True Freeze – A DeFi Patience Primitive

Intro

True Freeze is a tokenized patience protocol for generating yield on long-term cold storage of blockchain native assets. Given the constantly evolving landscape of decentralized finance, there are no protocols aiming to provide long-term (multi-year) storage of assets that also generate yield while remaining *immutable*.

Extrinsic yield = external risk & effort

Currently, to get yield, you must trust your assets to a smart contract that pays *extrinsic* yield. One major example is AAVE which generates yield from collateralized borrowing of assets. When giving your assets to AAVE, it gives you a derivative version of your asset (e.g., deposit ETH and get AAVE's aETH). It's value (in ETH terms) will grow over time at some variable rate depending on the market's lending/borrowing activities. And while possible to put this derivative token in long term storage, it is not practical to do so because of the *risk to yield.*

Yield generating protocols are actively managed. Many use upgradeable proxy contracts. As they release new upgraded versions of their offerings, the market reacts. If you deposited your long-term assets into AAVE V2 (released 12/2020) and put your corresponding aETH into long term cold storage, you would have a problem. AAVE V3 was announced in 11/2021 and the market will shift to using V3. This exposes you to the headache of (1) moving your assets to the newest version preferred by the market or (2) participating in governance to push for AAVE to do the migration for you using their upgradeable proxy contracts.

Note, AAVE is a blue chip DeFi protocol trusted with billions of dollars. It's probably one of the safest places in all of DeFi to store assets. This is not an attack on AAVE, the creators of True Freeze are active AAVE users and fans of the protocol. The point is **extrinsic yield** has risks that make them less suitable for long term (i.e., multi-year) holdings. Not just smart contract risks (which can be minimized) but also risk to yield that requires the user to *do something* (migrate or trust 3rd parties to handle the automatic migration).

True Freeze solves this problem using a game theory approach that tokenizes patience. The more patient you are, the more you can earn. You earn it all **upfront**. What you do with your yield is up to you. The yield is *intrinsic*. But the *value* of that yield, is market determined- are you more patient than the average investor? Are you more patient than the market as a whole?

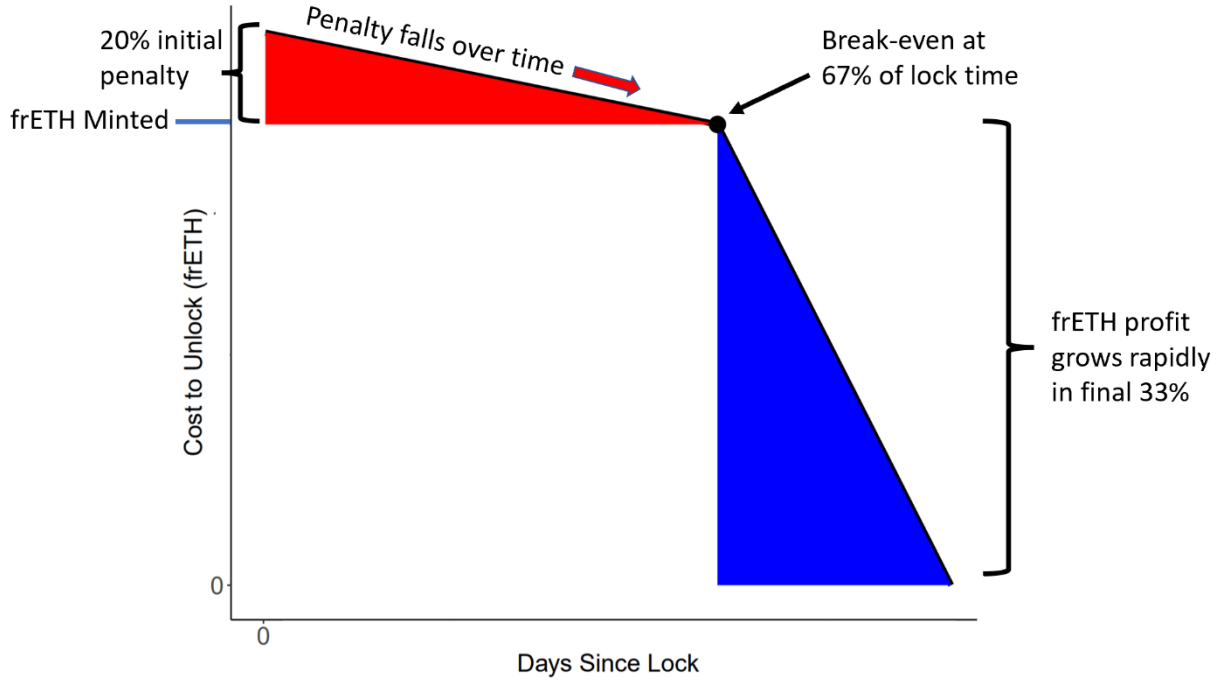
True Freeze enables a market for tokenized patience itself

Alice has 100 ETH. She doesn't really need 100 ETH in her hot wallet, she can probably get by with 10 ETH in her everyday account(s) and 90 ETH in long term storage. She considers herself very patient and wants to try out True Freeze.

She goes to the True Freeze site and deposits 90 ETH to generate a new "Freezer" NFT that serves as the "key" to her deposit. The NFT is transferrable (i.e., to a hardware wallet or multi-sig) and contains all the details of her deposit in an easily viewable fully on-chain SVG.

Now, to generate yield from her deposit, Alice needs to decide- how patient is she?

True Freeze enables her to lock her ETH for yield. Locking ETH earns freezer-ETH: *frETH*. (When deployed on other chains the mechanics will be the same, but the blockchain native asset is used instead: MATIC, FTM, etc.). This yield is intrinsic and paid upfront. But to reap all the benefits of this yield, she must be patient because early withdrawals are penalized.



However long Alice locks her ETH for, she will face a frETH penalty for withdrawing early (in red in the figure). At first the penalty ***exceeds*** the amount of frETH she mints, requiring her to buy frETH from others or lock new ETH generate new frETH. After 67% of her time has expired, she will be at "break-even" where the cost to withdraw in frETH is equivalent to the amount of frETH she originally minted. In the final 33% she rapidly earns her minted frETH until she is able to withdraw her ETH at no frETH penalty at "maturity".

Note: All withdrawals prior to maturity face a small 0.25% ETH penalty to incentivize patience.

Strategies

Alice has a few strategies to consider:

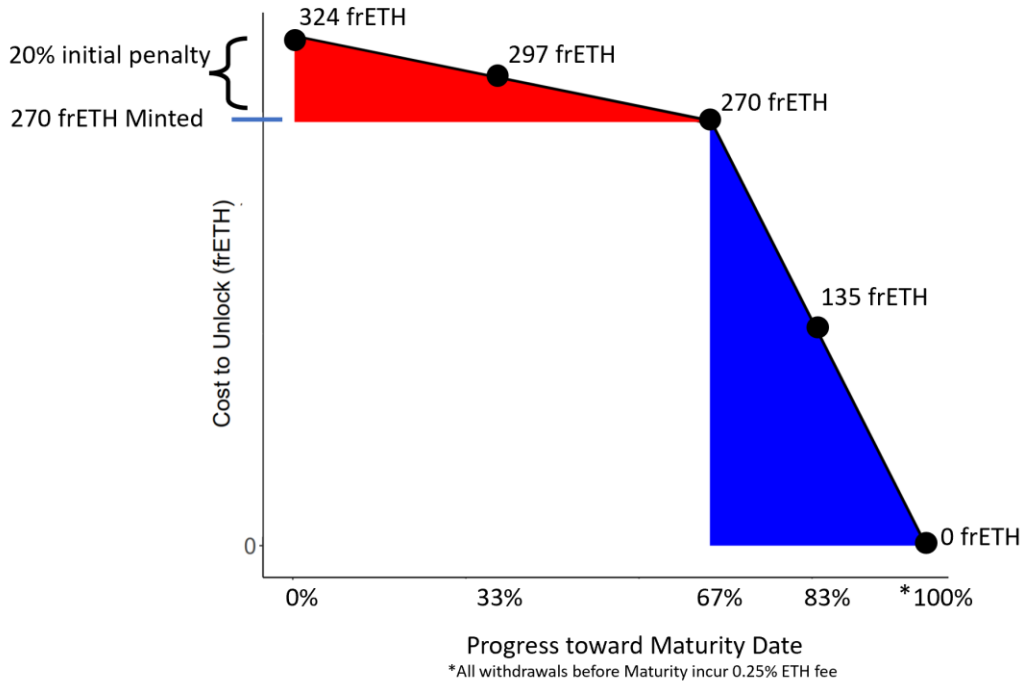
Strategy	Action	Gain	Risk
The Degen	1. Lock 90 ETH for Max Time 2. Sell new frETH for new ETH 3. Lock new ETH for Max Time 4. Repeat until gas cost becomes prohibitive.	Maximum instant yield all in ETH.	Fully exposed to frETH market volatility for any early withdrawals. May need to sell her freezer(s) at a discount if the market highly values frETH and early withdrawal costs (in frETH) become high.
The Guru	1. Lock 90 ETH for Max Time 2. Sell new frETH for ETH Enjoy the yield, wait patiently.	Instant yield in ETH	Fully exposed to frETH market volatility for early withdrawal. May need to sell her 1 freezer at a discount if the market highly values frETH and early withdrawal costs (in frETH) become high.
The Hedger	1. Lock 90 ETH across multiple freezers for rolling amounts of time. Manage a balance of frETH alongside ETH.	Instant yield, some in frETH, some in ETH.	Partially exposed to frETH market but has both a stash of frETH and strategically cheaper freezers to access early withdrawals.
The Timid	1. Deposit 90 ETH for small amounts of time. 2. Accrue a buffer of frETH. Repeat slowly while maintaining a frETH stash.	Small bits of yield, nearly all in frETH.	Minimum exposure to frETH market. Avoids risk of not being able to withdraw early. Earns less yield upfront.

Alice likes things simple and isn't a fan of leverage, her risk profile most aligns to The Guru strategy. She decides to lock her 90 ETH for 3 years. She receives (90 * 3 years) = 270 frETH.

Early Withdrawal Cost Curve

Her lock is initiated with a 20% penalty on Day 0. Her break-even day is 67% of her lock time: here, 2 years later, or Day 730. This is where the frETH early withdrawal cost is the same as her initial minted yield (270 frETH). At the end of her lock time, 3 years later, or Day 1095, her freezer has reached maturity and she has earned all her yield. It would cost 0 frETH to unlock and there would **no longer be the 0.25% ETH early withdrawal fee**.

In visual form Alice's frETH payoff graph would look like this:



Minted	Day 0* Withdraw Cost	Day 365* Withdraw Cost	Day 730* Withdraw Cost	Day 912* Withdraw Cost	Day 1095 Withdraw Cost
270 frETH	324 frETH	297 frETH	270 frETH	135 frETH	0 frETH

Her early withdrawal cost depends on if she is before or after her break-even day. It is a simple linear function of her progress toward either the breakeven date or her maturity date (whichever hasn't happened yet). The penalty decreases slowly until the breakeven day, afterwards, her profit rises extremely quickly. This is to maximize the incentive of waiting the entire lock period.

Since 365 is halfway to the breakeven day; her penalty (originally 20%) is halfway reduced – she would pay a 10% penalty (297 frETH) to withdraw early. After her breakeven day (Day 730), her frETH profit begins. Day 912, halfway between breakeven and maturity, corresponds to halfway into her profit, i.e., she's earned half of her 270 minted frETH and would pay 135 frETH to withdraw early.

At the end of her lock time, Day 1095, her freezer reaches maturity and she has earned all her yield. It would cost 0 frETH to unlock and there would **no longer be the 0.25% ETH early withdrawal fee**.

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Freezer Asset Tokenomics

1. There is no fixed supply

Patient people create supply.
Impatient people burn supply.

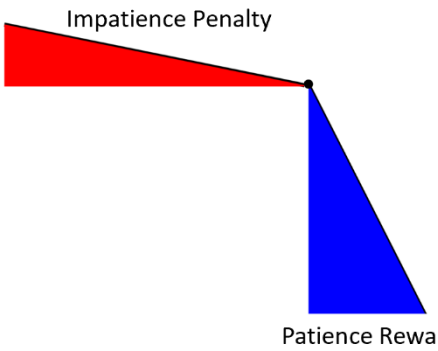
frETH is created when someone deposits ETH, which removes ETH from the circulating supply. 1 frETH = [1 ETH removed from the market for 1 year]. The amount of frETH in the market is directly proportional to the amount of ETH currently locked **and previously earned** in freezers. How should it be valued?

2. The value of frETH is partially determined by internal factors

frETH price in ETH represents the market discount rate for removing ETH from circulation for 1 year!

frETH's internal value is the opportunity cost someone who has locked ETH gives up by not having ETH readily available. As a baseline comparison, the frETH value could find equilibrium near the net present value of 1 year of yield from staking ETH after the proof of stake merge: 0.02 – 0.04 ETH.

Similar to how new ETH issuance should hypothetically dilute existing ETH's value by increasing supply, users who successfully wait for their freezers to unlock are increasing the supply of frETH.



EIP-1559 created a burn mechanism to manage new ETH issuance (including issuance possibly being smaller than ETH burned) – the "ultrasound money" meme. Similarly, the *penalty* mechanism of frETH (i.e., withdrawing early) also removes frETH from supply. Just like EIP-1559 makes the supply of ETH change as a function of use, the penalty mechanism makes the supply of frETH change as a function of the market's changing patience.

The fundamental question becomes which will be bigger?

The total market penalties for impatience (red), or the total rewards for patience (blue)? This determines the supply flow of frETH.

In addition, frETH can be burned to earn the FRZ token discussed in later sections, which is staked to earn early withdrawal penalties from impatient users of True Freeze.

3. The value of frETH is partially determined by external factors

When Alice locks her ETH in a freezer to earn frETH, she has reasons to keep the frETH (just in case she needs to withdraw early) and reasons to sell the frETH (get a different asset, even ETH again!). These push and pull incentives are affected by the broader market. When ETH's price grows (and maybe even becomes short-term overpriced), she'll feel pressure to withdraw early, pay the penalty, and sell her ETH (so she can buy more ETH later when the price falls). When ETH's price drops (and maybe even becomes short-term underpriced), she'll feel less pressure to withdraw early, and may even feel she can deposit more ETH to get more frETH!

With thousands of people going through these feelings in parallel, frETH's price will be volatile. Some will withdraw early and some will double down. But even people without a True Freeze freezer can benefit from frETH.

Remember, 1 frETH = [1 ETH removed from the market for 1 year].

Who benefits when ETH is removed from the market for 1 year? All holders of ETH benefit! Reducing the available circulating supply of ETH, puts upward pressure on the price of ETH.

Imagine Bob has 20 ETH and $4000 USDC. If ETH is $4,000, he can buy 1 ETH, taking 1 ETH off the market for as long as he wants and putting a small upward pressure on ETH's price. If frETH is 0.02 ETH; he could instead buy 50 frETH. Remember what a frETH is:

1 frETH = [1 ETH removed from market for 1 year]

Bob buying 50 frETH is equivalent to paying to remove 50 ETH from the market for 1 year. This directly increases the cost for Alice to withdraw early and indirectly puts upward pressure on the price of ETH.

Now of course, **there's no guarantee that 50 frETH grows in value the way 1 ETH might grow in value**. But this opportunity to manipulate the circulating supply of ETH enables advanced strategies in algorithmic trading, new yield opportunities for yield farms, and intrinsic yield for long-term holders of ETH to provide evidence on-chain that their holdings are truly long-term.

In summary, True Freeze creates a pure free market for tokenized *patience* itself. Non-users of True Freeze can engage in this market, hoard frETH to increase the cost of impatience (early withdrawal) and profit both directly from trading frETH and indirectly by reducing the supply of ETH available in other markets.

4. <u>There is a market for even the *lowest yield* if it is also *lowest risk*</u>

When pitching True Freeze, we heard 2 things repeatedly: First, why isn't the ETH locked in freezers deposited to earn yield- i.e., why don't freezers "double dip" in both extrinsic and intrinsic yield? This misunderstands the problem statement and the fundamental theory of finance- maximizing *risk adjusted* returns. True Freeze is targeting the *very large* market for truly minimized risk storage of assets. Every blockchain native asset held "raw" is addressable market for True Freeze and its purely intrinsic yield. For a view of some of the addressable market, see the top raw ETH balances here: https://etherscan.io/accounts/

The extremely large balances are typically exchanges (e.g., Kraken, Binance) or large protocol smart contracts. But as you get Trueer into the list, there are EOAs holding 1,000s of ETH raw!

Top Accounts by ETH Balance

A total of > 1,999,999 accounts found (118,091,908.584 Ether)
(Showing the last 10,000 top accounts only)

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Rank	Address	Name Tag	Balance	Percentage	Txn Count
1	0x00000000219ab540356cbb839cbe05303d7705fa	Eth2 Deposit Contract	9,204,786.000069 Ether	7.79459500%	178,252
2	0xc02aaa39b223fe8d0a0e5c4f27ead9083c756cc2	Wrapped Ether	8,108,164.71720547 Ether	6.86597822%	5,433,424
3	0xda9dfa130df4de4673b89022ee50ff26f6ea73cf	Kraken 13	2,113,030.001 Ether	1.78930972%	64
4	0xbe0eb53f46cd790cd13851d5eff43d12404d33e8	Binance 7	1,996,008.34511594 Ether	1.69021601%	1,037
5	0x73bceb1cd57c711feac4224d062b0f6ff338501e		1,990,678.57090949 Ether	1.68570277%	447
6	0x9bf4001d307dfd62b26a2f1307ee0c0307632d59		1,490,000.0180927 Ether	1.26172914%	103
7	0x4ddc2d193948926d02f9b1fe9e1daa0718270ed5	Compound: cETH Token	1,234,013.88507205 Ether	1.04496057%	263,014
8	0x61edcdf5bb737adffe5043706e7c5bb1f1a56eea	Gemini 3	929,498.95358134 Ether	0.78709792%	335
9	0x07ee55aa48bb72dcc6e9d78256648910de513eca	Gemini: Contract 1	595,241.11148462 Ether	0.50404902%	888
10	0xdc24316b9ae028f1497c275eb9192a3ea0f67022	Lido: Curve Liquidity Farming Pool Contract	577,926.32889124 Ether	0.48938690%	27,712
11	0x1b3cb81e51011b549d78bf720b0d924ac763a7c2		560,000.000065 Ether	0.47420692%	187
12	0x8484ef722627bf18ca5ae6bcf031c23e6e922b30	Polygon (Matic): Ether Bridge	535,054.76959876 Ether	0.45308335%	63
13	0xc61b9bb3a7a0767e3179713f3a5c7a9aedce193c	Bitfinex: MultiSig 3	500,020.76046368 Ether	0.42341661%	106
14	0x011b6e24ffb0b5f5fcc564cf4183c5bbbc96d515	Arbitrum: Bridge	476,446.48358304 Ether	0.40345396%	50

While it is unlikely that centralized exchanges and cross-chain bridges can lock their user funds, we feel there is a sizeable addressable market for:

1. DAOs holding large amounts of ETH from their internal activities (e.g., selling governance tokens).
2. NFT communities holding ETH from mint sales.
3. Investment clubs storing ETH in multi-sig wallets for their members.
4. Institutions that can engage in True Freeze with algorithmic trading of frETH and making bids on Freezers (essentially using Freezers as peer to peer bonds) to allow users to exit early without paying frETH or ETH penalties (remember, freezers are NFTs that will be transferable and tradeable on the respective chain's NFT marketplaces).

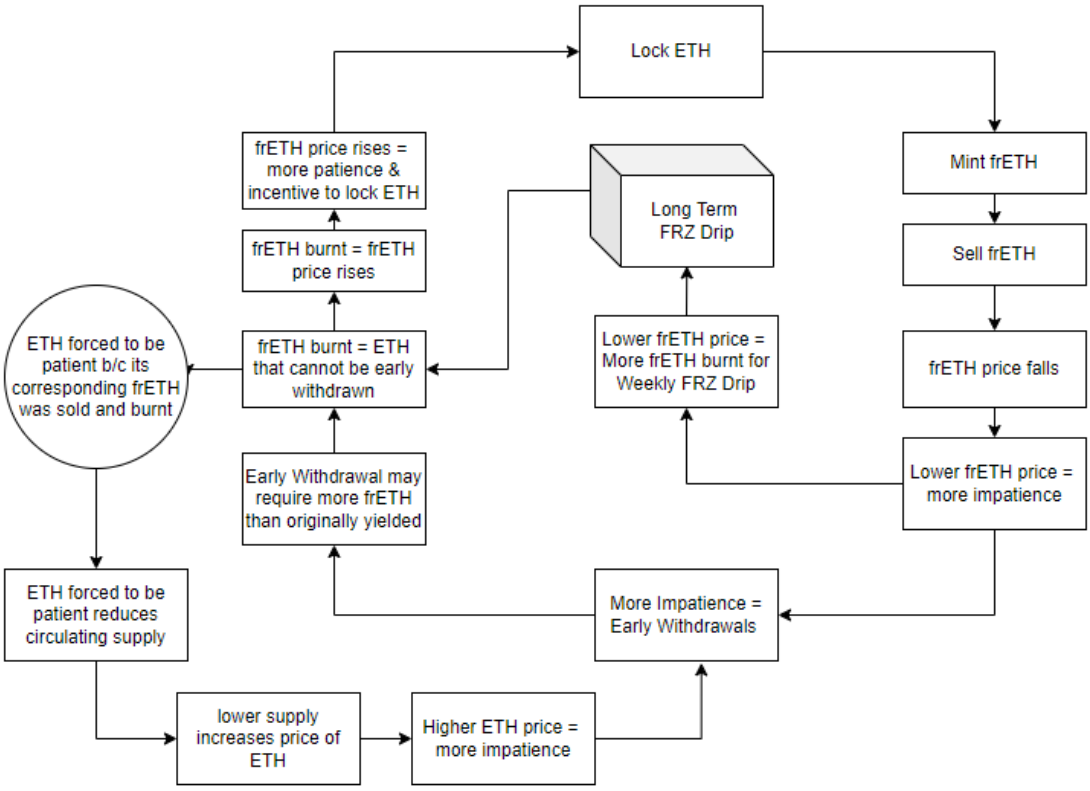
5. frETH dumping means ETH pumping – a natural equilibrium exists

The second thing we heard repeatedly was: what happens if everyone does The Degen strategy and dumps frETH and leverages up on ETH?

The price of frETH plummets, that's what happens! But remember:

1 frETH = [1 ETH removed from market for 1 year]

This will never change – it is the essence of how frETH is valued (and why we've repeated it ad nauseum). To get a better understanding of how a natural equilibrium will be found (as a function of the market's reaction to changing prices of patience), review this diagram:



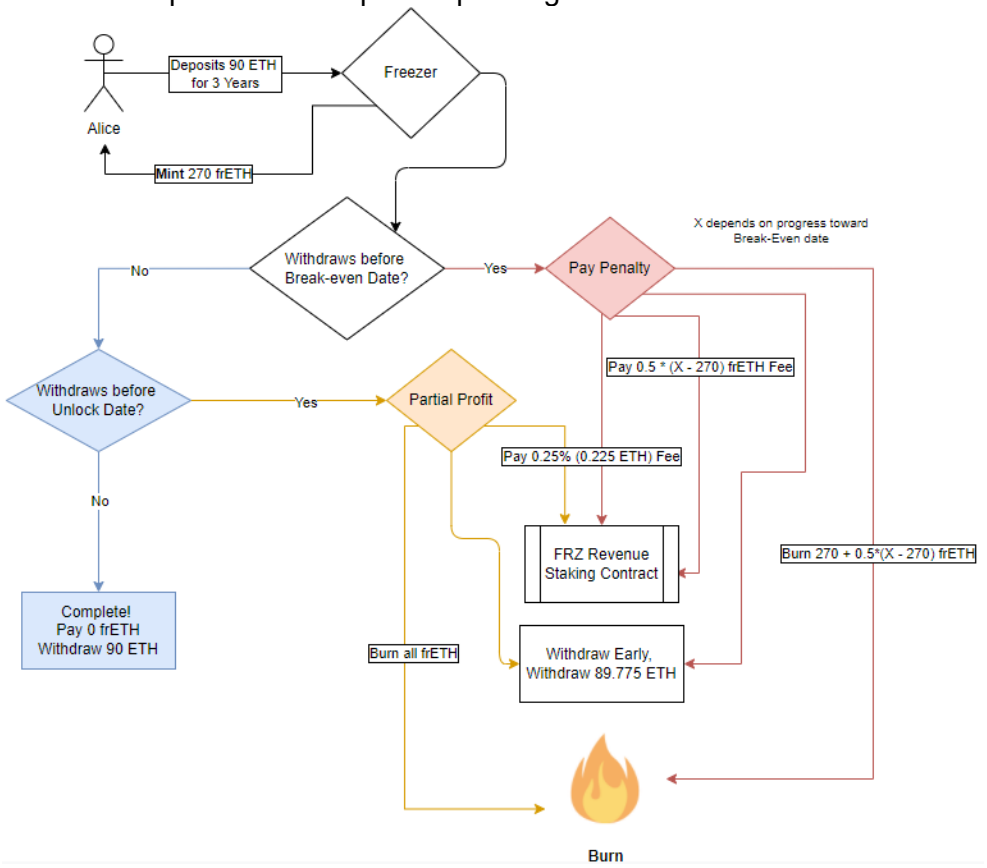
The cheaper the frETH, the cheaper impatience. The cheaper impatience, the more early withdrawals we should see. Early withdrawals that pay penalties burn frETH. Burnt frETH forces a corresponding amount of ETH to be patient. This ETH that is forced to be patient reduces circulating supply, which puts upward pressure on the price of ETH. Higher priced ETH also incentivizes early withdrawals. This causes a feedback loop of more frETH burnt to withdraw ETH early. All this burnt frETH increases the price of frETH, which incentivizes more patience and more locking of ETH to create more frETH. A natural equilibrium is found between these counteracting forces.

In addition, we've incorporated a mechanism for burning frETH to earn a stream of the FRZ revenue token (which earns a corresponding share of early penalty fees).

Revenue / Governance

True Freeze will have **no governance**. It will be immutable upon launch with a fixed fee structure to generate revenue for FRZ stakers. 100% of early withdrawal penalties (excluding burned frETH) are given to FRZ stakers. The developers of the protocol will be indistinguishable from any other FRZ stakers and have no special privileges nor emergency powers.

A diagram of Alice's deposit and fees paid depending on her withdrawal time is included here:



Stakers of the FRZ token will receive 2 forms of revenue.

1. frETH penalties

The frETH penalty for withdrawals (up to 20% of the amount minted) is frETH taken out of the market- it only exists because someone has locked ETH and made their frETH available for purchase. Half of this frETH penalty (half the amount above frETH minted originally) is paid to stakers of the True Freeze revenue token FRZ. The rest is burned, offering a small deflationary pressure to offset inflation of frETH from those whose freezers reach maturity. Early withdrawals after the breakeven date do not deliver frETH to FRZ stakers, but the 0.25% ETH fee remains.

2. ETH withdrawals

To further incentivize patience, a small 0.25% fee is applied to **all** early withdrawals and paid to directly to stakers of FRZ. This is binary, only completed lock cycles avoid the fee.

FRZ Tokenomics

True Freeze is targeting launch on 4+ EVM chains all with **entirely separate** blockchain native assets:

1. Ethereum – where WETH and frETH will be the tokens for (ETH) FRZ, "FRZ".
2. Polygon – where WMATIC and frMATIC will be the tokens for (MATIC) FRZ, "FRZ-m".
3. Fantom – where WFTM and frFTM will be the tokens for (FTM) FRZ, "FRZ-f".
4. Avalanche – where WAVAX and frAVAX will be the tokens for (AVAX) FRZ, "FRZ-a".
5. *Binance Smart Chain – where WBNB and frBNB will be the tokens for (BNB) FRZ, "FRZ-b".

There is **no** cross-chain functionality in the True Freeze protocol. All instances of True Freeze are entirely unique on each chain. This should make sense, as differences in the chain's architecture result in different external costs and pressures to withdraw early (i.e., gas costs and token prices).

Initially there will be 100,000,000 FRZ-* minted on each chain **all** airdropped as follows:

Creating Team	25,000,000
Targeted Airdrop to users	50,000,000
Targeted Airdrop to protocols	25,000,000

Liquidity incentives for frETH and FRZ (and the corresponding duplicates on other EVM chains) will **not** be provided by the Creating Team, as there will be no governance or emergency powers to handle contract migrations or distribution fixes. Instead, 25% of the supply will be dedicated to protocols who've agreed to receiving the airdrop. Whether they pass FRZ to their users, integrate True Freeze into their protocol as a yield mechanism, or other action is up to them and their users. There will be no oversight or governance by the Creating Team.

As True Freeze is constructed to be a complete ecosystem from Day 1, users can enjoy the primary use cases of FRZ and frETH all within the ecosystem to earn value from patience and penalties from impatience. We trust the free market will provide some amount of liquidity given existing AMM swap fees are a positive source of revenue for many unincentivized assets today.

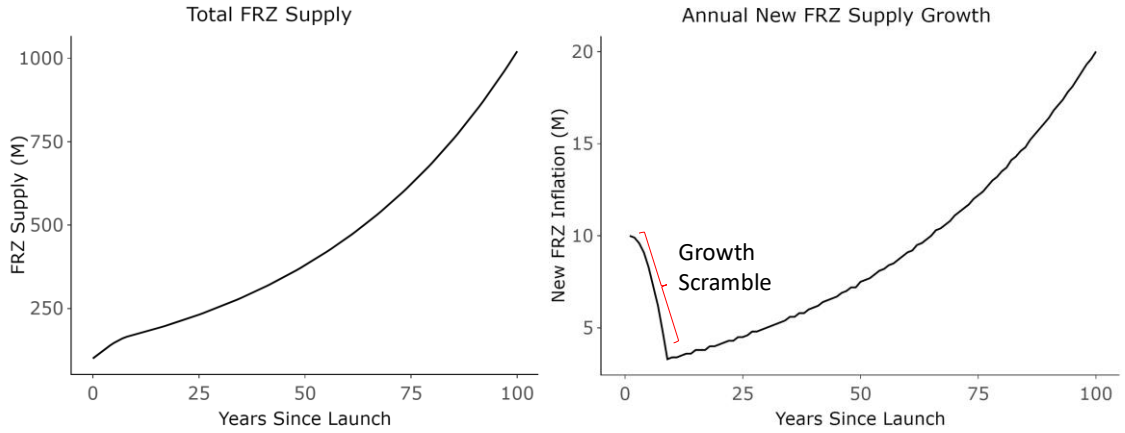
To ensure stable demand for frETH (and the alt chain duplicates frMATIC, frFTM, etc.) long term (i.e., consistent demand to burn it) the supply of FRZ will inflate on a defined schedule starting at 10%, then dropping 1% per year down to 2% (after 9 years). It will then inflate at 2% annually in perpetuity.

This avoids a common problem in decentralized finance, where promises of "fixed supply" tokens cause early adopters of a protocol to experience disproportionate harm via token price collapses and impermanent loss when incentives end.

There are valid reasons to emit tokens from a treasury- it dilutes early adopters share of the total supply and allows new users access to the asset while giving flexibility to protocol governors to change the behaviors they incentivize. This transfer of value from previous users to new users is critical for growth. But True Freeze has no governors, so we feel direct transparent inflation is the best way to ensure demand to burn frETH in perpetuity. For FRZ holders, this decays their share of revenue flow but in exchange they get higher demand for frETH, more protocol use, and ideally revenue growth in excess of their share decay.

FRZ Emissions Schedule

To clarify on the FRZ emission and supply schedule: At first, the supply will grow rapidly as the application gains adoption to reach critical mass (the "Growth Scramble" period). After this, the total amount of FRZ will grow 2% a year in perpetuity. The idea being that in the first 10 years, higher than long-term inflation allows many users to compete and accumulate FRZ, but this *scramble* for long-term revenue plateaus after 10 years (when the net new FRZ bottoms at 3.3M FRZ added). The largest stakers of FRZ after 10 years will receive the largest (but still proportional) revenue in perpetuity, and this revenue will only be diluted 2% a year. Bitcoin's "halving" of block-rewards is a good analogy here, where FRZ would act as the reward for "proof of patience" by burning frETH.



FRZ Supply Schedule

Year	FRZ Supply	YoY Inflation %	New FRZ Units
0	100 M	N/A	N/A
1	110.0 M	10	10 M
2	119.9 M	9	9.9 M
3	129.5 M	8	9.6 M
4	138.5 M	7	9.0 M
5	146.9 M	6	8.3 M
6	154.2 M	5	7.3 M
7	160.3 M	4	6.1 M
8	165.1 M	3	4.8 M
9	168.5 M	2	3.3 M
10	**171.8 M**	**2**	**3.3 M**
11	175.3 M	2	3.4 M
…		2% YoY	
25	231.3 M	2	4.5 M
26	235.9 M	2	4.6 M
…		2% YoY	
100	1,021.4 M	2	20.0 M
101	1,041.8 M	2	20.4M