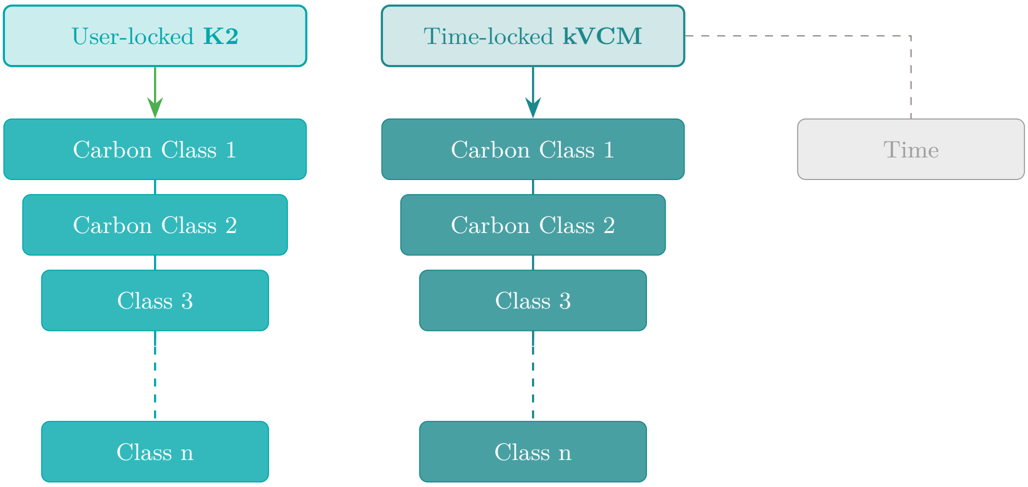


Figure 7: Token staking class structure.

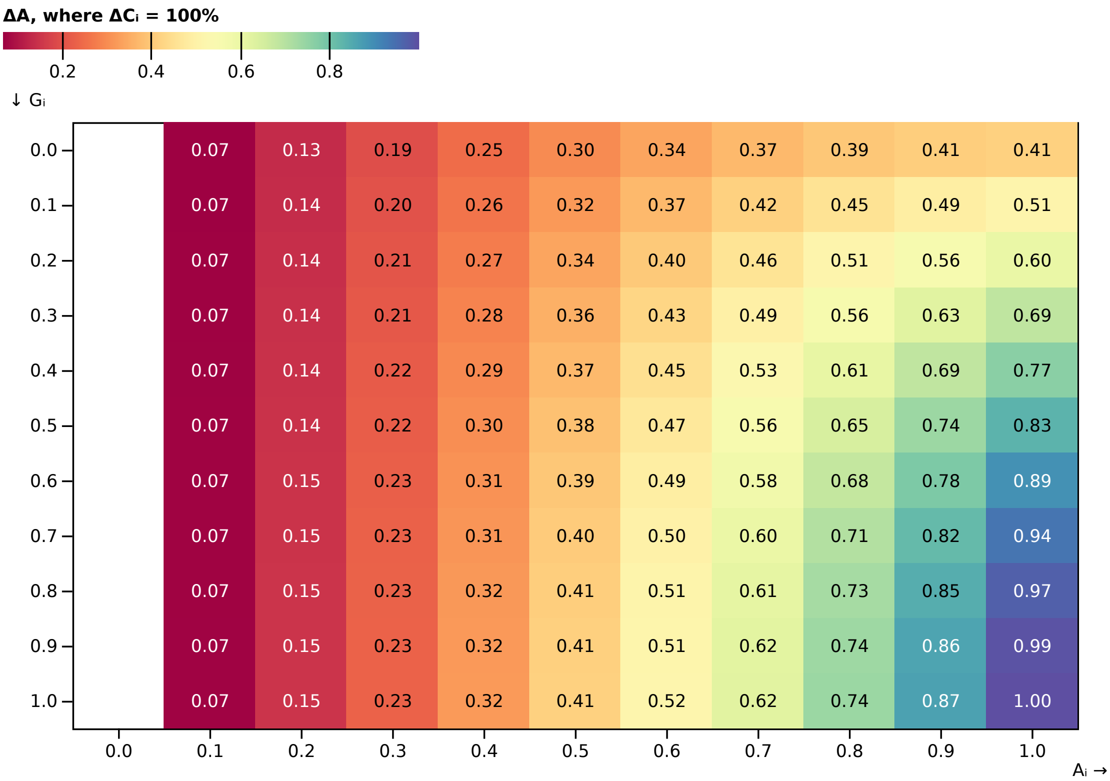


Figure 8: **A** price curves (ΔA).

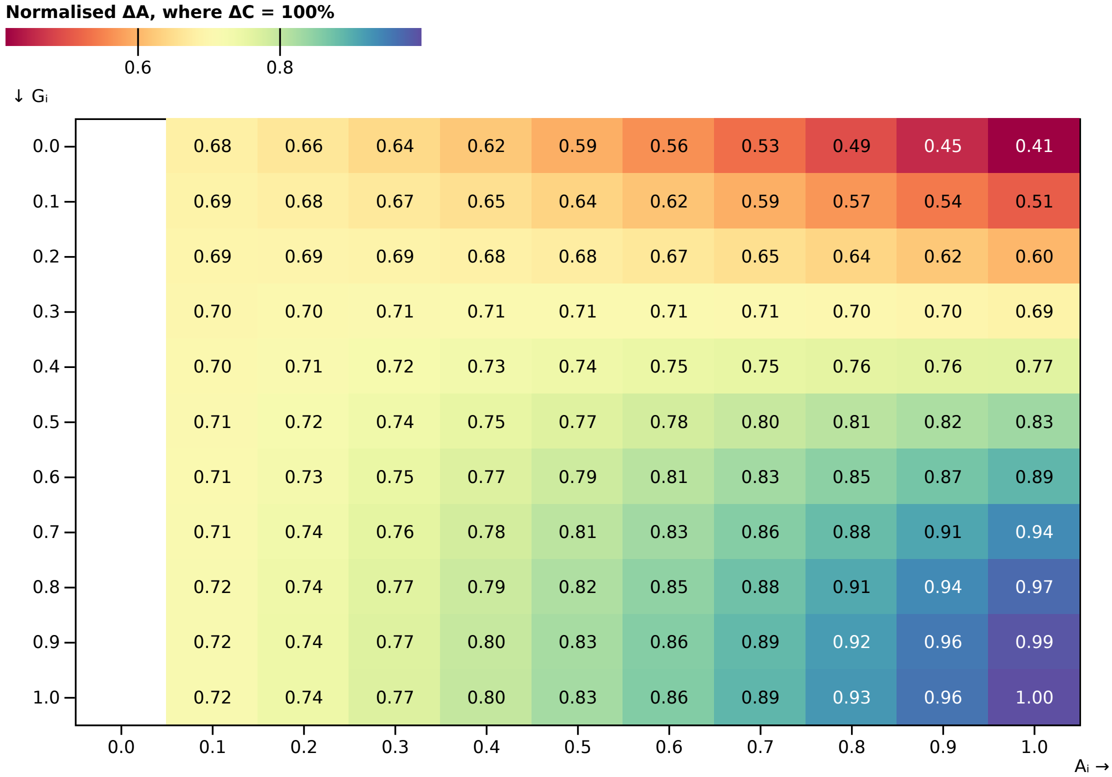


Figure 9: Normalised **A** price curves.

3.2.1.2 Zero Carbon Scenario

There are circumstances when there is zero carbon held in the inventory for a particular class, i.e. $C_i = 0$, which invalidates the calculation of ΔC_i and a different approach is required.

Taking $\Delta C_\emptyset$ as the tonnes of carbon tokens (implying an existing balance of 1 tonne) to be supplied for any carbon class that has a strictly positive **A** allocation $A_\emptyset$, together with **G** allocation $G_\emptyset$:

$$\Delta A = \frac{\Delta C_\emptyset}{1 + \Delta C_\emptyset} \left(A_\emptyset - \frac{A_\emptyset^2 (1 - G_\emptyset)^2}{2} \right)^2 \tag{17}$$

3.2.2 Carbon Credit Retirements

*User swaps **A** tokens for carbon retirement certificates.*

3.2.2.1 Weighted Carbon Class

For retiring carbon that is *weighted*, that is for which there is a strictly positive **A** token allocation, an **A** token holder can extract the carbon class retirement certificate of their choice C_i:

$$\ln(1 + \Delta C_i) = \frac{-\ln(1 + \Delta A)}{A_i + \frac{1}{2} A_i^2 \, (1 - G_i)^2} \tag{18}$$

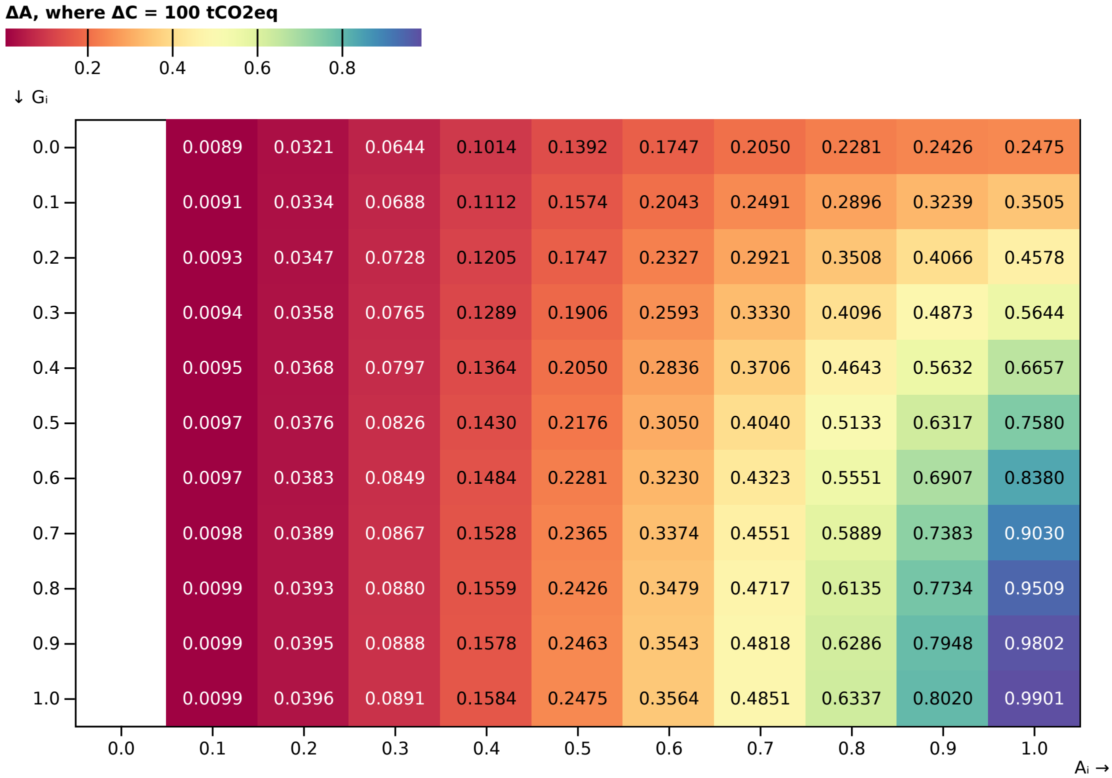


Figure 10: **A** price curves (ΔA) in the zero carbon scenario.

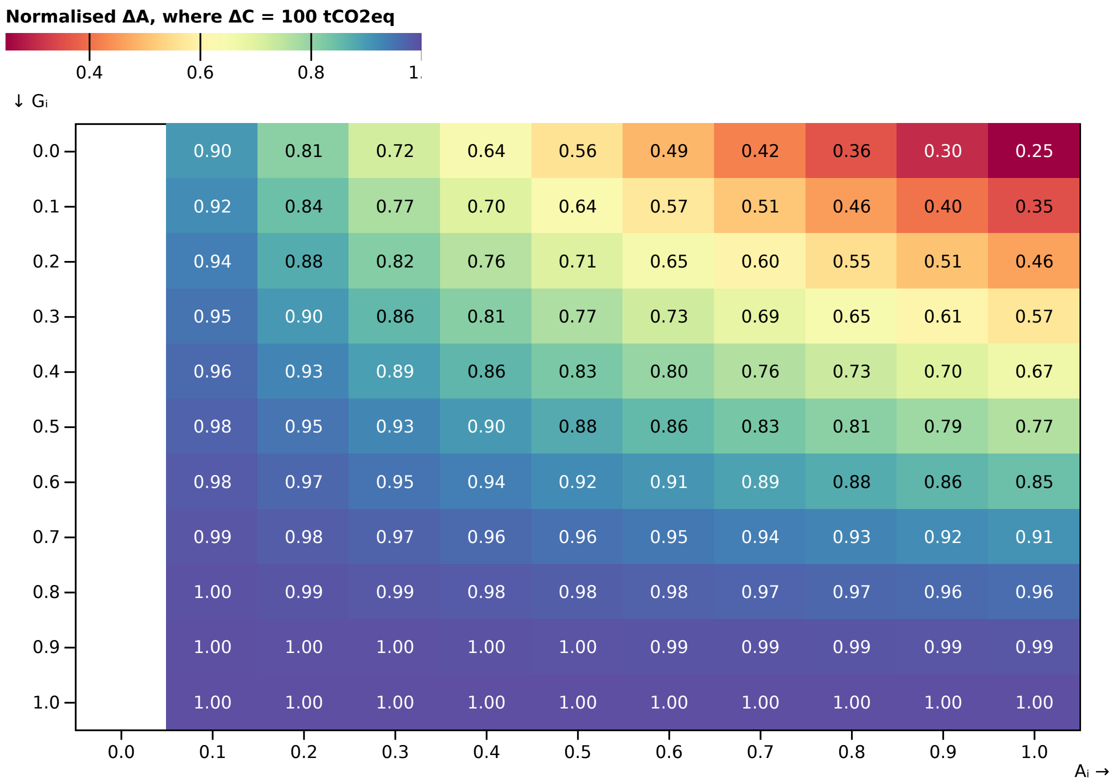


Figure 11: Normalised **A** price curves in the zero carbon scenario.

As before, denoting the expression on the right hand side of Equation 18 as RHS:

$$\Delta C_i = \exp(\mathsf{RHS}) - 1 \tag{19}$$

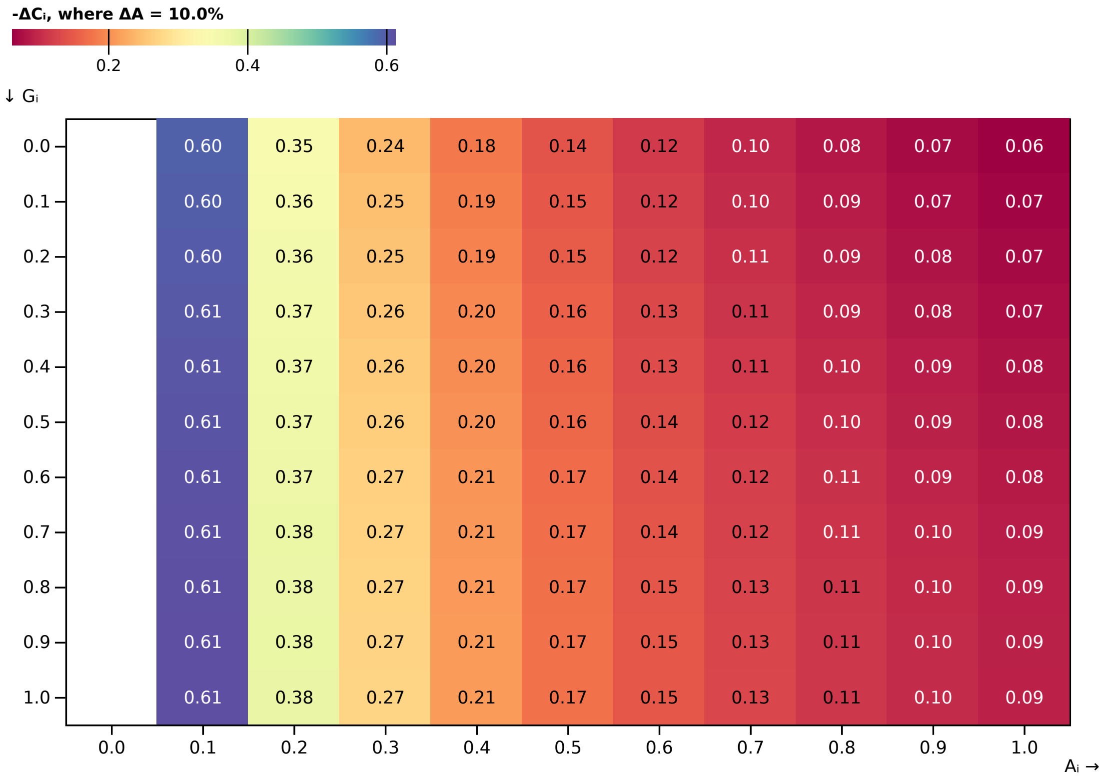


Figure 12: Proportion of carbon retired.

Figure 12 shows the cost of carbon increasing with A_i and decreasing with G_i.

3.2.2.2 Unweighted Carbon Class

A retirement certificate for a carbon class with a zero **A** allocation cannot be extracted from the inventory by swapping in **A** tokens.

3.2.2.3 Round Trip Difference

Any difference between the **A** tokens issued in connection with carbon intake and the **A** tokens burnt in connection with retirement is reflected solely as a change in the circulating supply of **A** tokens, according to the above protocol rules. No margin, profit, or financial surplus is retained or extracted by the protocol or any privileged entity.

Figure 13 below shows the difference captured on a 'round trip' by the system where ε is the proportion retained:

Figure 14 shows the component difference contributions on a carbon supply and purchase round trip of a carbon retirement certificate.

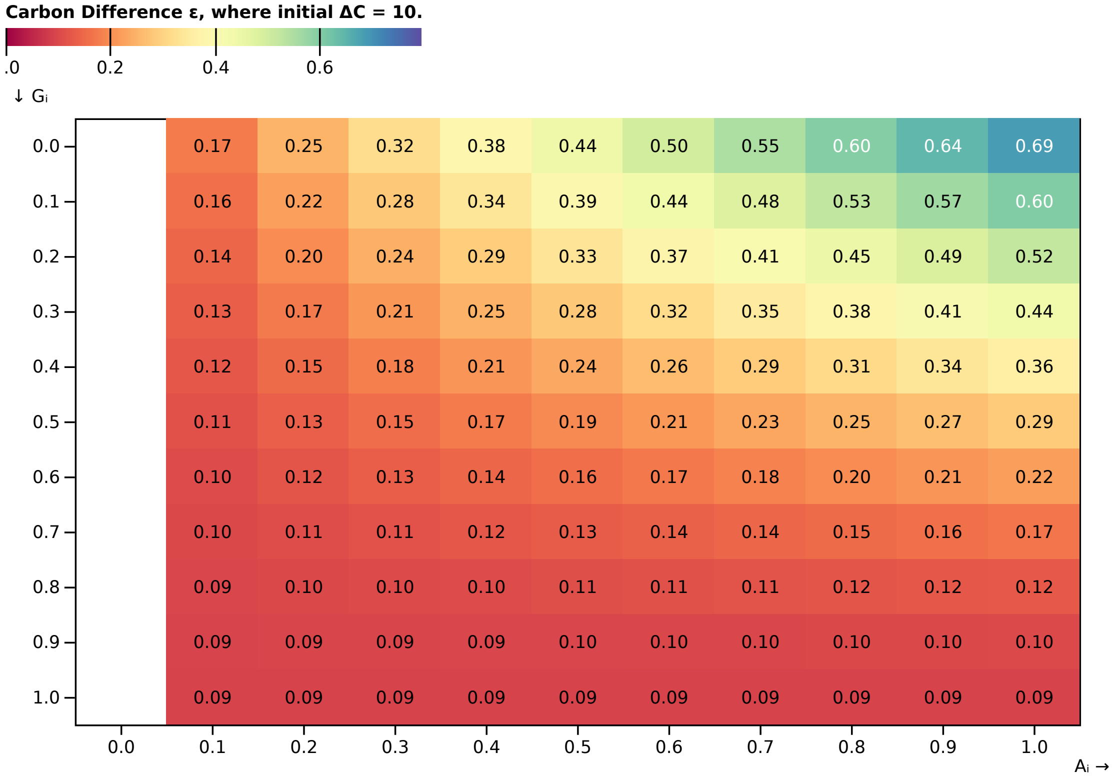


Figure 13: Carbon ‘difference’.

3.3 Liquidity Mechanics

Both **A** and **G** tokens can be used for providing liquidity.

There are two core liquidity pools:

1. An AMM 50:50 pairing of **A** and **G** tokens: pool $\overline{\mathbf{AG}}$.
2. A hard currency USDC denoted as **Q** paired with **A**: pool $\overline{\mathbf{AQ}}$.

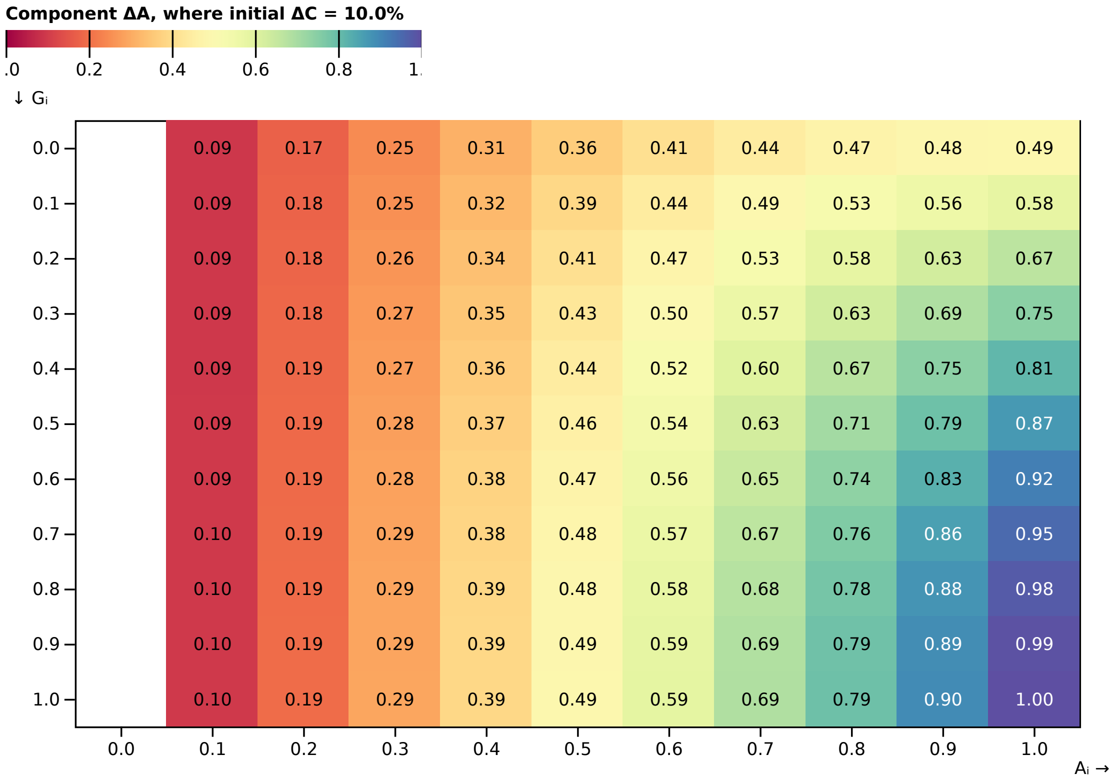
3.3.1 Liquidity Fees

The $\overline{\mathbf{AQ}}$ pool will have its own set of fees in the standard way.[1]

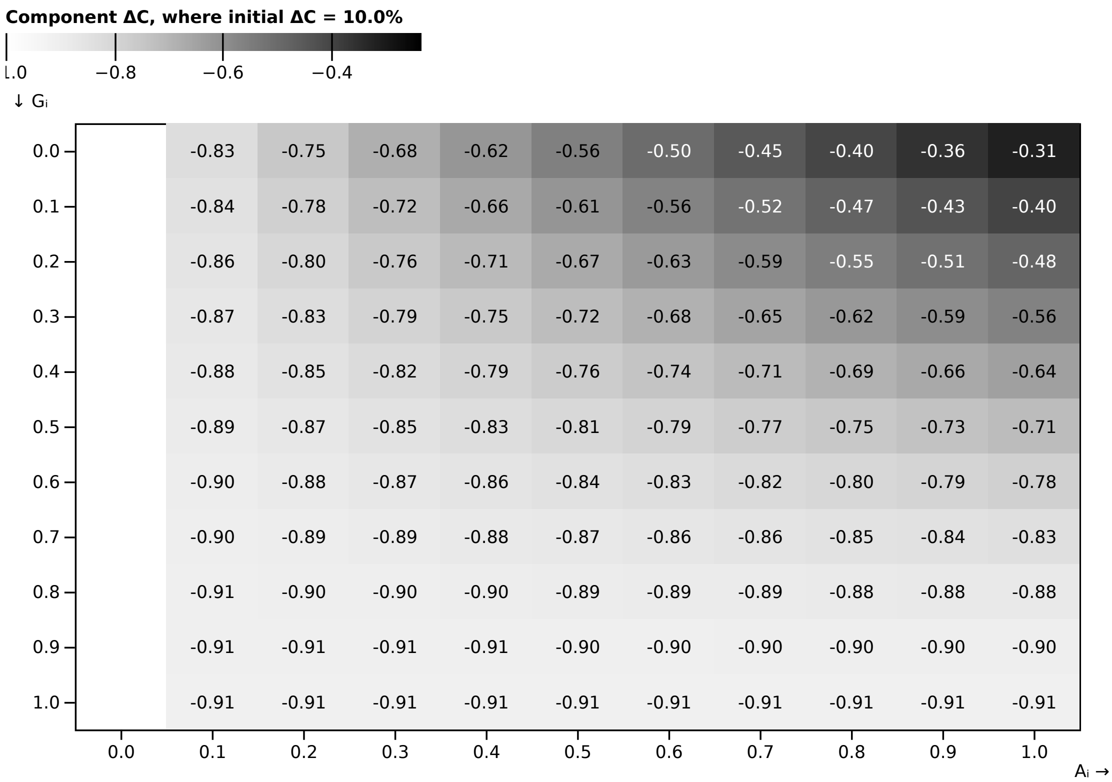
The $\overline{\mathbf{AG}}$ pool has different economics as the assets are highly correlated since they represent the same economy. For this reason, the fees are extremely low.

By staking liquidity (liquidity provider tokens) to the **standard durations**, both pools may receive a distribution of **A** tokens determined from Section 3.3.2 below. This is an additional primary issuance to the Base Accrual already discussed.

[1]Note the development of liquidity pool pricing functionality may be applicable.



(a) Carbon ‘difference’ component ΔA.



(b) Carbon ‘difference’ component ΔC.

Figure 14: Carbon ‘difference’ components.

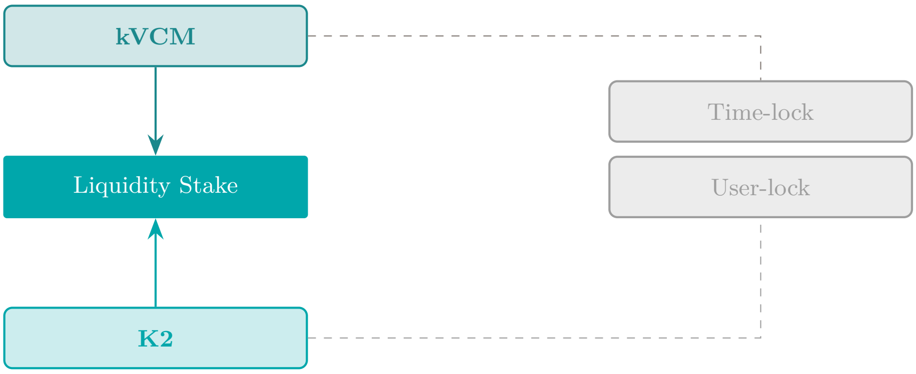


Figure 15: Token liquidity and execution structure.

3.3.2 kVCM Incentives

In addition to the base accrual mechanism, **kVCM** incentives are distributed to user-locked **G** token holders and staked liquidity providers of **A** and **G** tokens.

As we have seen, a higher allocation of **G** tokens, G_i, for a carbon class increases the protocol's capacity to process additional carbon activity without materially altering the execution terms. As a consequence, the relationship between the carbon class selected under G_i and the **A** strengthens. If we consider G_i as an estimate of residual or idiosyncratic sensitivity in the carbon class, we can calculate an inventory beta β from the implied betas of each carbon class i.

$$\beta = \sqrt{\sum_{i=1}^{n} A_i - A_i\,(1 - G_i)^2} \tag{20}$$

The inventory β determines a sensitivity factor for the liquidity pools of **A**.

For intuition, the map in Figure 16 shows the various outputs of the function per carbon class.

The table and figure below show an example of the effects on β of allocating large G_i values to small A_i values where the shift in G_i results in a lower β (0.27 from 0.55) with no change to total **G** and **A** allocations.

Class	1	2	3	4	β
A_i	0.50	0.20	0.10	0.05	
Initial G_i	0.30	0.10	0.05	0.01	
Initial β_i^2	0.2550	0.0380	0.0098	0.0010	0.5511
New G_i	0.01	0.05	0.10	0.30	
New β_i^2	0.0100	0.0195	0.0190	0.0255	0.2719
ΔG_i	(0.29)	(0.05)	0.05	0.29	
$\Delta \beta_i^2$	(0.2451)	(0.0185)	0.0092	0.0245	

Table 2: Effect on β from outsized **G** allocation.

Figure 17 shows the effect of **G** allocation on β as a function of **A** allocation; that is to say that a large G_i stake on a small A_i stake has limited effects (notwithstanding other consequential factors).

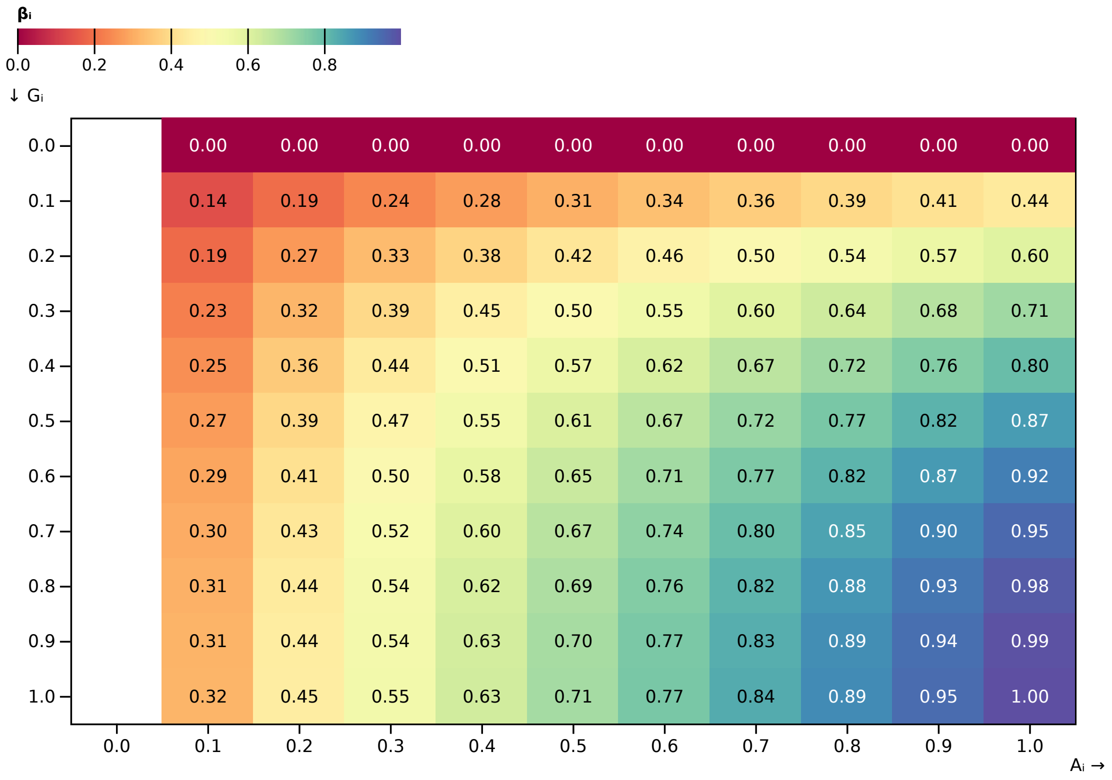


Figure 16: Range of β_i.

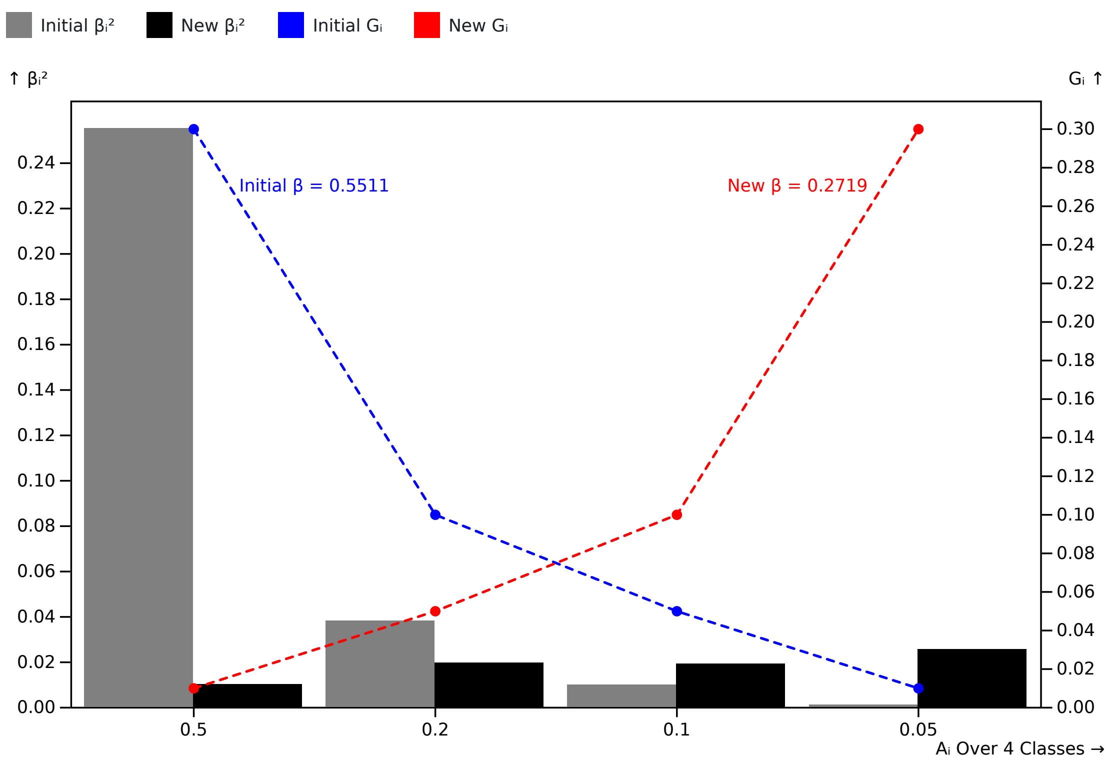


Figure 17: Example of $\mathbf{G}$ allocation on β.

3.3.3 Allocation of kVCM incentives

The full issuance of **A** tokens is depicted below, including now the **A** incentives for the liquidity pools.

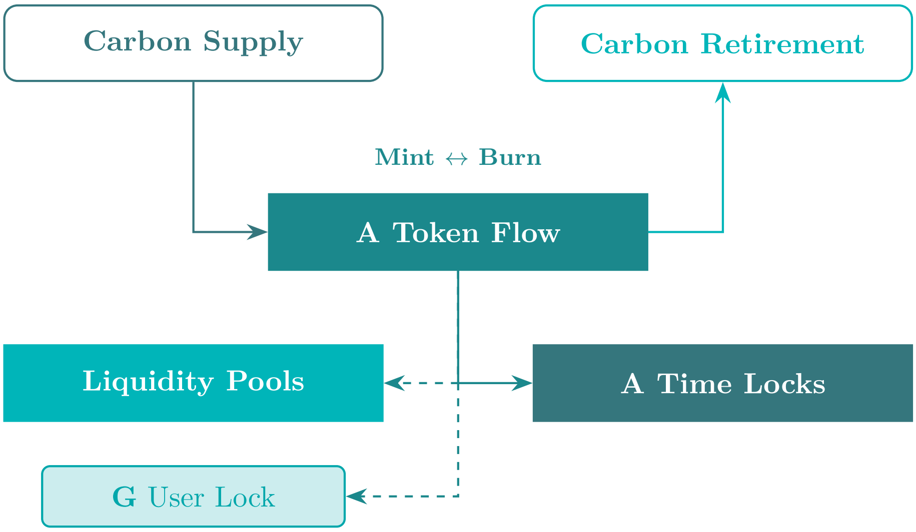


Figure 18: **A** token flow structure.

3.3.4 Share of kVCM incentives

The **kVCM** incentives are shared between user-locked **G** tokens, $\overline{\mathbf{AG}}$. and $\overline{\mathbf{AQ}}$ pools, with shares λ_{GG}, λ_G, and λ_Q respectively.

Defining:

- G_G: Total **G** tokens in the $\overline{\mathbf{AG}}$ pool, expressed as a proportion of the outstanding supply of **G**.
- A_G: Total **A** tokens in the $\overline{\mathbf{AG}}$ pool, expressed as a proportion of the outstanding supply of **A**.
- A_Q: Total **A** tokens in the $\overline{\mathbf{AQ}}$ pool, expressed as a proportion of the outstanding supply of **A**.

The allocation to user-locked **G** tokens, λ_{GG}:

$$\lambda_{GG} = \frac{1 - A_Q}{1 + \left(\frac{\sum_{i=1}^{n} G_i}{G_G}\right)^2} \tag{21}$$

Noting the relationship between G and β, and particularly if $G = 0$, $\beta = 0$.

The residual share, $1 - \lambda_{GG}$, is split between the liquidity pools:

$$\lambda_G = (1 - \lambda_{GG}) \frac{2A_G}{2A_G + A_Q\sqrt{2}} \tag{22}$$

For completeness:

$$\lambda_Q = 1 - \lambda_{GG} - \lambda_G \tag{23}$$

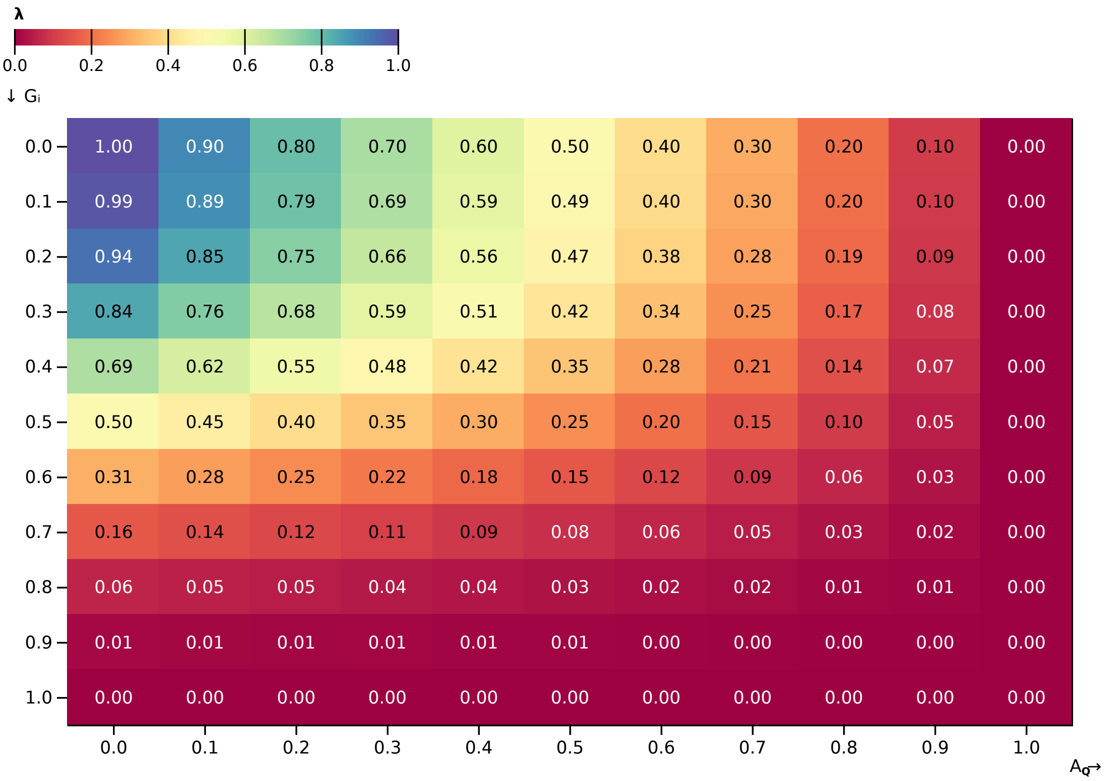


Figure 19: **G** stake allocation (assuming $G_G = 1 - G_i$).

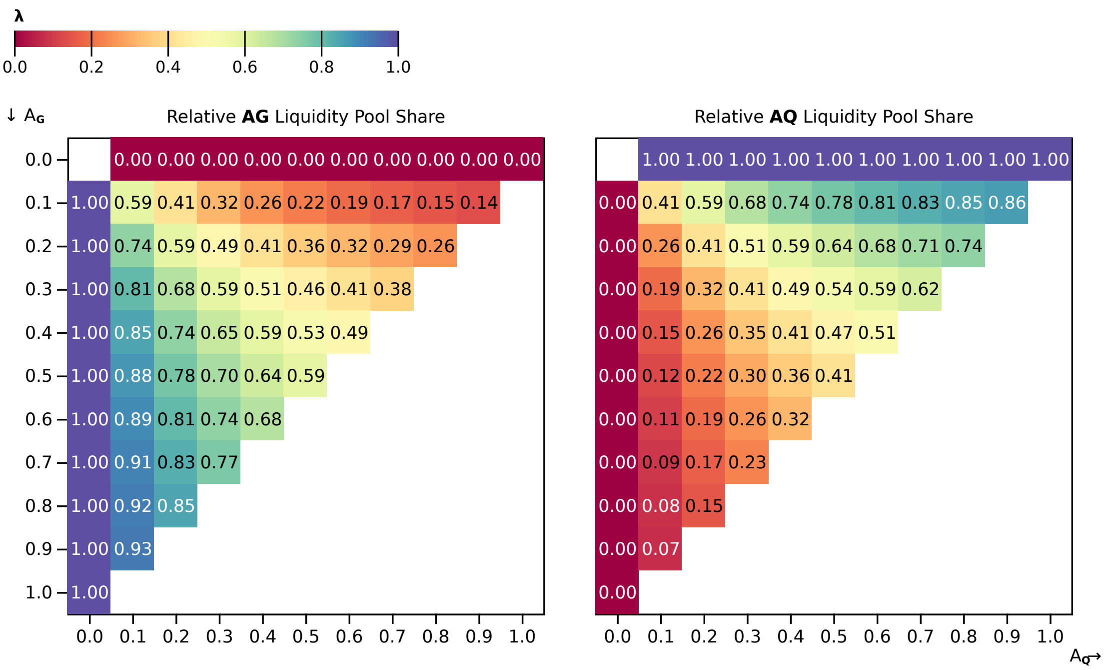


Figure 20: Liquidity pool split λ_G, λ_Q.

3.3.5 kVCM Incentives Distribution

For λ_{GG}, λ_G, λ_Q we apply β:

$$\Lambda_X = \lambda_X \, \beta, \quad \text{for } X \in \{GG, G, Q\} \tag{24}$$

Taking b as a discount parameter:

$$b = \frac{\sum_1^{40} Z_t \, S_t \, B_t}{\sum_1^{40} Z_t \, S_t} \tag{25}$$

The total **kVCM** incentive tokens R_λ:

$$R_\lambda = b \, R \, (\Lambda_{GG} + \Lambda_G + \Lambda_Q) \tag{26}$$

The allocations of R_λ are pro-rata to Λ_{GG}, Λ_G, Λ_Q, and thereafter:

1. Locked **G**: Λ_{GG} in proportion to **G**.
2. Locked $\overline{\mathbf{AG}}$, $\overline{\mathbf{AQ}}$ tokens are allocated a weighting G_t, Q_t depending on their time bucket t:

$$G_t = \frac{Z_t \, L_{Gt} \, B_t}{\sum Z_t \, L_{Gt} \, B_t} \tag{27}$$

$$Q_t = \frac{Z_t \, L_{Qt} \, B_t}{\sum Z_t \, L_{Qt} \, B_t} \tag{28}$$

Where L_{Gt}, L_{Qt} are the proportion of all liquidity locked in each time bucket for $\overline{\mathbf{AG}}$ and $\overline{\mathbf{AQ}}$ respectively.

Thereafter each time bucket allocation is proportionate to staked liquidity provider token holdings.

4 Klima 2.0 Token Distribution

4.1 Planned Allocations

Cohort	Proportion	Quantity (m)
Klima Holders	87.5%	17.5
DAO/Treasury	10.0%	2.0
01X	2.5%	0.5
Total	**100.0%**	**20.0**

Table 3: **kVCM** token.

Cohort	Proportion	Quantity (m)	Liquidity
Klima Holders	40.0%	40.0	Logistic Vesting 48 months
Ecosystem Grant	5.0%	5.0	Logistic Vesting 48 months
Programmatic Incentives	40.0%	40.0	Incentive Curve
pKlima Holders	3.0%	3.0	Logistic Vesting 48 months
DAO/Treasury	4.5%	4.5	24 month locked LP of $\overline{\mathbf{AG}}$
01X	2.5%	2.5	24 month locked LP of $\overline{\mathbf{AG}}$
Product Design and Development	5.0%	5.0	Logistic Vesting 48 months
Total	**100.0%**	**100.0**	

Table 4: **K2** token.

4.2 Programmatic Incentive Curve

The incentive issuance is built on a logistic function, P, to generate total proportion of supply in issue. It is calibrated from the initial issuance at TGE P_0 and the inflection point time T where 50% of **G** token incentives have been released.

Setting x_0 from the initial supply parameter:

$$x_0 = \ln\left(\frac{P_0}{1-P_0}\right) \tag{29}$$

With x_t at time point $t \in (0, \infty)$:

$$x_t = x_0\left(1 - \frac{t}{T}\right) \tag{30}$$

Giving supply function $\mathrm{P}(t)$ as:

$$\mathrm{P}(t) = \frac{\exp(x_t)}{\exp(x_t)+1} \tag{31}$$

P_0 set at 7% and T at 24 months:

4.3 Share of K2 Incentives

The **relative utilisation** measurement factor υ is calculated as follows.

Defining initially:

- G: Total **G** tokens staked expressed as a proportion of the circulating supply, $G \in [0, 1]$.
- L: Total **G** tokens held in the $\overline{\mathbf{AG}}$ pool expressed as a proportion of circulating supply, $L \in (0, 1]$.

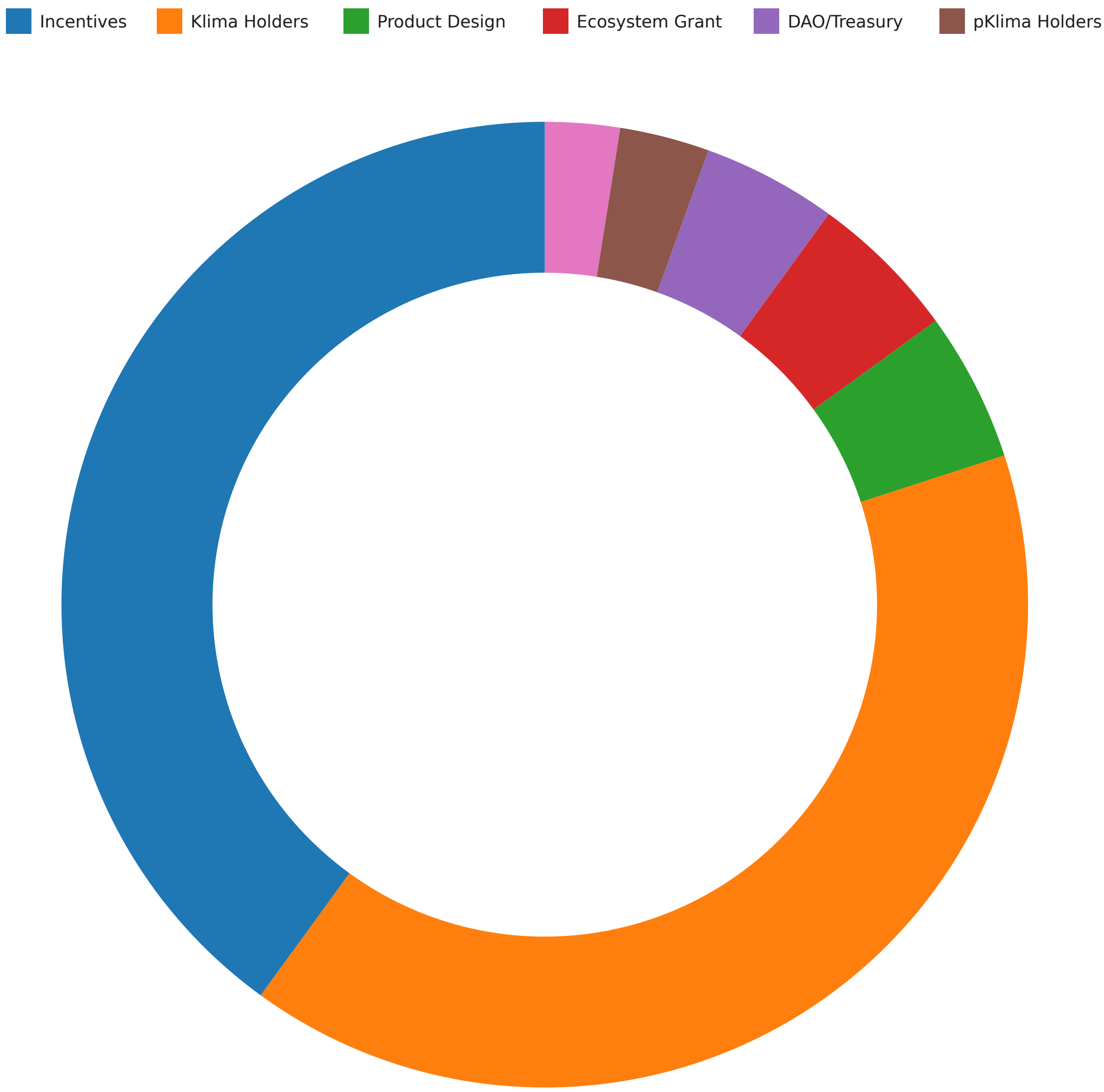


Figure 21: **K2** token allocations.

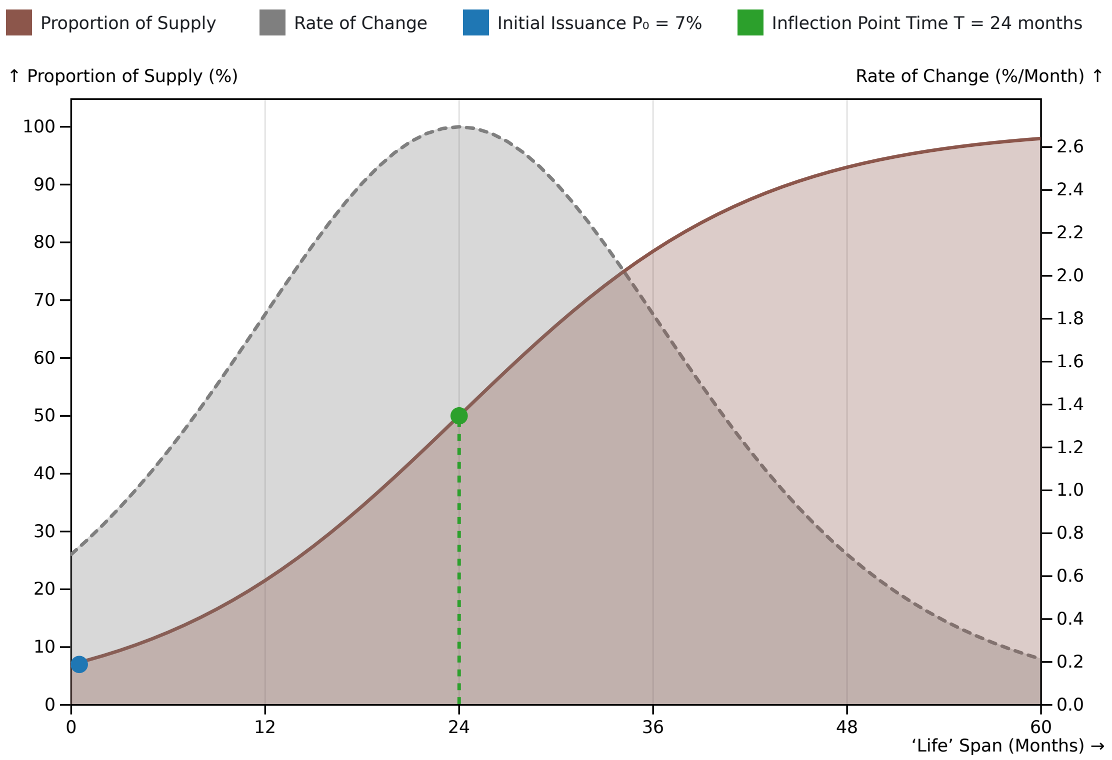


Figure 22: Incentive Issuance

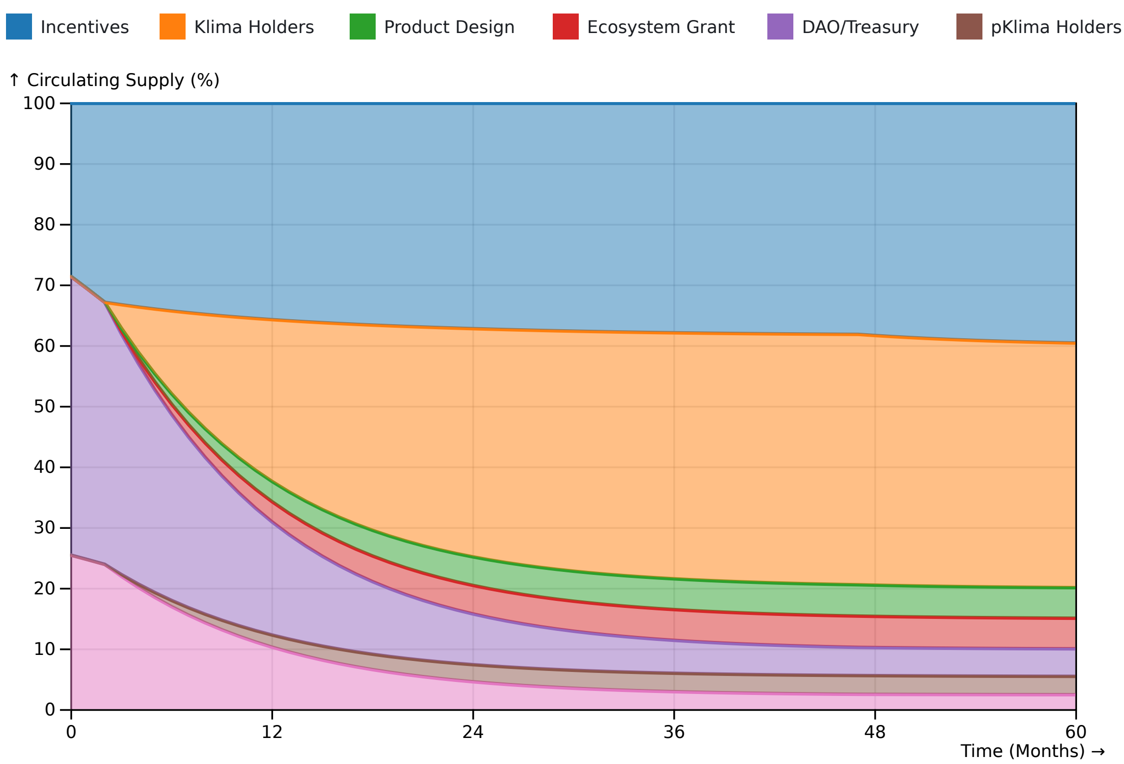
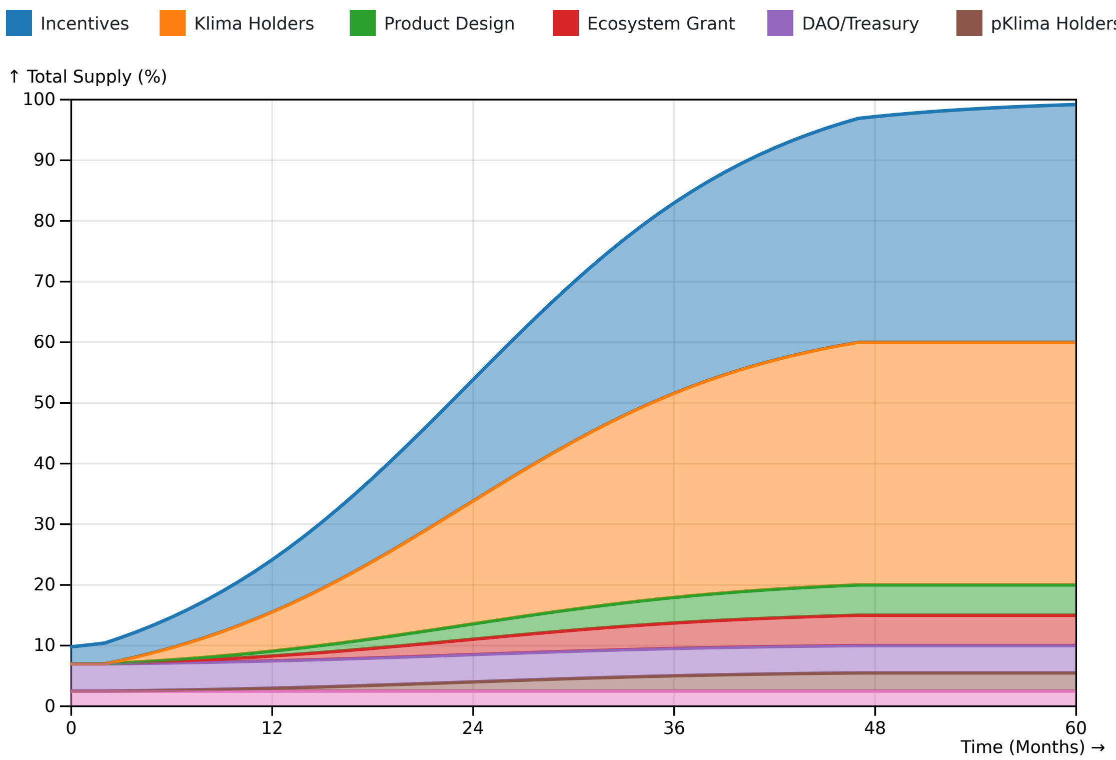
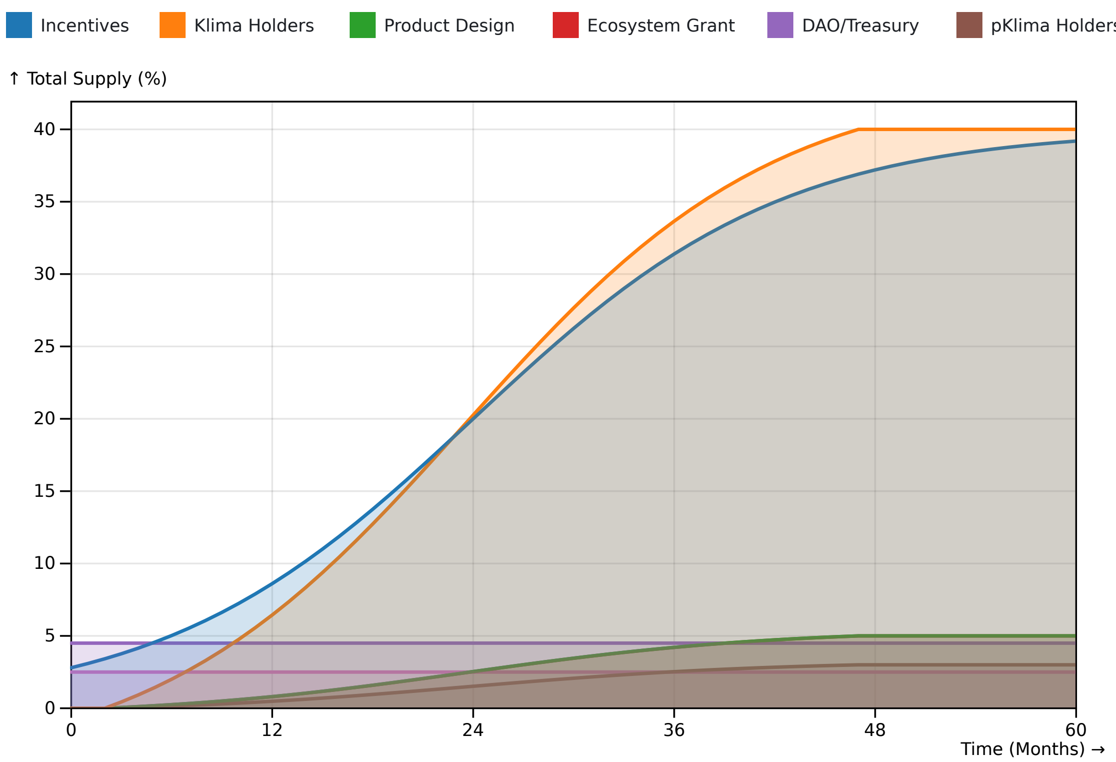


Figure 23: **K2** token circulating supply over time.



(a) Total supply (stacked).



(b) Total supply (unstacked).

Figure 24: **K2** token total supply over time.

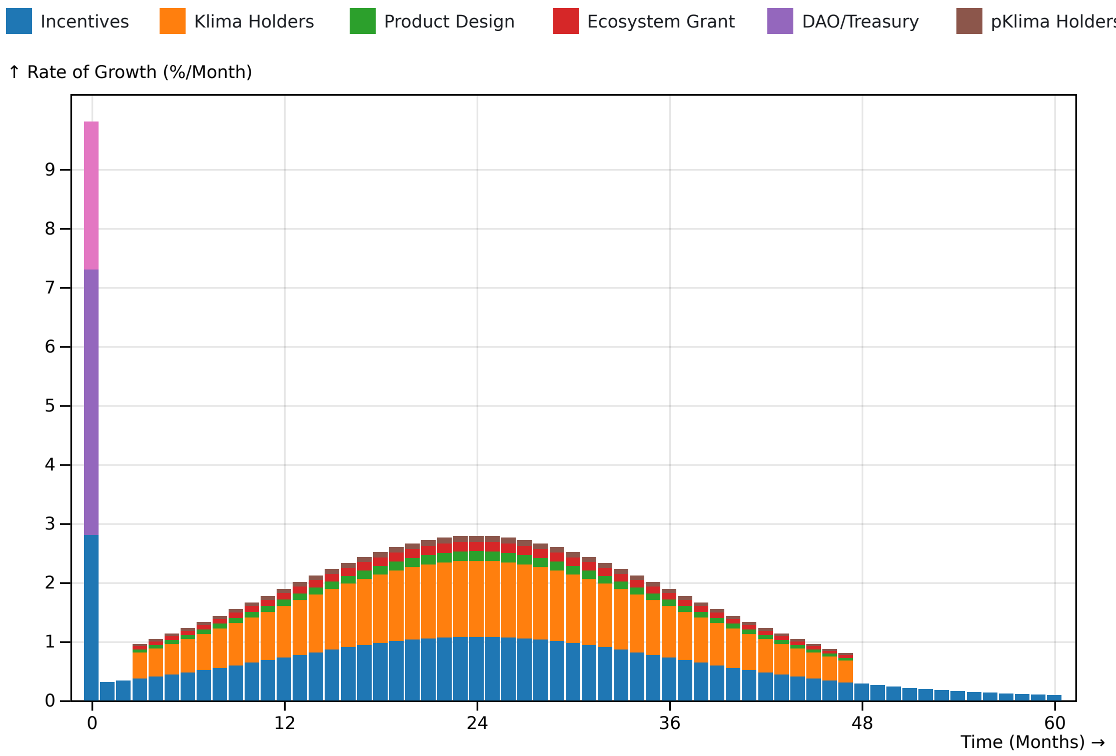


Figure 25: **K2** supply differential (stacked).

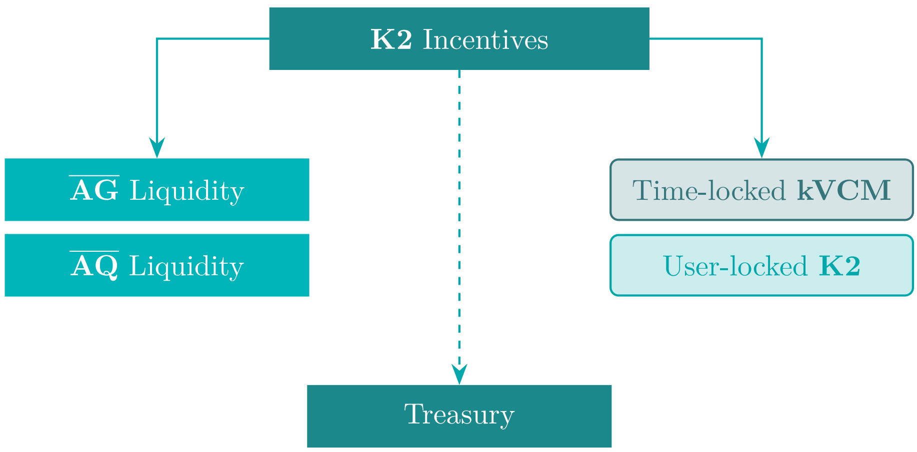


Figure 26: **K2** token incentive distribution structure.

Where $\upsilon = 0$ if $G + L = 0$, otherwise:

$$\upsilon = \left(\frac{2GL}{G^2 + L^2}\right)^2 \tag{32}$$

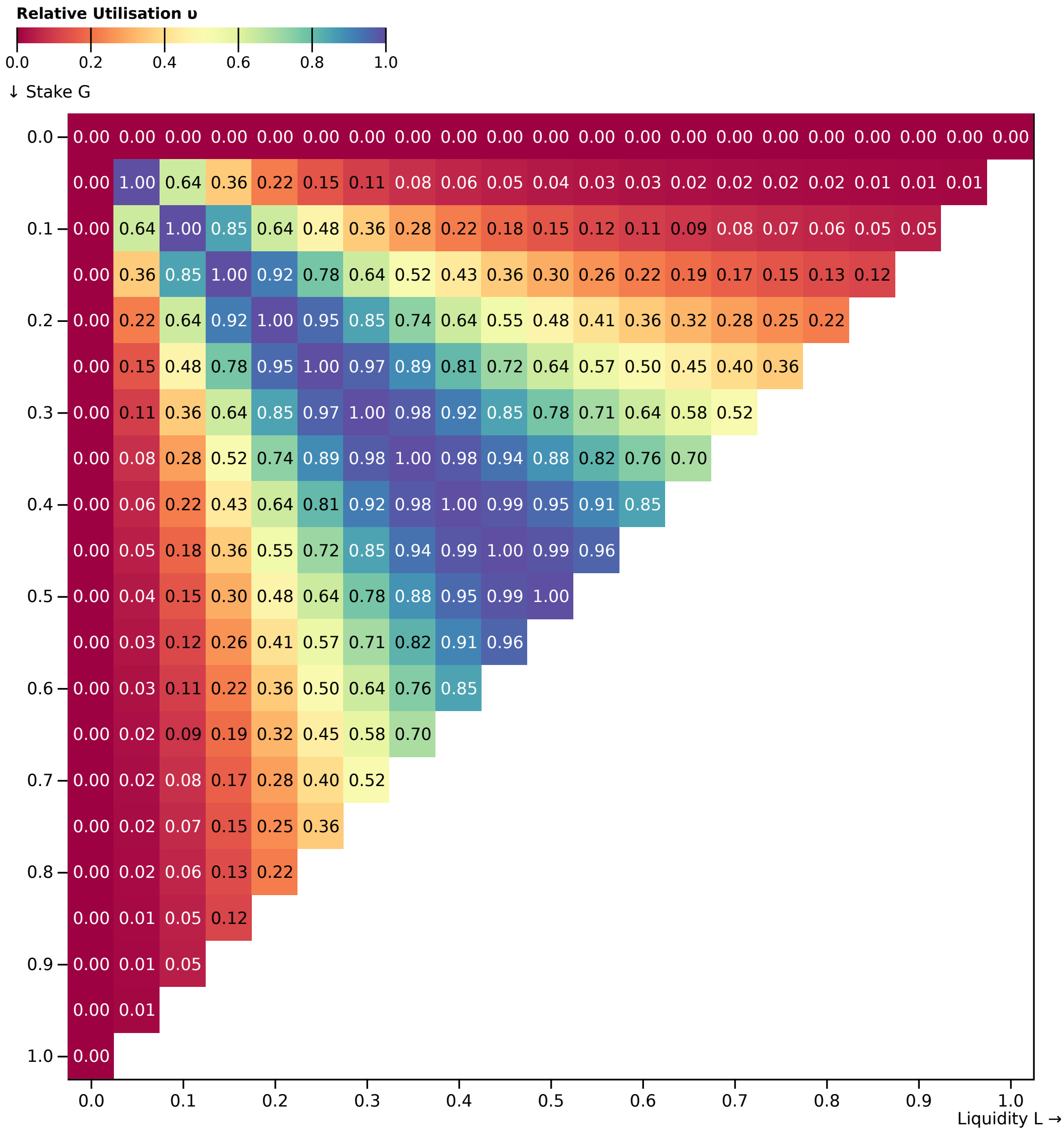


Figure 27: Upsilon υ range of values.

The **absolute utilisation** parameter η is defined as $\eta = 0$ if $G + L = 0$, otherwise:

$$\eta = \frac{2GL}{G(1-G) + L(1-L)} \tag{33}$$

Incentives I are allocated as follows:

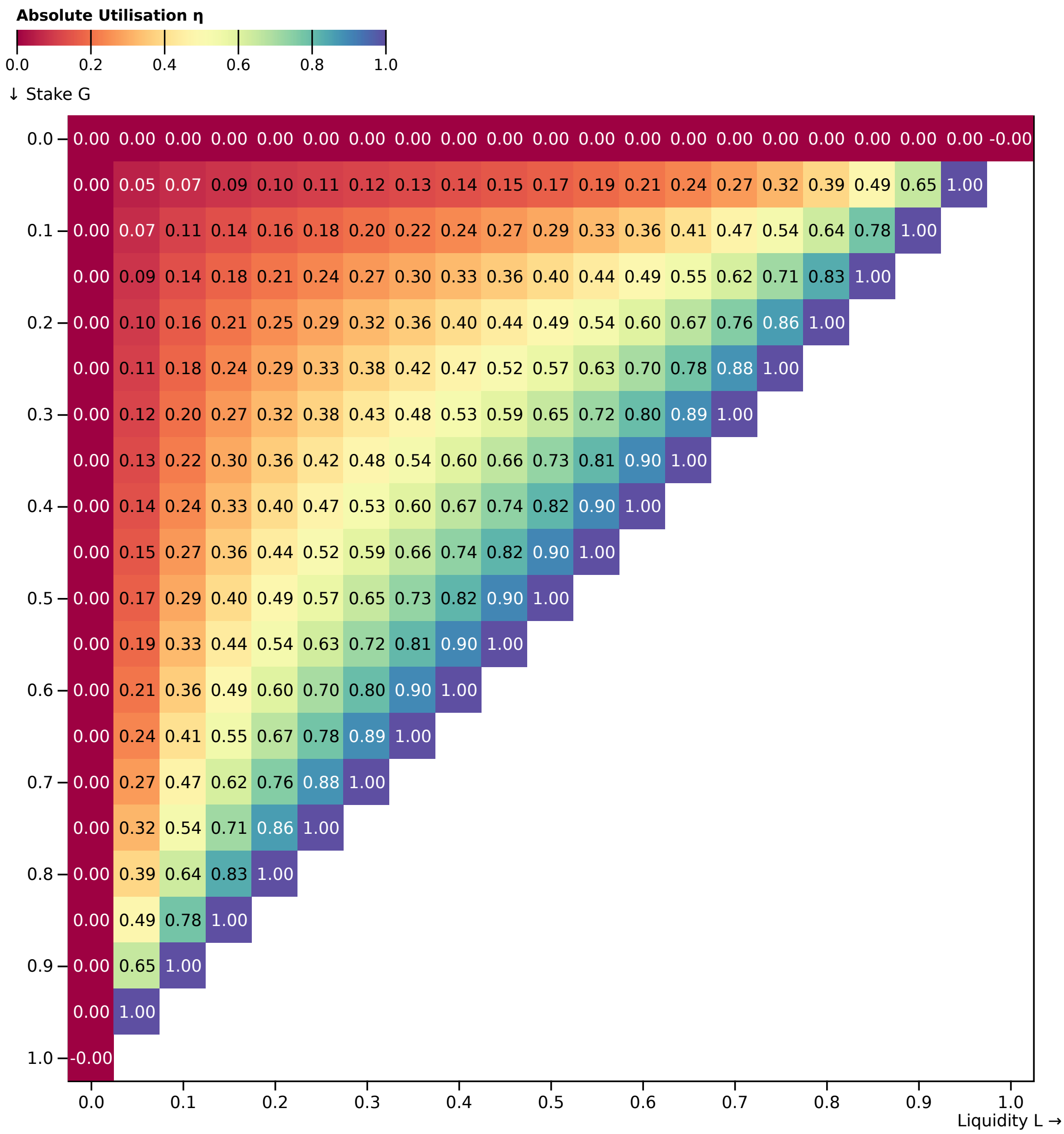


Figure 28: Eta η range of values.

4.3.1 Treasury

The allocation to the Treasury I_T is the imbalance generated from υ:

$$I_T = 1 - \upsilon\,\eta \tag{34}$$

4.3.2 Post Treasury

The residual post-treasury allocation is shared four ways within 2 buckets:

1. Time-locked **A** & user-locked **G** tokens

   Where S is the proportion of time-locked **A** tokens (as defined previously in Section 3.1.1):

   1. Time-locked **A**, I_S:

   $$I_S = S\,\frac{L^2}{G^2 + L^2} \tag{35}$$

   2. User-locked **G**, I_G:

   $$I_G = (1 - S)\,\frac{L^2}{G^2 + L^2} \tag{36}$$

2. Liquidity

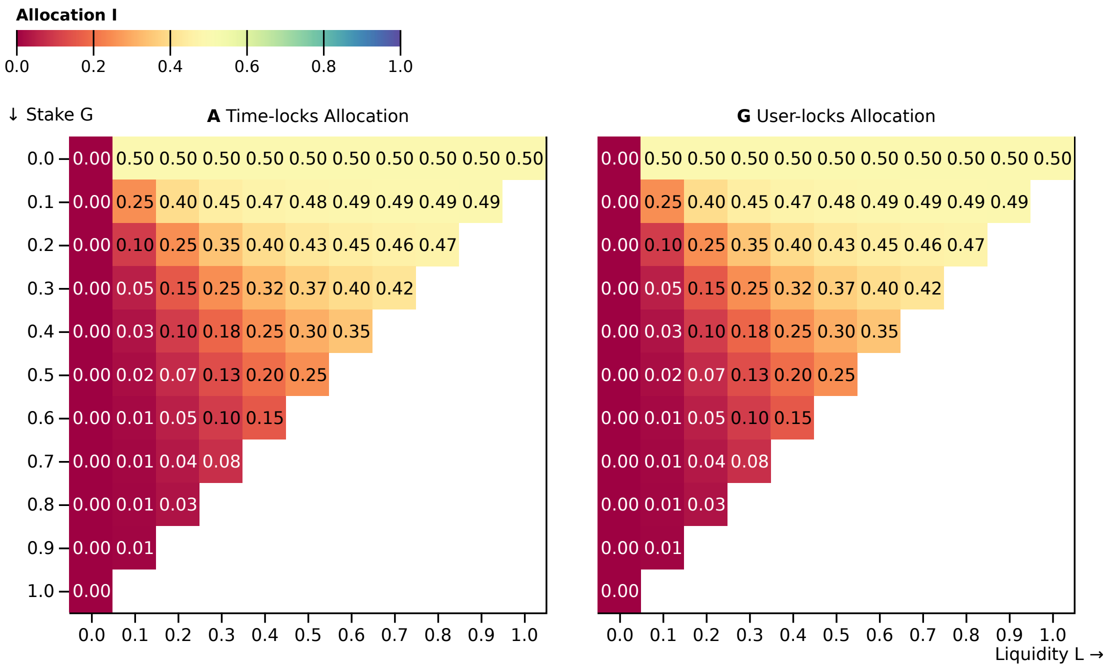
   With λ_G, λ_Q, λ_{GG} as defined in Section 3.3.4:

   3. $\overline{\mathbf{AG}}$ pool I_{AG}:

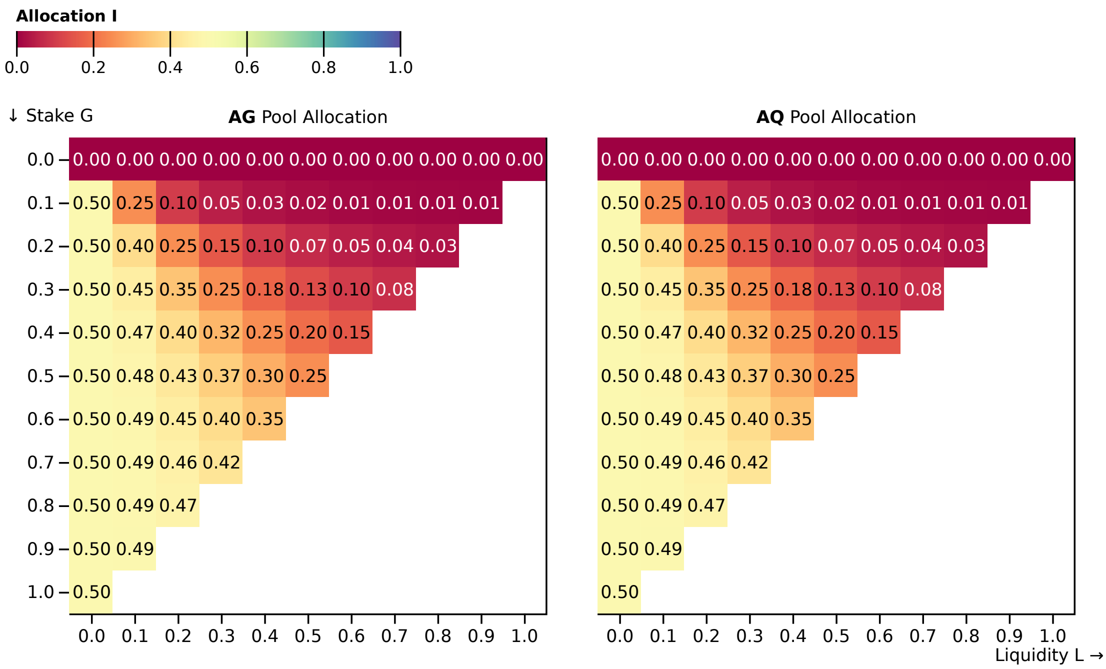
   $$I_{AG} = \frac{\lambda_G}{1 - \lambda_{GG}}\,\frac{G^2}{G^2 + L^2} \tag{37}$$

   4. $\overline{\mathbf{AQ}}$ pool I_{AQ}:

   $$I_{AQ} = \frac{\lambda_Q}{1 - \lambda_{GG}}\,\frac{G^2}{G^2 + L^2} \tag{38}$$



(a) Time-locked **A** and user-locked **G** allocations.



(b) Liquidity pools allocations

Figure 29: Share of non-treasury incentives I_S, I_G, I_{AG} and I_{AQ}.

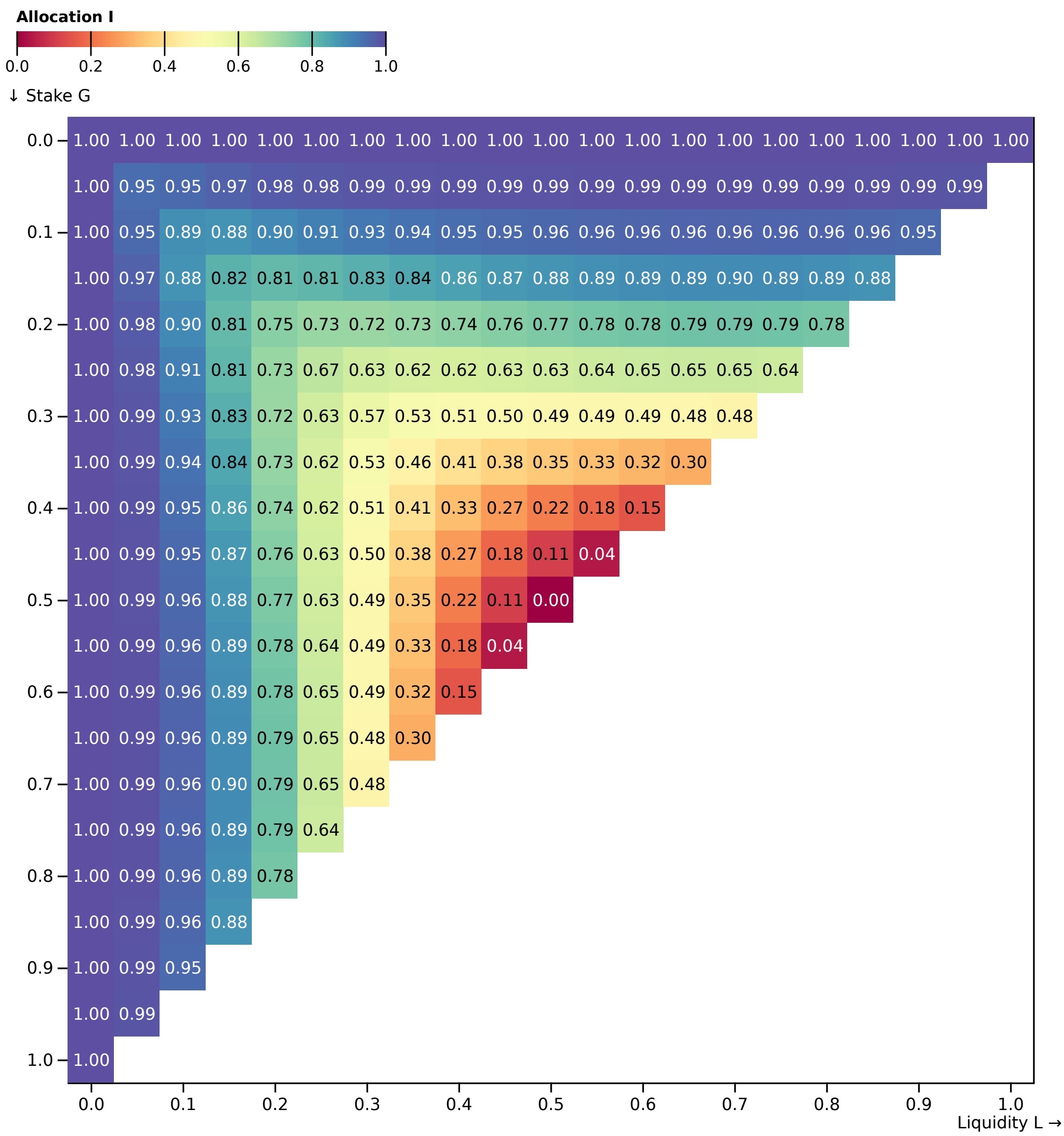


Figure 30: Treasury incentives I_T.