CO_2 Emitter Liability using Atmospheric CO_2 Removal Deposits (ACORDs) for Financing of Future Negative Emissions

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and
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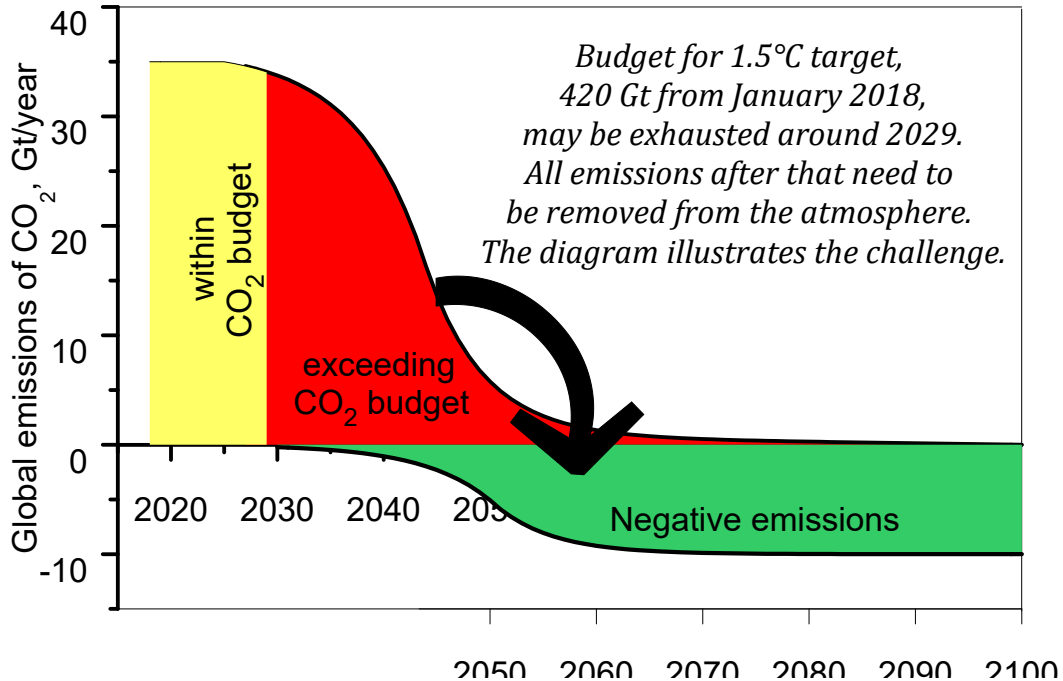
- Global carbon budget for +1.5°C is likely spent around 2029
- To meet max 1.5°C, all CO_2 emissions made after 2029 must be removed from the atmosphere.
- Emission reductions will not be made fast enough to meet the target, => all realistic scenarios for meeting max 1.5°C have large negative emissions.
- Incentives to drive needed emission reductions are lacking or have not yet reached the CO_2 price needed.
- Scenarios for meeting 1.5°C target include **gigantic of negative emissions**, but there is **no realistic mechanism for the financing** of negative emissions in place.



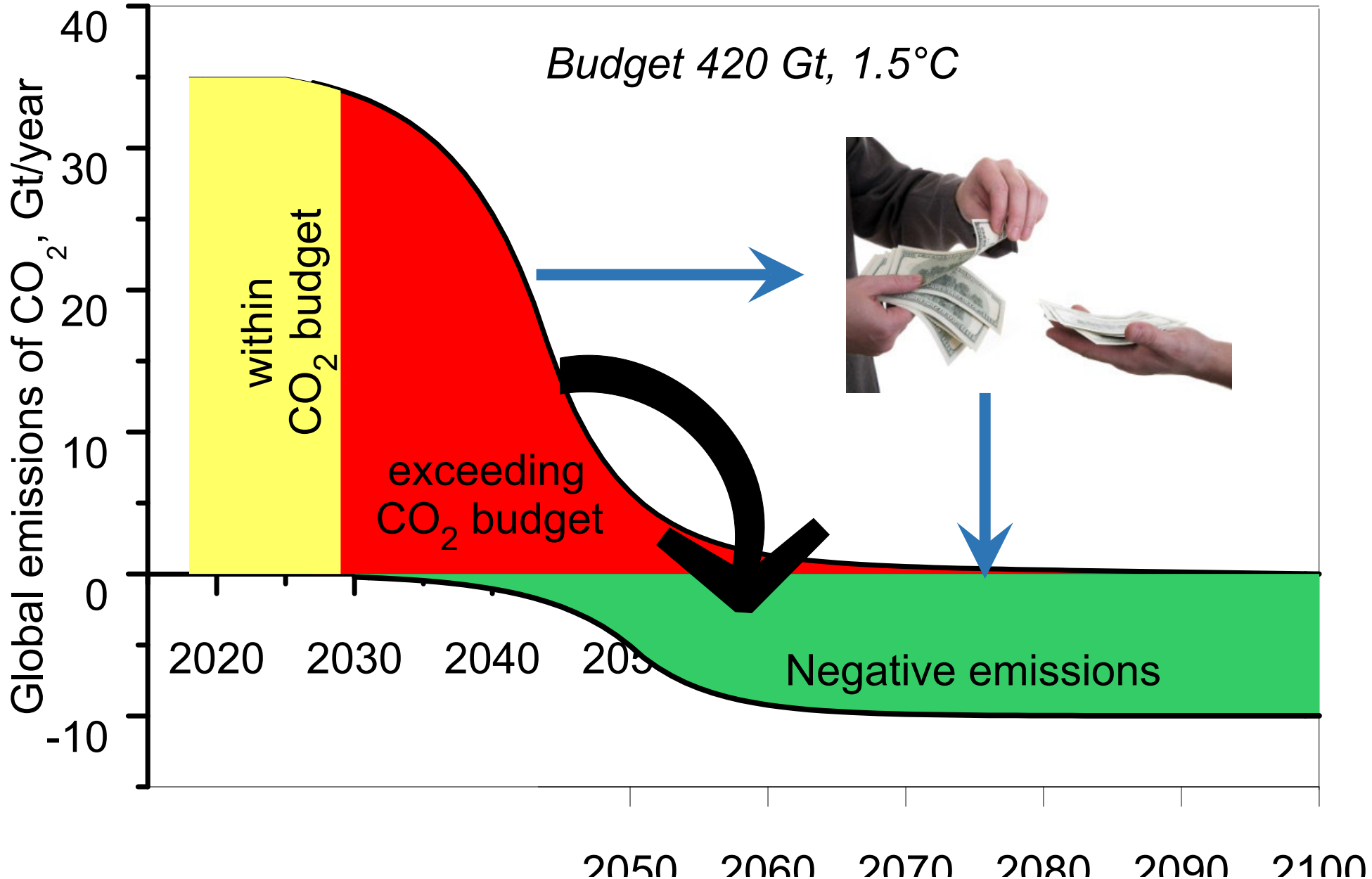
- The overspending of the carbon budget, poses a large burden on our children.

- This burden, or **climate debt**, involves removing a huge quantity, of the order of 800 Gt CO_2, at a cost likely exceeding 10.000 €/capita globally.

- Incentivizing emission reductions by pricing CO_2 is attractive as it steers the market to the least costly ways of avoiding emissions. In addition CO_2 pricing could provide fiscal income. Even so, pricing emissions has been hard to accomplish.

- **Incentivizing negative emissions is fundamentally more difficult** than pricing emissions, as it comes with a large **cost**, and in the case of the burden left to our descendants, it is hard to identify who will pay for negative emissions.

- The major moral hazard/collapse, may not be debt as such, but handing over to our children and grandchildren **a problem** that is likely to be **insoluble**, i.e. how the climate debt should be **shared** between nations and ultimately also between citizens.
- The insolubility involves sharing a burden between nations with *widely different historic emissions*, different motivation, different political systems and *different opportunities* for achieving negative emissions. How to reach consensus of fair sharing.
- Taken down to individual nations, it is difficult to see how negative emissions - a common good for mankind with *little tangible and immediate climate benefits for voters* - can be prioritized by a sufficient amount of funding from governments *in competition with material public expenditures like healthcare and education*.
- A possible, and obvious, solution to this problem would be to implement a **climate recovery liability** on the emitters to make them responsible for removing their emissions from the atmosphere.


Budget 420 Gt, 1.5°C
Global emissions of CO_2, Gt/year
40
30
20
10
0
-10
within CO_2 budget
exceeding CO_2 budget
Negative emissions
2020
2030
2040
2050
2060
2070
2080
2090
2100

- Such a liability would be **fair, comprehensible and rational**, and also provides an incentive for emissions reductions.

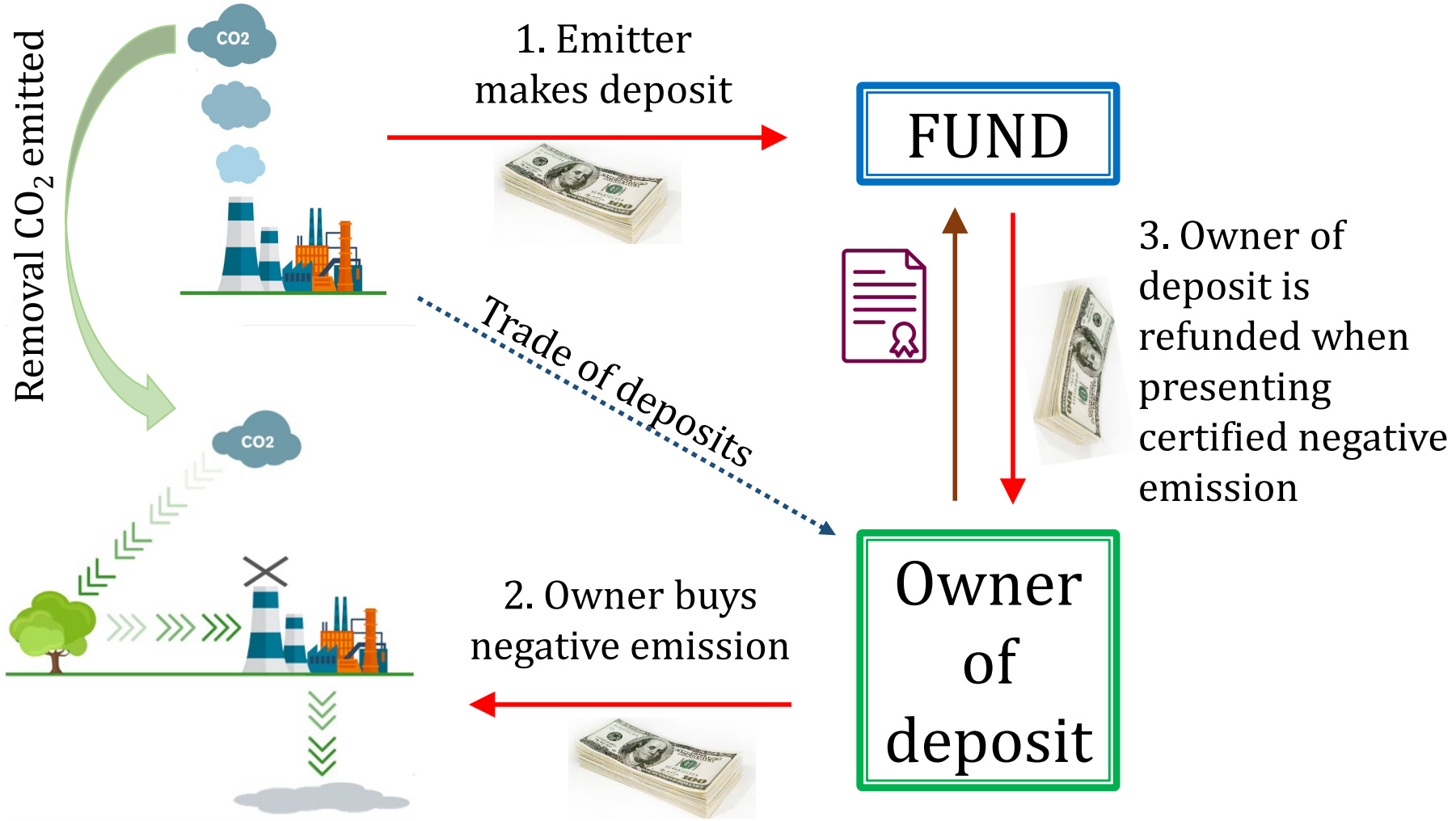
- With the carbon budget soon exhausted, such liability should be introduced **as soon as possible**, in order minimize temperature overshoot and associated damage as well as the risk it would entail for the triggering of climate system tipping points.

- A climate recovery liability would need a design that considers that a majority of the negative emissions will be made long after actual the emissions.

- To deal with the timelag between emissions and removal, and to promote a cost-efficient market for negative emissions, the design of such a liability could be operationalized through a **deposit and refund scheme**.

- Thus, emitters will make financial deposits. Refunds can be claimed by deposit owners, when presenting proof of certified negative emissions.

Atmospheric CO_2 Removal Deposits (ACORDs)



Likely cost of negative emissions ≈ 0.1-0.2 €/kg CO_2

Carbon dioxide intensity in global economy: 0.25 kg CO_2/€

Thus: a CO_2 cost of 0.15 €/kg corresponds to ***3.75% of global economy***

The cost to avoid CO_2 emission is normally lower than 0.15 €/kg.

Thus: Cost well below 4% of GDP.

The deposits will be placed in a fund, and the value of the deposits will **increase with the returns.** Deposits can be **traded.**

The deposits need to be **confined in time**, i.e. come with a final year. If final year is exceeded, the owners will need to pay a fee to keep the deposit. If not payed, the owner will loose the deposit and it will be sold.

Example (a bit simplified):

Cost of deposit for emitter : 150 €/tonne,

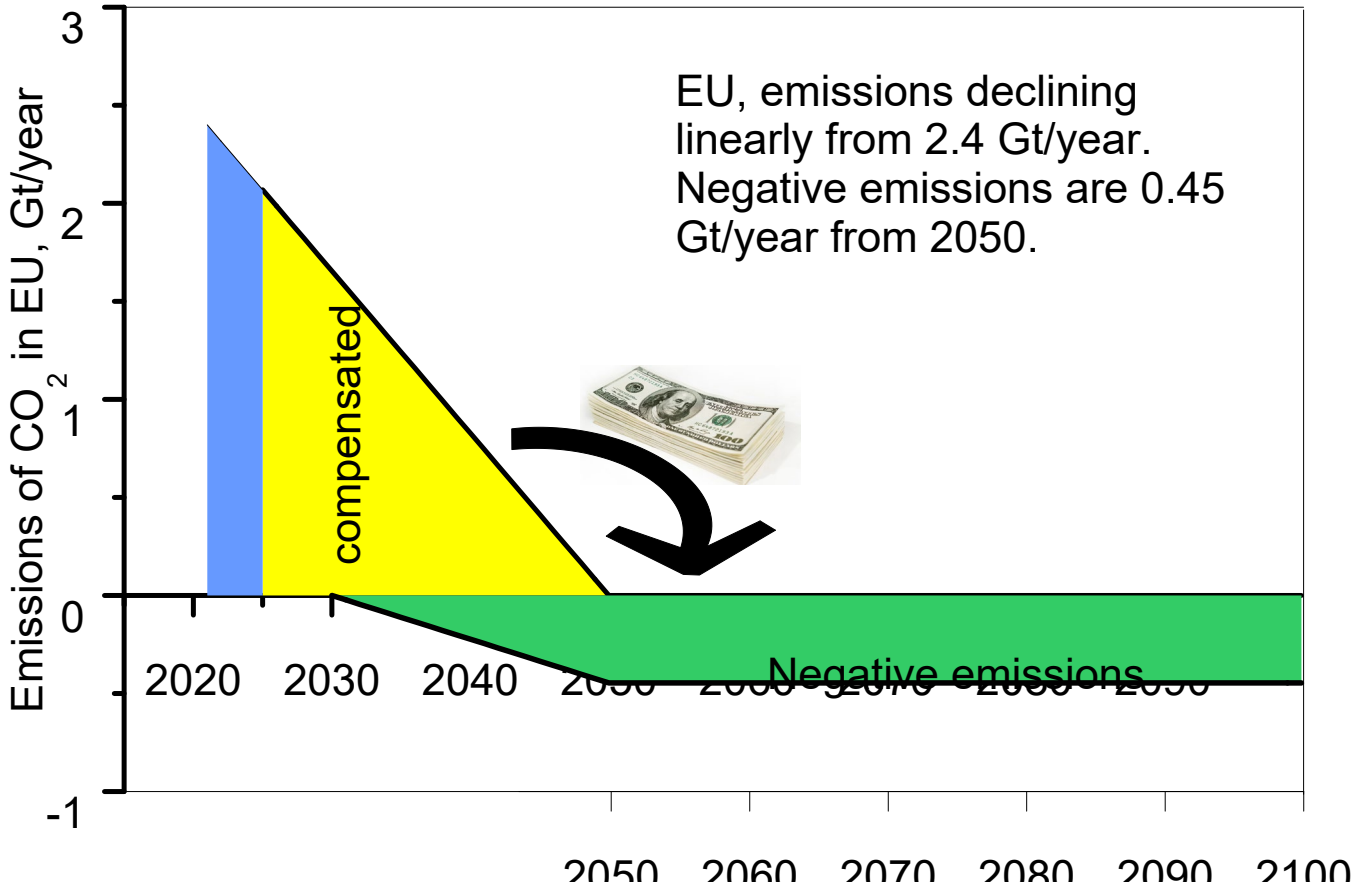
Cost of removal: 100 €/tonne

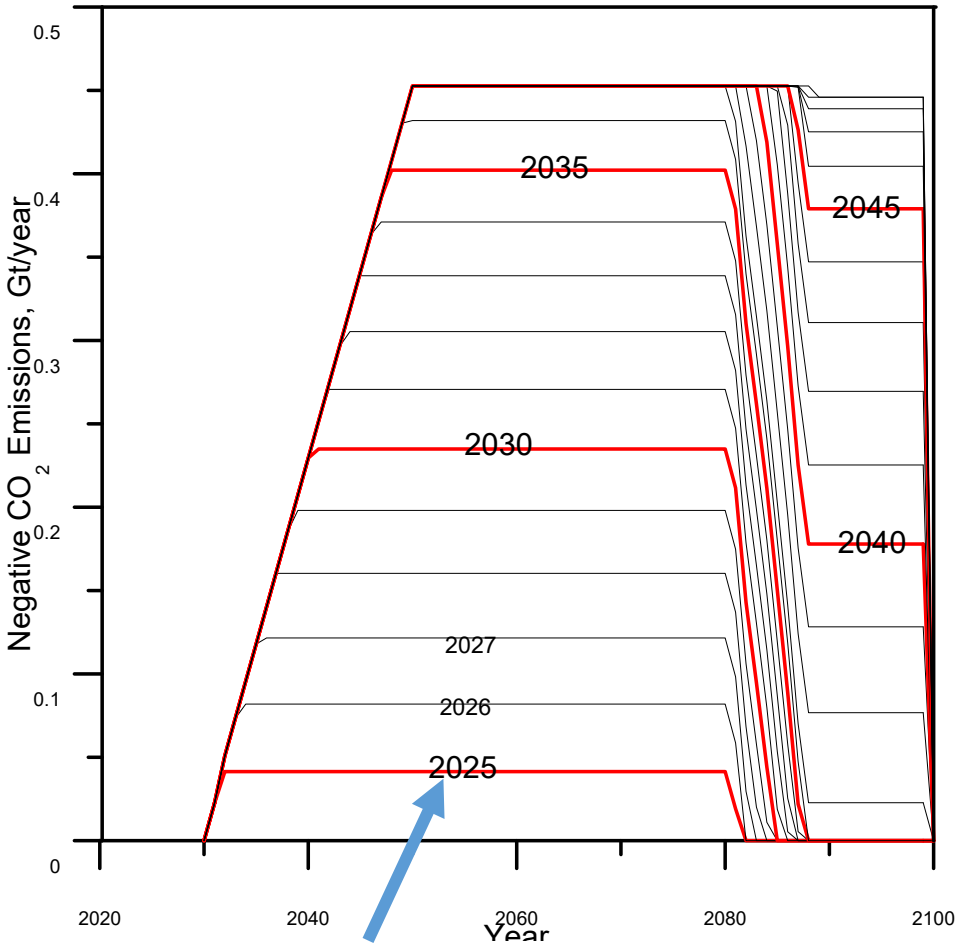
$\Rightarrow$ Market value of deposits: 50 €/tonne (increases with yearly returns)

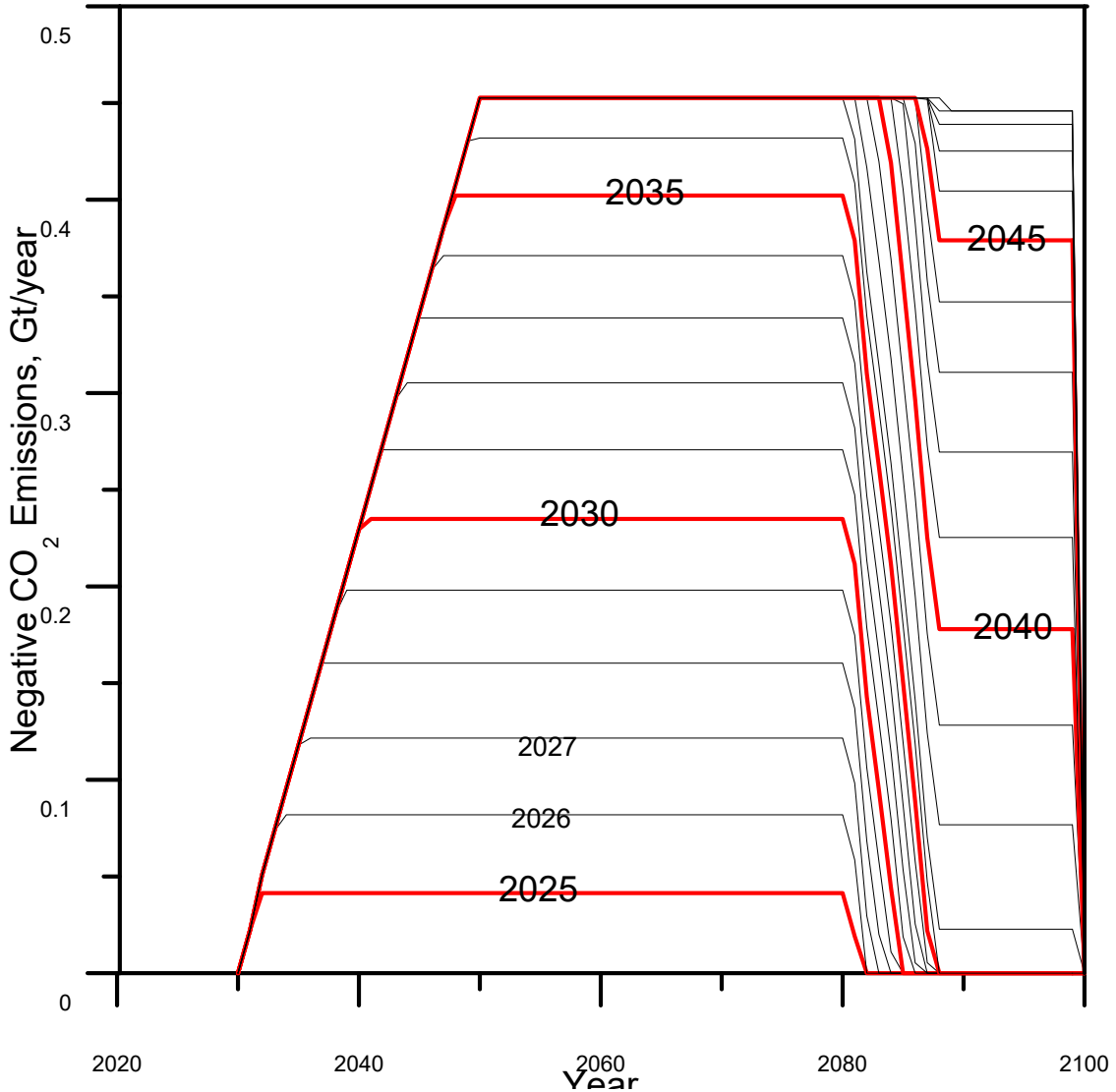
If emitter sells the deposits for 50 €/tonne => actual cost is 100 €/tonne of CO_2 emitted.

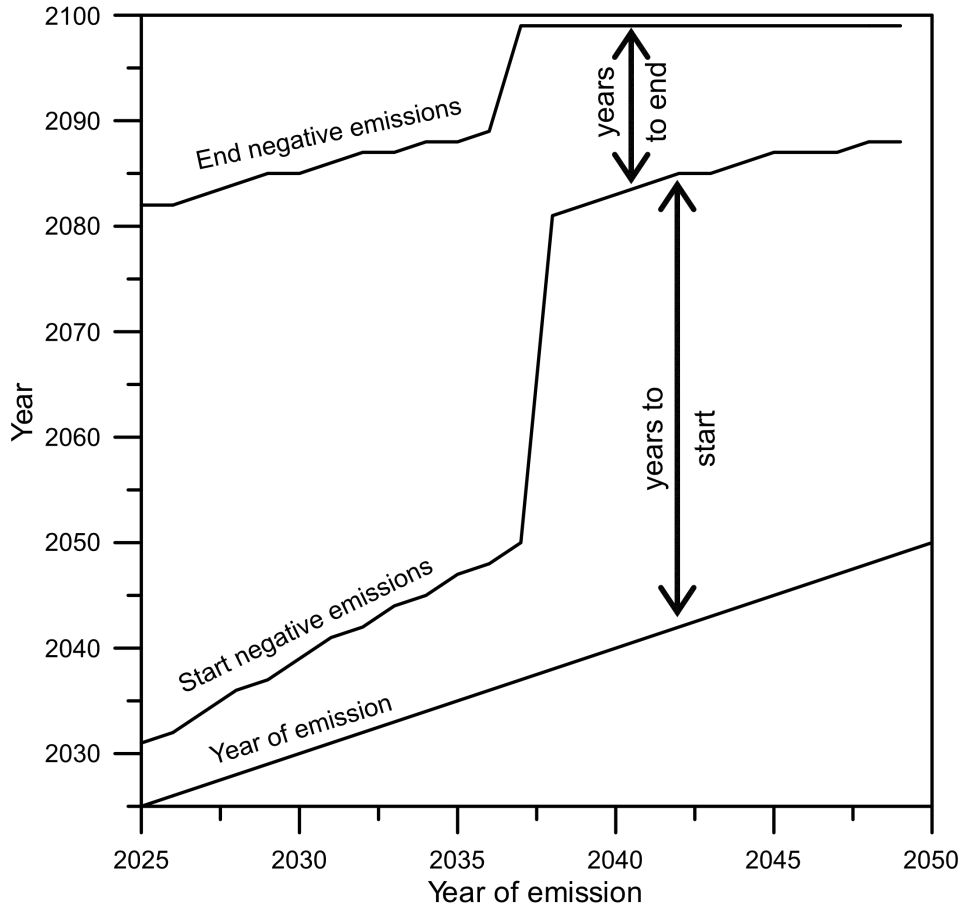
Example: ACORDs introduced in EU 2025

2025 years emitters will have end years to promote an even distribution between 2030 and 2080.






0.5
0.4
0.3
0.2
0.1
0
Negative CO 2 Emissions, Gt/year
2035
2045
2030
2040
2027
2026
2025
2020
2040
2060
2080
2100
Year


2100
2090
2080
2070
2060
2050
2040
2030
Year
End negative emissions
years to end
years to start
Start negative emissions
Year of emission
2025
2030
2035
2040
2045
2050
Year of emission

Owner of deposits is motivated to make long-term contracts with operators of negative emission plants.

Long-term contracts will secure investments in NETs.

ACORDs creates a market that promotes technology development and reduces costs

Owners of deposits will pick low-hanging fruits first.

As low-hanging fruits have been reaped, costs of deposits will eventually be increased.

This will gradually raise incentives to the levels needed for achieving the real deep reductions in fossil emissions needed.

Safety of deposits:

Even though the value of the deposits will increase with the returns there is still a risk that the market price for available negative emissions may have reached a level that exceeds the value of the deposits, making them worthless.

A possibility for solving this is to charge new buyers of deposits with an **additional fee**, that is used to increase the value of deposits (i.e. the sum of money received per tonne of CO_2 when redeeming the deposits).

Overcompensation and undercompensation

Overcompensation means emitter needs to buy deposits in excess of the actual emissions. Example: emitter of 1 tonne of CO_2 needs to pay a deposit for removal of 1.5 tonne of atmospheric CO_2. Motivations could be:

- Failure to introduce ACORDs or any similar system in time on a global scale, meaning that carbon budget is exceeded without sufficient liabilites to remove the overshooting CO_2.
- Rich countries, being the main responsible for the large historic emissions of CO_2, must also share a larger burden for removals from the atmosphere.
- In the interest of lowering the fossil emissions, a high price of CO_2 is obviously helpful, and overcompensation would lead to higher price thus further lowering fossil emissions, as well as increasing the negative emissions. (Perhaps even a possibility to work towards more ambitious targets than max 1.5°C.)
- It could be relevant to introduce an overcompensation for less safe carbon removal options, e.g. nature-based.

Also possible to undercompensate emissions, e.g. to phase in ACORDs.

Directed compensations

Limits could be introduced on specific negative emission technologies, i.e. a max 50% of nature-based solutions, or a minimum 10% for DAC. Motivations could be:

- To assure that the mix of negative emissions being done include an adequate amount of safely removed carbon.
- In the case of a minimum fraction DAC, this could be to relieve the pressure on biogenic negative emissions, by creating a parallel market for the expensive negative emission technologies not dependent on biomass.
- It could also be used in combination with overcompensation, for instance to achieve raised ambitions without increasing pressure on biogenic negative emissions or to raise cost of fossil CO_2 emissions.

Carbon intensity in EU is around 0.17 kg CO_2/€, so a cost of 0.15 €/kg corresponds to 2.5% of economy.

Proposal for Sweden* Emitter Recovery Liability for non-ETS-emissions.

- 23 Mt/year, >halving Swedish domestic CO_2 emissions
- mainly transportation fuels

Cost: 2.3 billion €/year assuming 0.1 €/kg

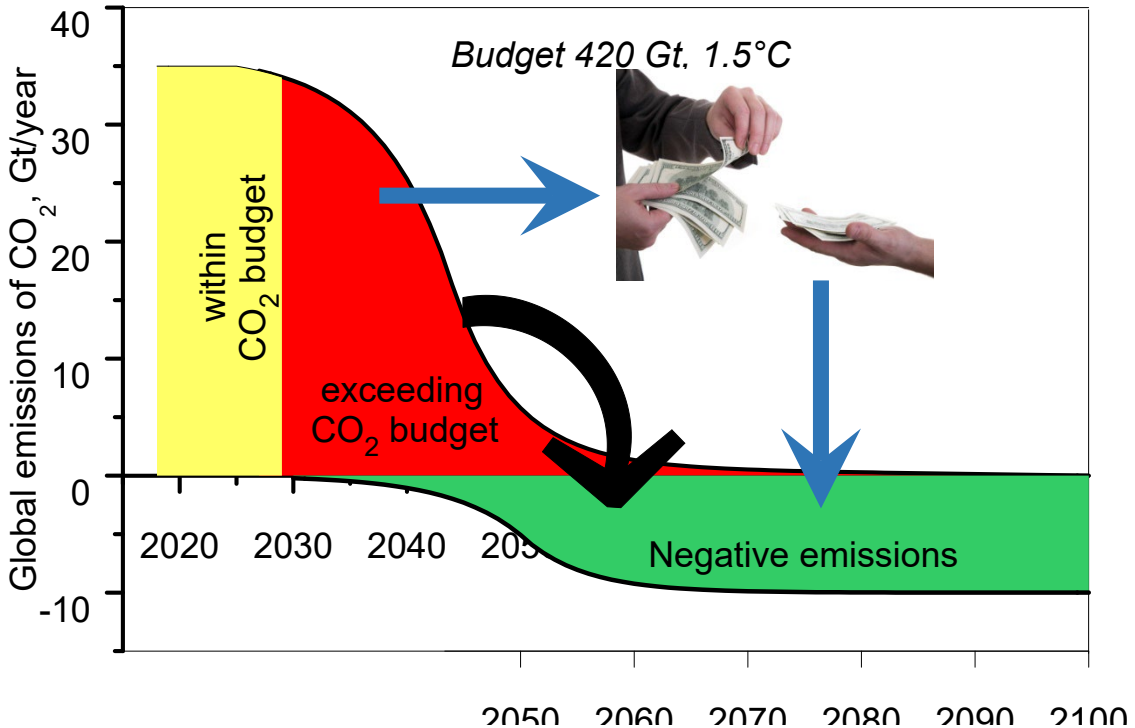
0.5% of GDP

230 €/Swede,year

0.23 €/L petrol (10% of petrol price)

*Lyngfelt, A., and Fridahl, M., *Så kan vi halvera Sveriges koldioxidutsläpp nu*, DN Debatt, Dagens Nyheter, 16 april 2020.

Thank you !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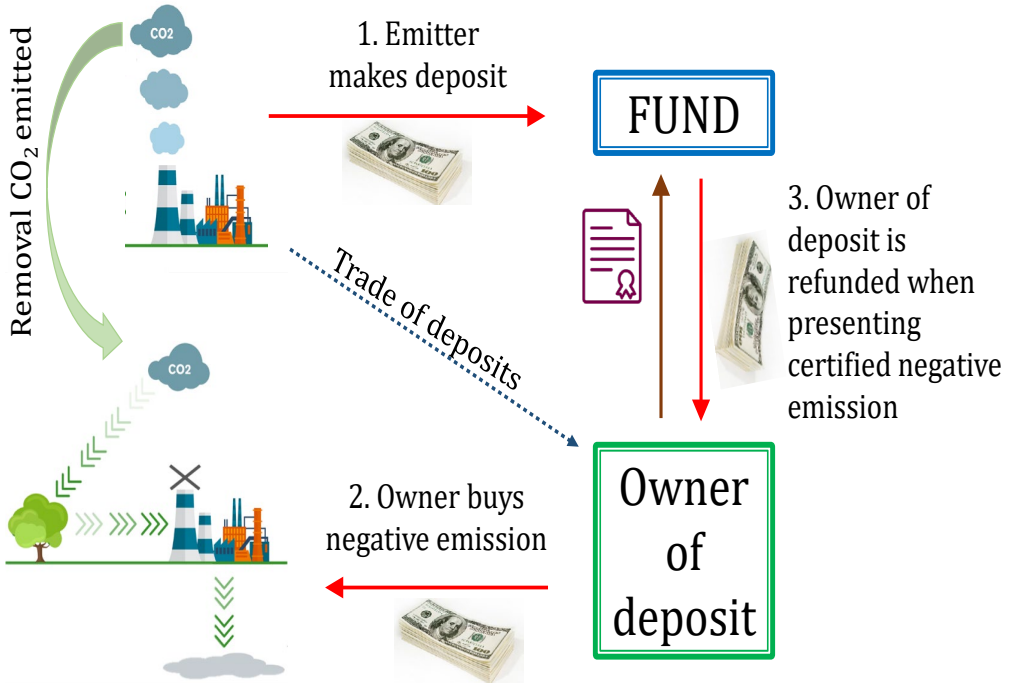
Removal CO_2 emitted
CO2
1. Emitter makes deposit
FUND
Trade of deposits
3. Owner of deposit is refunded when presenting certified negative emission
2. Owner buys negative emission
Owner of deposit