Forward Carbon

How crypto may finance planting trees?

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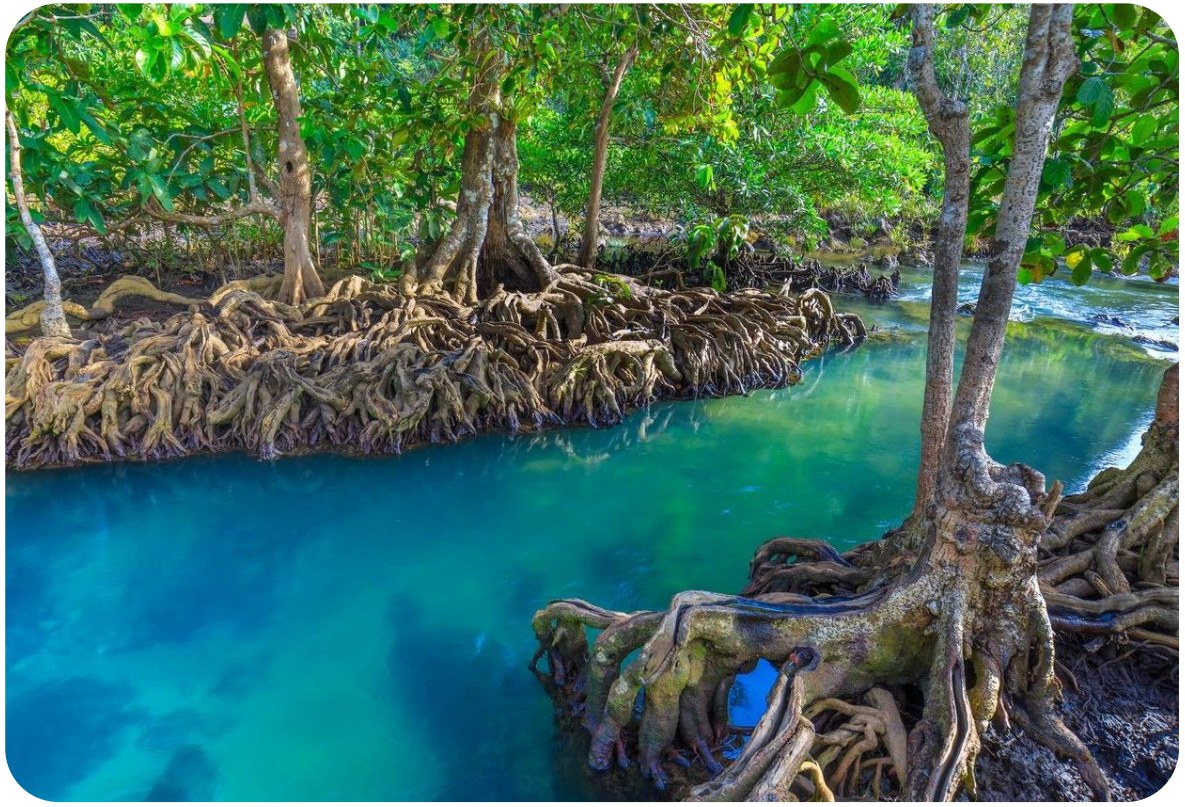
Problem

- Generational problem: remove 10 GtCO2 / year to stay below 2°C
- Our ‘North star’ is to enable 1 GtCO2 removal with SDG impact
- 1 mln ha mangroves restoration
- $3-5B capital deployment required
- Most likely coming from corporates (Net Zero pledges), but before they buy verified carbon credits in 2030-2050 we need to plant trees now => finance projects at early stage to enable planting & certification
- Crypto can make coordination of this scale possible

Why mangroves?

- Largest carbon stock
- High biodiversity
- Reducing coastal erosion
- Protecting against storms
- Food security
- 1 ha generates $194k/yr *
- 13 mln ha globally
- 3.6 mln ha lost since 80s



* DeGroot et al., 2012

Communities are ready to restore

- Eco heroes
- CBOs / Youth groups
- NGOs

Restoration is intensive and costly

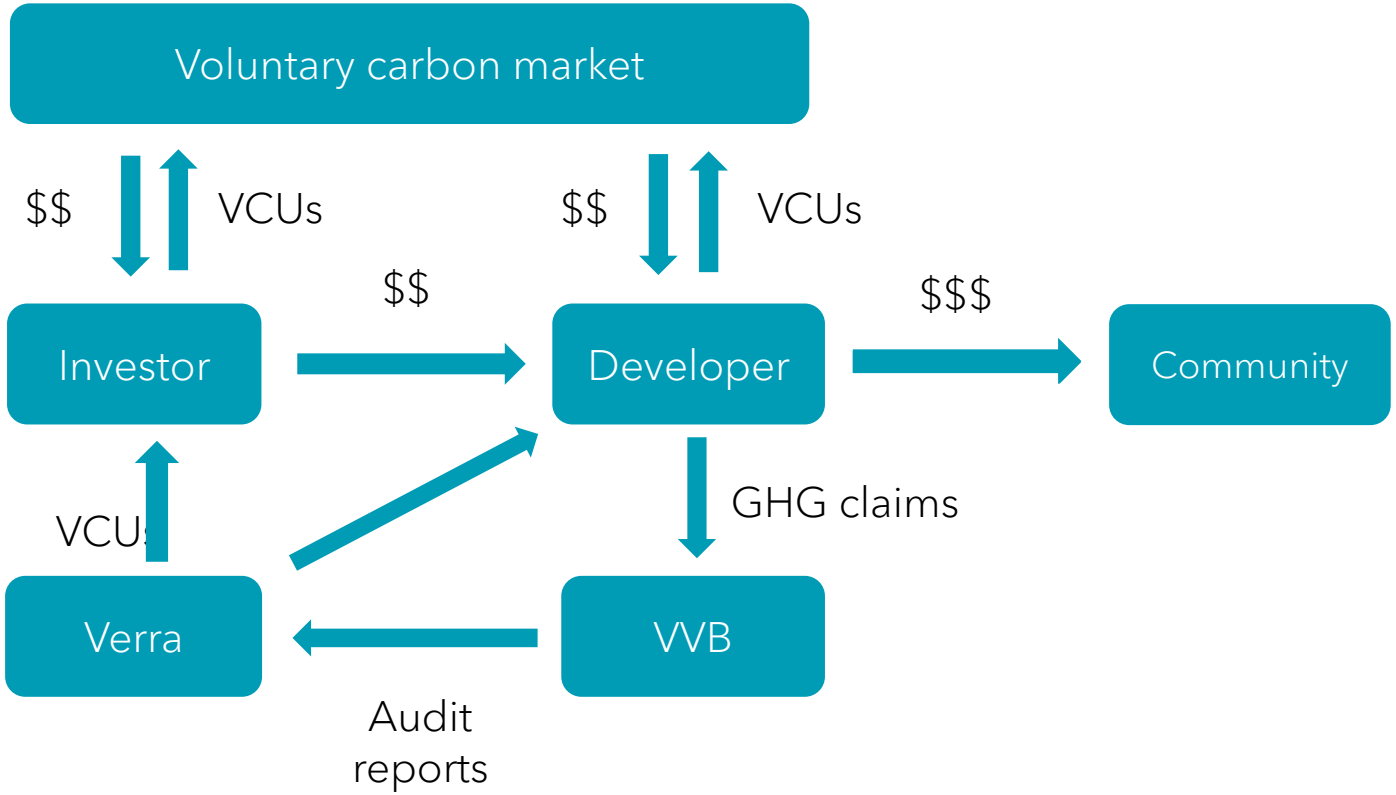
- Tenure rights
- Nurseries
- Trenching
- Planting
- $1 direct costs
- 3-4k trees/ha

Restoration is risky

- Wrong species
- Wrong places
- Wrong time of year
- Climate change
- Natural catastrophes
- Illegal logging
- Survival rate 0-70%

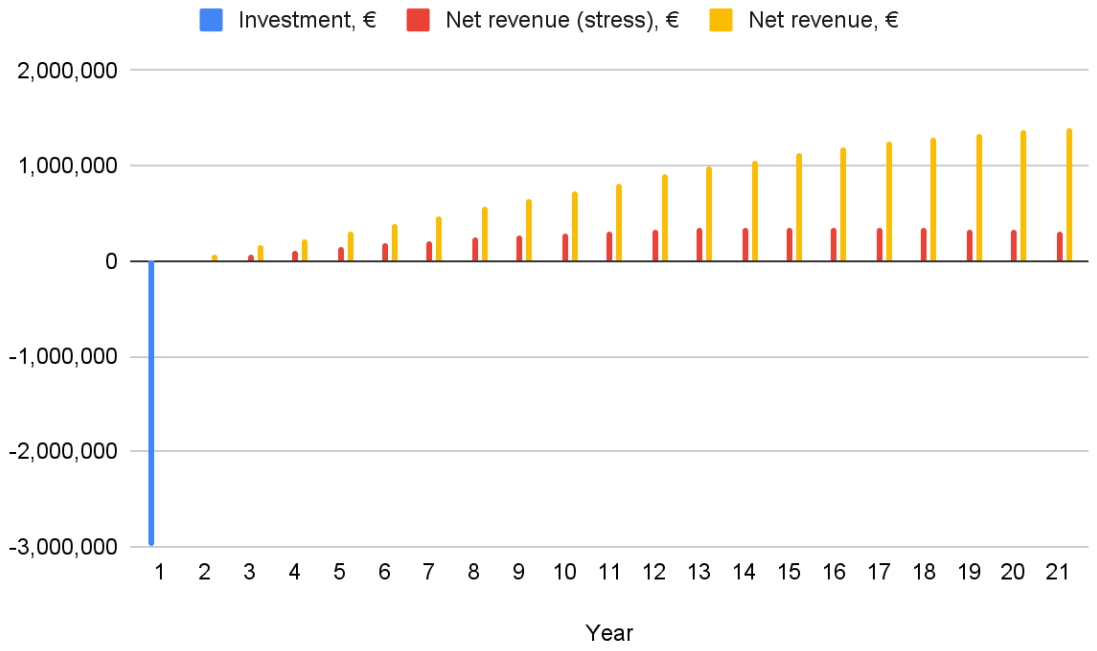
Carbon finance mechanism

- Understood by govt
- Early stage funding
- Long term incentives
- Verified sequestration
- Standardized asset
- Verified impact

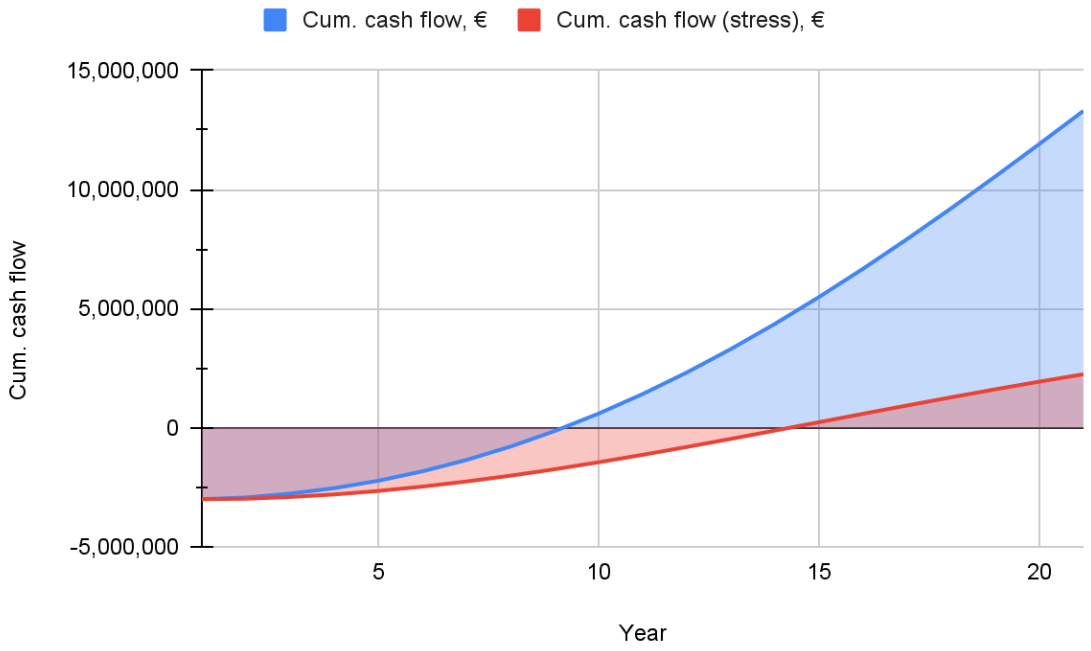


Carbon finance mechanism

Project cash flow



Cumulative cash flow



Gap between financing and carbon revenue.
Cost $4-8/t, price $30-40/t

TREE Coin Story

- Issued in 2017
- 1 TREE coin = 1 mangrove tree = $1
- $1 mln crowdfunded
- 1 mln mangroves planted & VCS certification sponsored
- 50% of carbon is shared with a local community
- Converted to MANGROVE token
- 8% of carbon is committed to Mangrove DAO in 2022-2034
- First 4200 tCO2 transferred and tokenized in 2022

https://medium.com/@mangrovedao/tree-coin-story-2bce6723d496

Mangrove DAO is focused on restoration of degraded mangrove habitats in Myanmar and globally

Mangrove DAO is a Decentralized Autonomous Organization. It implements novel governance mechanisms to empower the community of TREE coin holders.

READ THE FULL TREE COIN STORY WIF COMMITMENT HOW TO HOLD TOKENS?

https://mangrovedao.earth/

TREE Coin Story

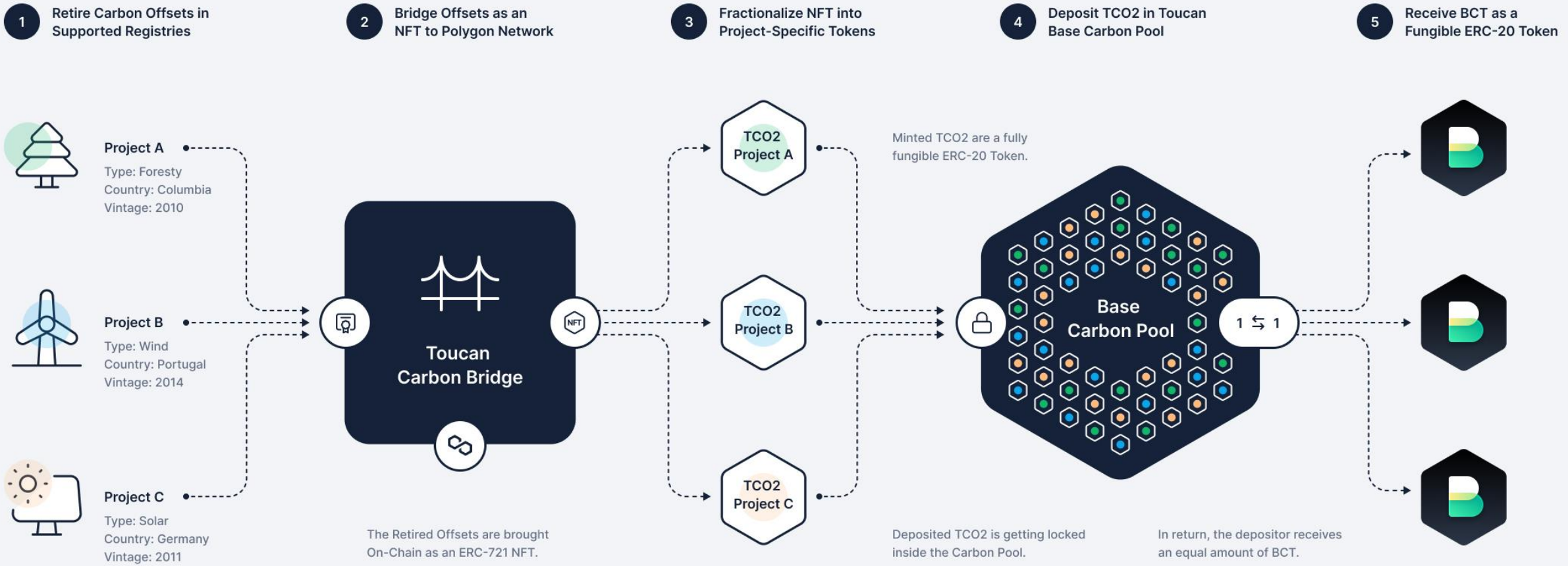
Issues:

- Trees are not good representation (density, survival)
- Token should mimic forward purchase agreement (tCO2)
- No pricing benchmarks

KlimaDAO Magic

- Mobilized $100m of risk capital
- Bridged 21.8m tCO2 (~3.7% of total surplus)
- Created very liquid carbon market (5-10 Mt/mo)
- Floor price benchmark for carbon
- Boost for ReFi

Toucan Tokenization Framework



Idea

- Finance nature-based carbon removal projects giving token holders the opportunity to earn on the value appreciation of forward carbon credits
- Pool together carbon projects
- Segregate the diversified risk-free forward
- Reserve part of spot carbon to smooth the drawdowns
- Governed by a DAO to make risk-on decision
- DAO token to capture excess carbon from reserve

Forward Carbon Token

- FCO2 represents validated carbon credits with prepaid delivery
- Delivery date (e.g. by EOY 2030)
- Delivery term (guaranteed, or ‘best effort’ basis)
- Delivery asset (tokenized spot carbon)

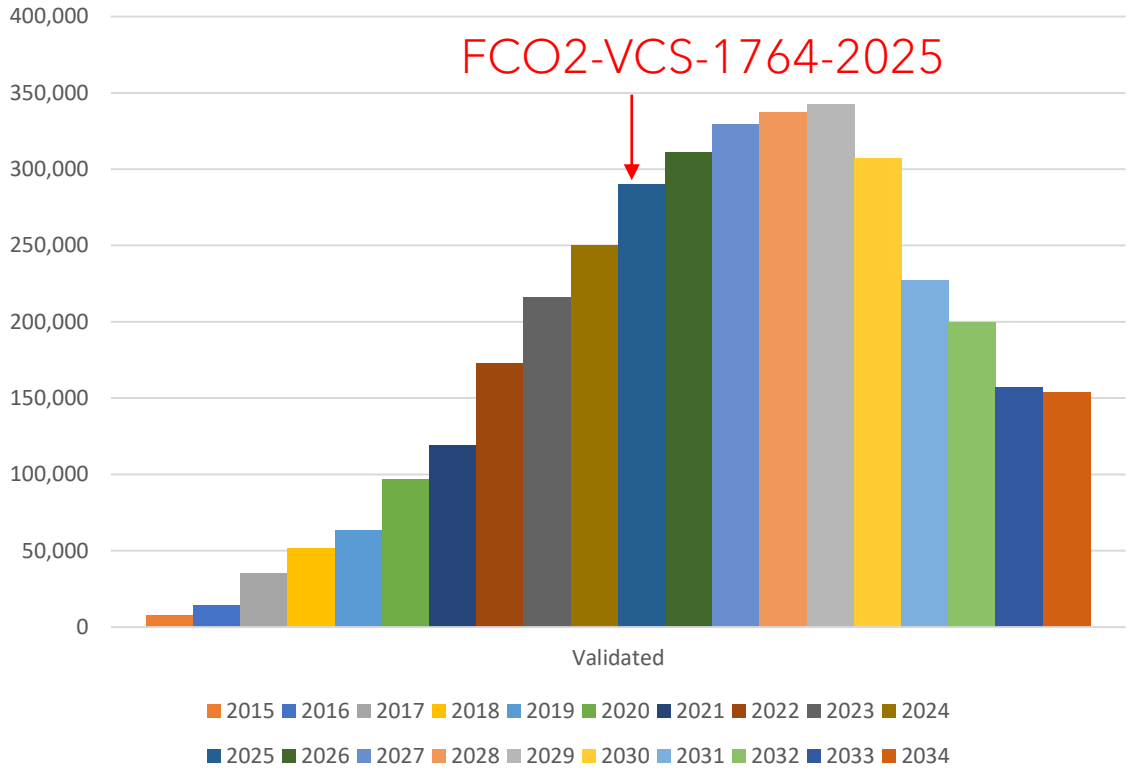
Base LEGO-block

Forward Carbon Token

Validated curve (PDD)

Year	Estimated GHG emission reductions or removals (tCO_2e)
2015	7,521
2016.	13,982
2017	35,161
2018	51,315
2019	63,447
2020	96,668
2021	118,828
2022	172,444
2023	215,732
2024	250,148
2025	290,429
2026	310,907
2027	329,081
2028	337,240
2029	342,849
2030	306,848
2031	227,274
2032	199,766
2033	156,895
2034	153,591

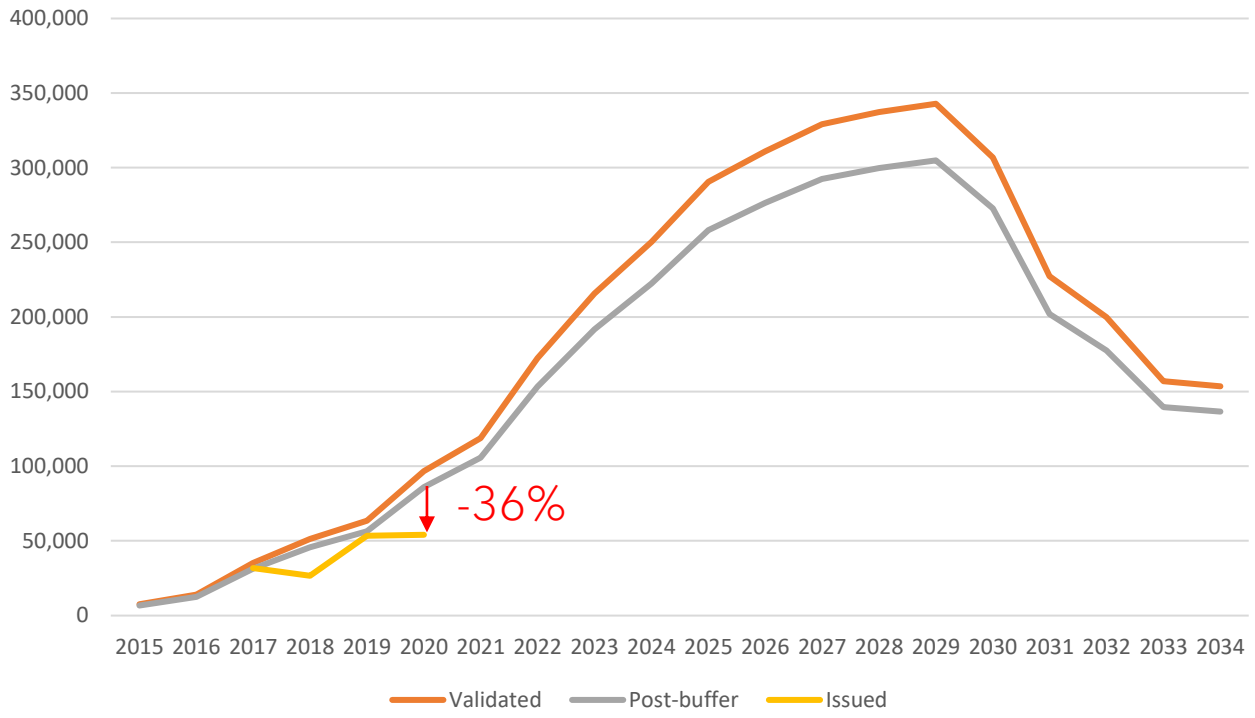
Batch of FCO2 tokens



Forward Carbon Token

Delivery risk:

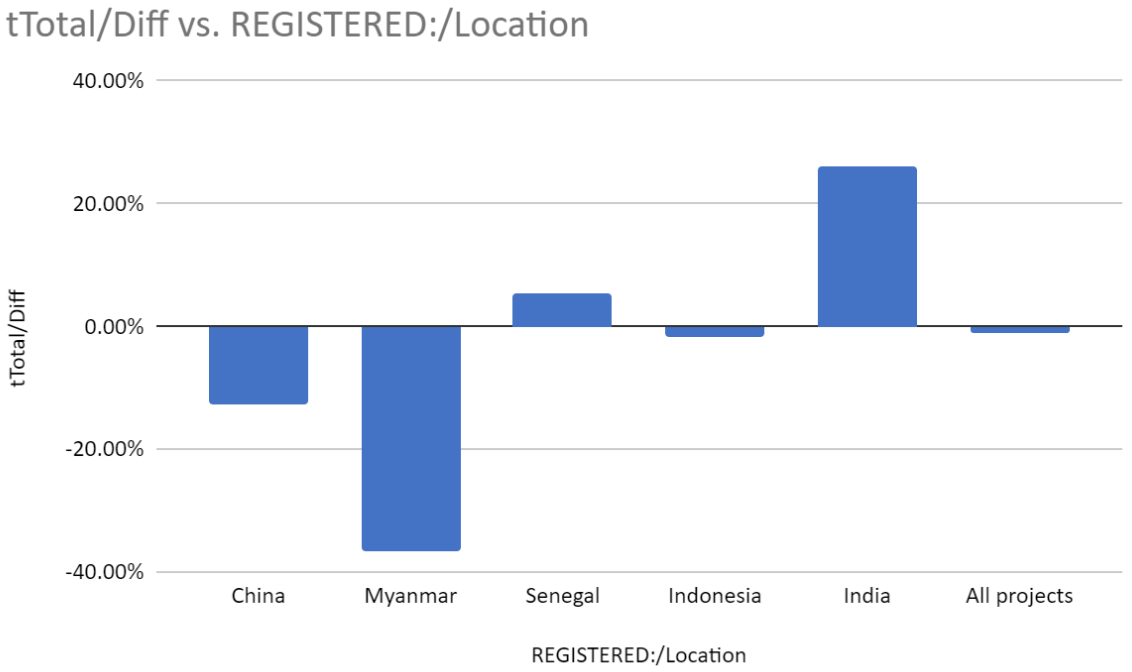
- Model risk
- Planting faults
- Certification delays
- Natural events
- Insolvency



Forward Carbon Token

Delivery risk:

- 5 mangrove projects
- Volatility ~15%



Forward Carbon Basket

Problem:

- Suppliers prefer not to take delivery risk (‘best effort’)
- No pricing benchmarks (discount = ?)

Solution:

Forward Carbon Baskets with dynamical risk reserve.

Forward Carbon Basket

- Basket – set of carbon projects with similar quality and delivery terms (e.g. *mangrove restoration*)
- 3-year delivery buckets (e.g. *2024-2026, 2027-2030*)
- '*Almost*' guaranteed delivery
- Dynamical risk reserve – individual risk assessment for every new project based on the risk scoring and diversification benefits
- Standardized tokens => deep AMM liquidity, carbon pools

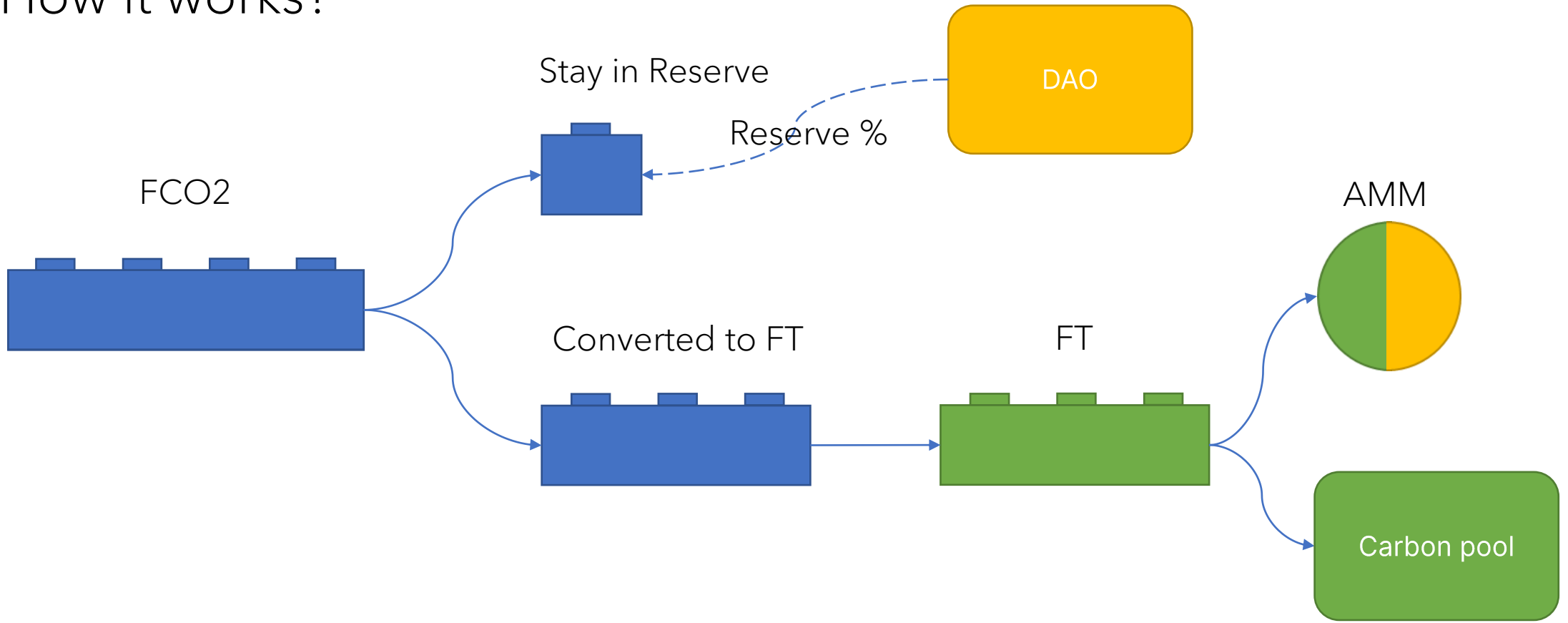
Forward Carbon Basket

How it works?

- Basket is governed by a DAO
- Supplier proposes to add FCO2 of a new project
- Project is assessed by DAO RiskCo and assigned a discount
- Supplier swaps FCO2 to Forward Basket Token at a discount
- Supplier sells Forward Basket Token to a DAO or on a market
- Supplier delivers spot TCO2

Forward Carbon Basket

How it works?



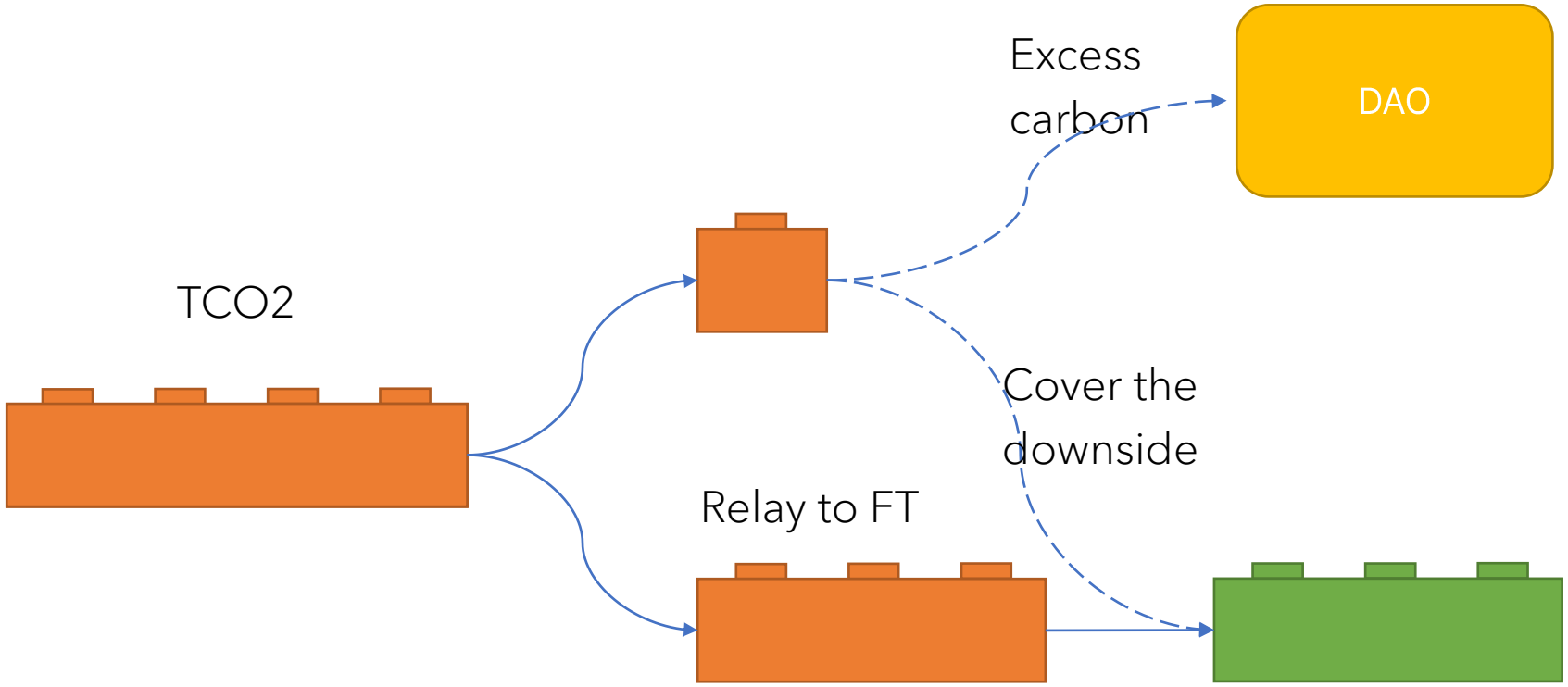
Forward Carbon Basket

What is the role of the Reserve?

- Reserve (aka *Buffer, Capital, Guarantee fund*) is a self-insurance mechanism to diversify the volatility of carbon curves between the projects and vintages
- In the sunny days reserve accumulate spot carbon
- In the rainy days reserve covers the downsides for FT holders
- Excess reserve (above certain threshold) goes to the DAO

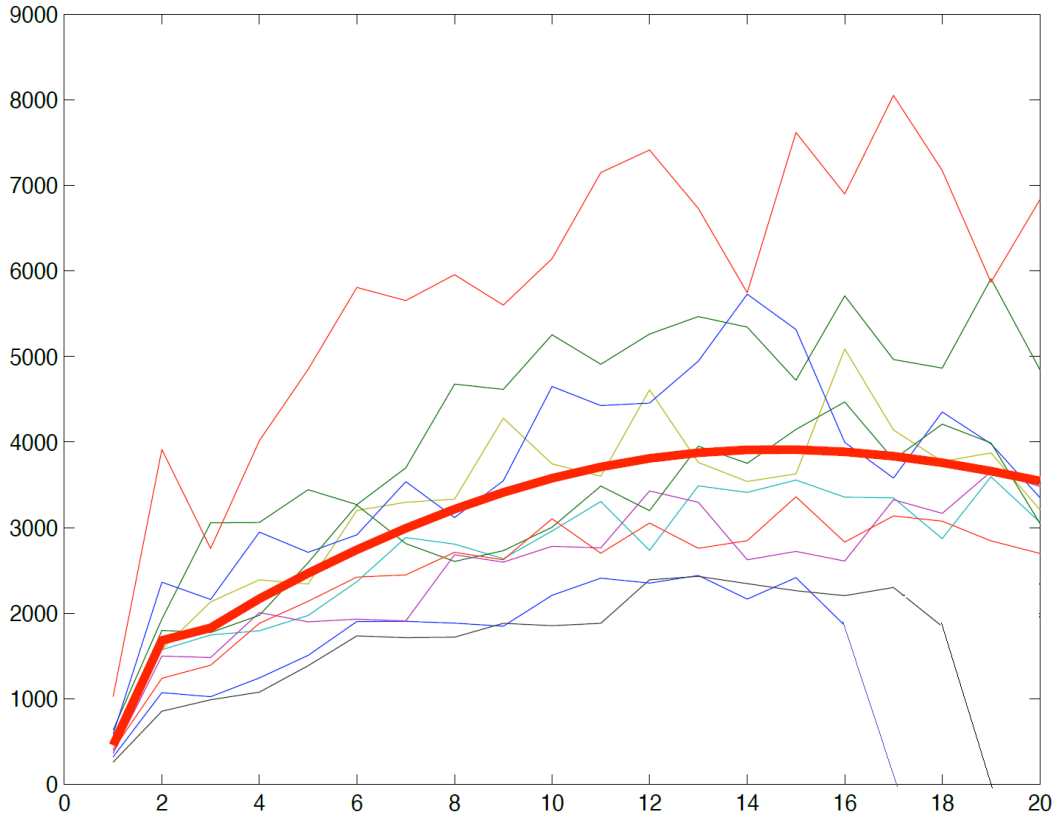
Forward Carbon Basket

How it works?



Forward Carbon Basket

Expected carbon curve and sample simulated path

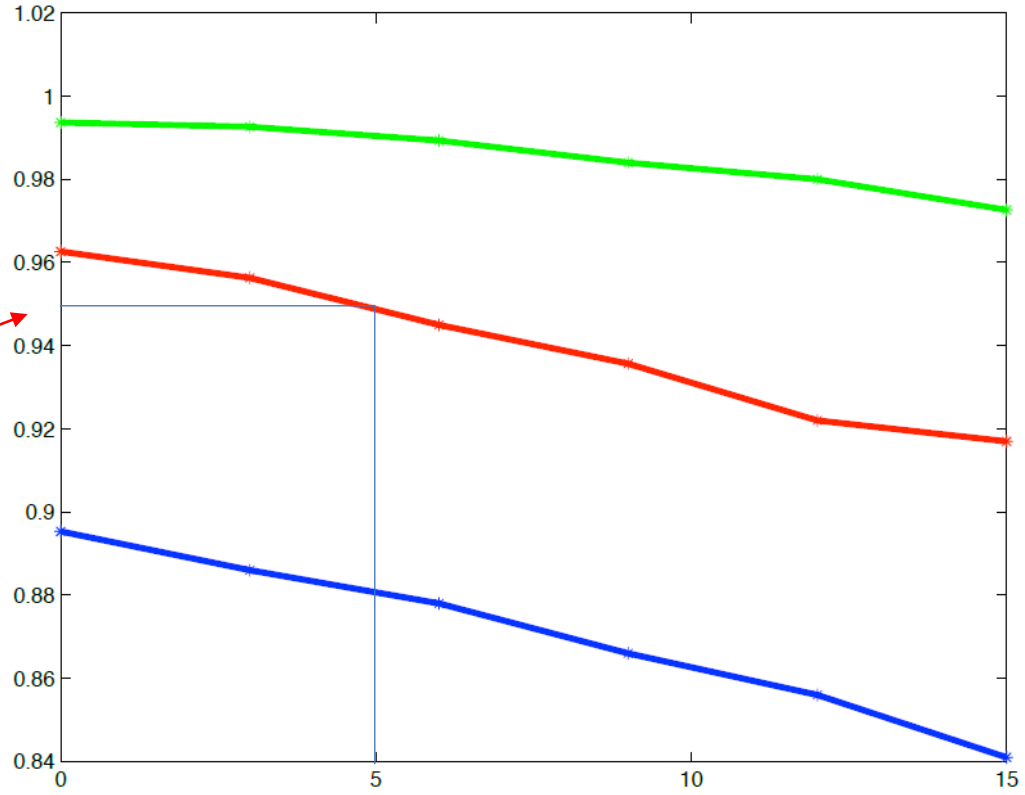


With extreme events

Forward Carbon Basket

'Almost' guaranteed => Probability of full settlement

Probability of full settlement for a 5-year delivery basket with 4 projects is 95%



Blue: 2 projects, 3 years in bucket, CapitalFee @ 30%, standard variation @ 30%
Red: 4 projects, 3 years in bucket, CapitalFee @ 30%, standard variation @ 30%
Green: 8 projects, 3 years in bucket, CapitalFee @ 30%, standard variation @ 30%

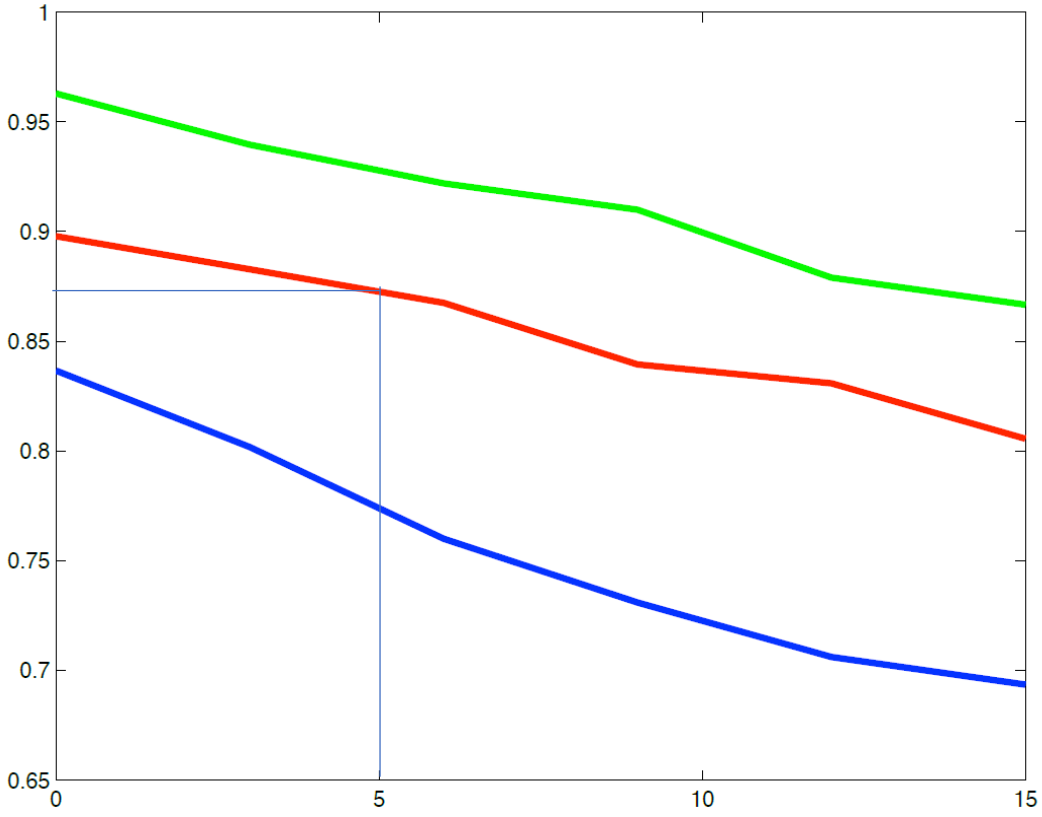
Forward Carbon Basket

'Almost' guaranteed => Conditional expected settlement

87% is settled in case of not full settlement (5% probability) for a 5-year delivery basket with 4 projects

Loss * risk = 0.65%

Carbon price annual volatility 60-80%, CAGR 50-100%



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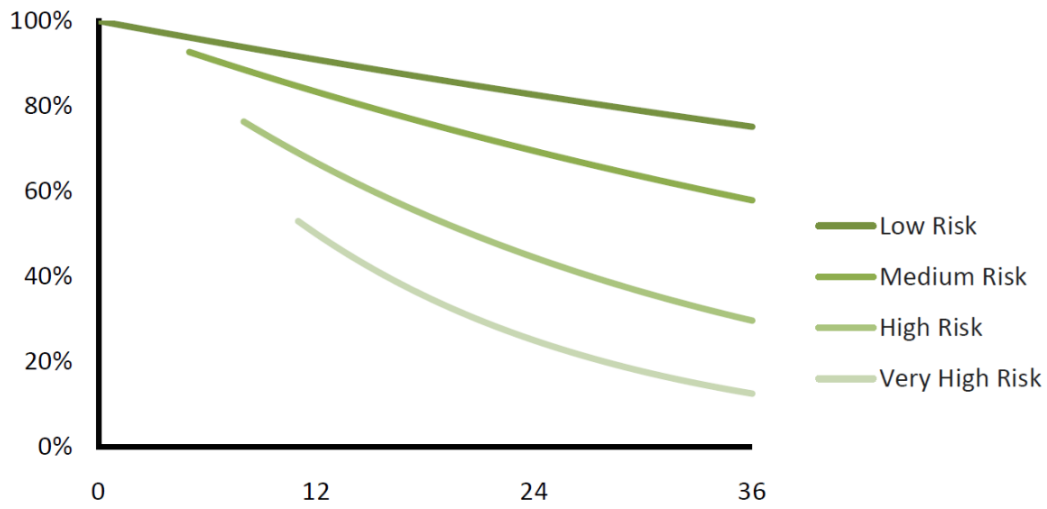
Forward Carbon Basket

Fixed discount structure vs. variable

Risk category	Common Scenario	Reserve ratio
Low risk	Project validated, first spot credits are issued	10%
Medium risk	Project validated, spot credits are not yet verified	30%
High risk	Project documentation is developed (PDD), but not yet validated	50%
Very high risk	Project documentation is in development, uncertain land tenure, first project, poor business environment	80%



Pros: Easy to understand for project suppliers

Cons: Doesn't account for term structure of risk (*2043 delivery is more risky than 2023*)

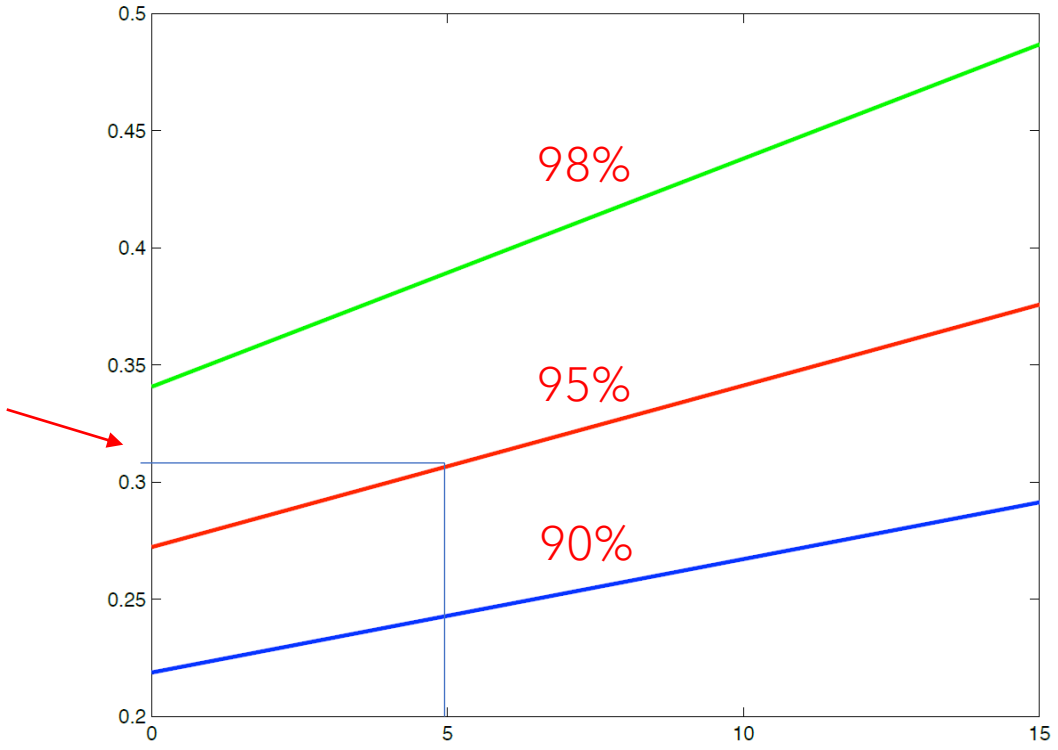
Pros: Easy to understand for forward buyers (fixed probability of full settlement, e.g. *95%*)

Cons: More complex model to estimate discounts

Forward Carbon Basket

Variable discount term structure => fixed probability of full settlement

31% discount on 5-year vintage in case of 95% risk for FT tokenholders



Vivo DAO

Incentives:

- Basket holders stake and bet on carbon price
- Projects get early financed at a fair terms
- DAO token holders benefit from doing their job right (*adding more good quality carbon projects to the pool*)