DECARBONIZING THE FUTURE

REVERSE CARBON MINING

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TOP 10

TOP 60 XPRIZE CARBON REMOVAL

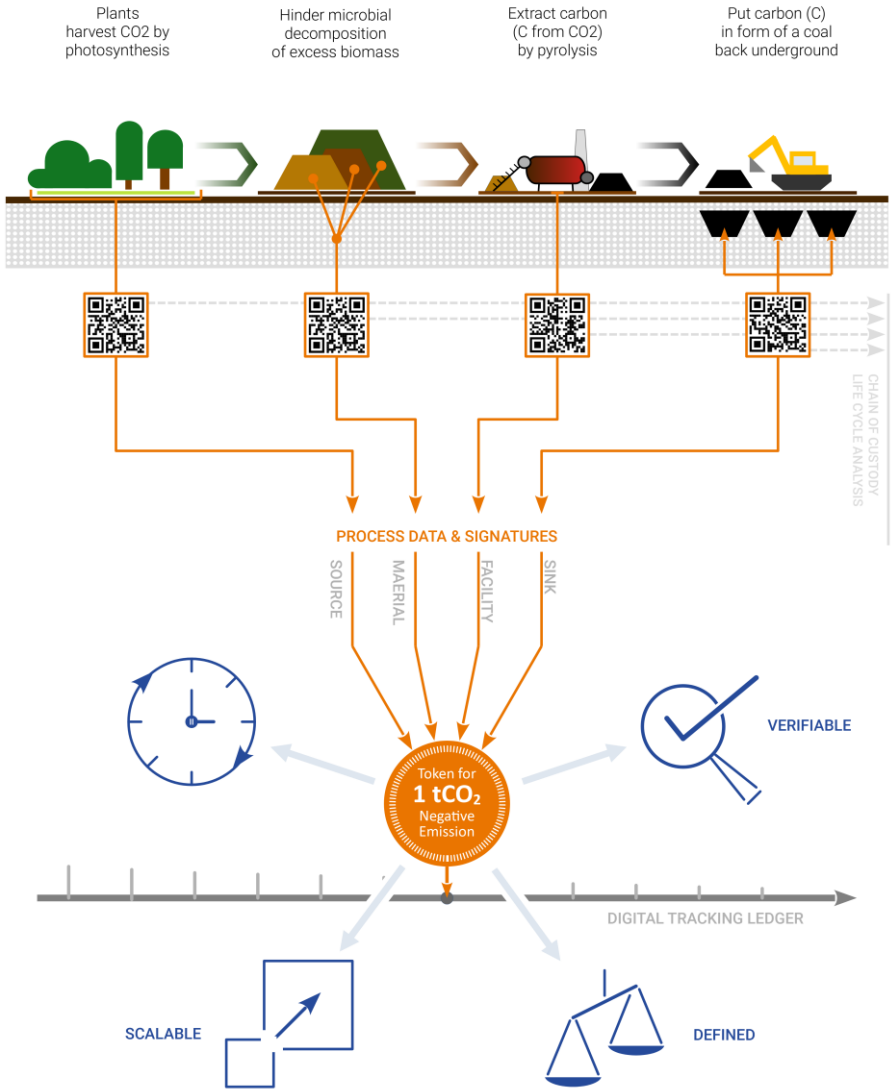
Executive Summary

REVERSE CARBON MINING PROJECT

The voluntary market for trustworthy and truly permanent **Carbon Dioxide Removal (CDR)** products is largely unsatisfied. The most prominent signs are the multi-million dollar Advanced Market Commitments from „Frontier“ and „Lowercarbon Capital“.

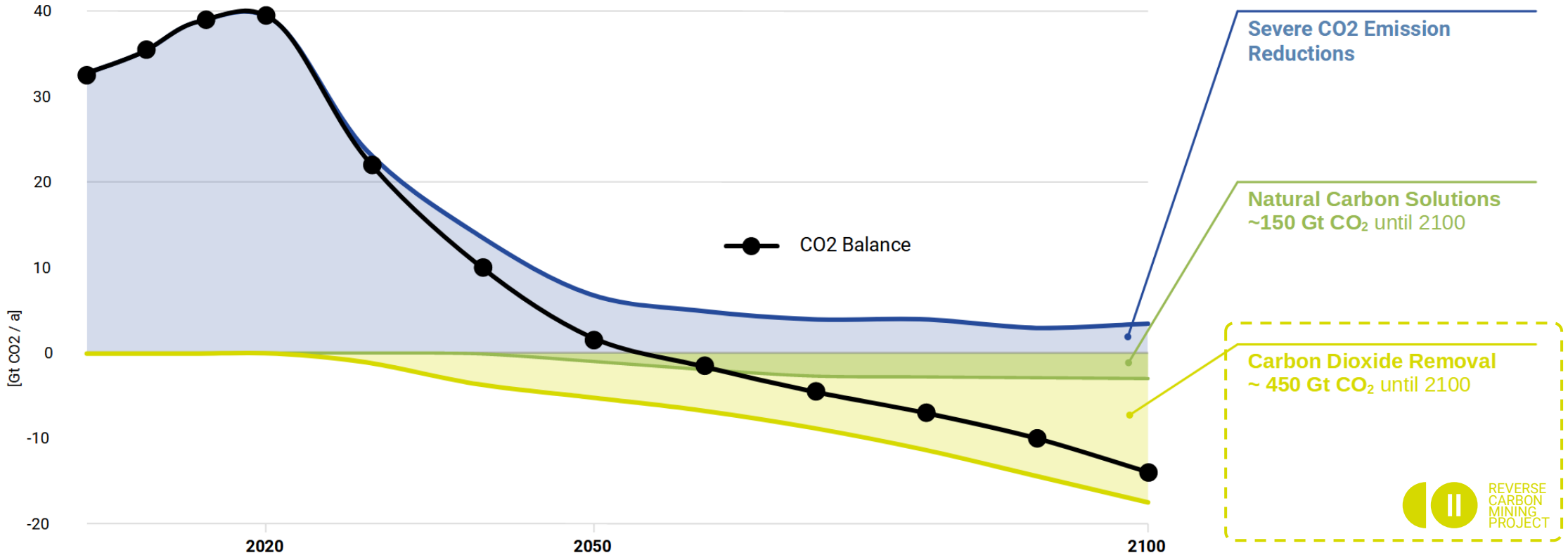
Thus, we introduce a unique, high-quality CDR commodity (permanent, defined & verifiable) generated in a process called **„Reverse Carbon Mining“ (RCM)**. The applied pyrolysis technology (highly scalable and readily available) transforms excess (joint- or by-product) biomass into a form of coal, and we literally put it back underground.

The central element of **RCM** is our **cradle-to-grave biomass tracking platform** that documents the whole CDR process in a tradable digital token equaling a ton of CO2 permanently removed from the atmospheric system.



Demand for permanent Carbon Dioxide Removal

Balance of Emission Reductions, Natural Carbon Solutions and permanent Carbon Dioxide Removal (CDR) required to limit global warming to 1,5°C.

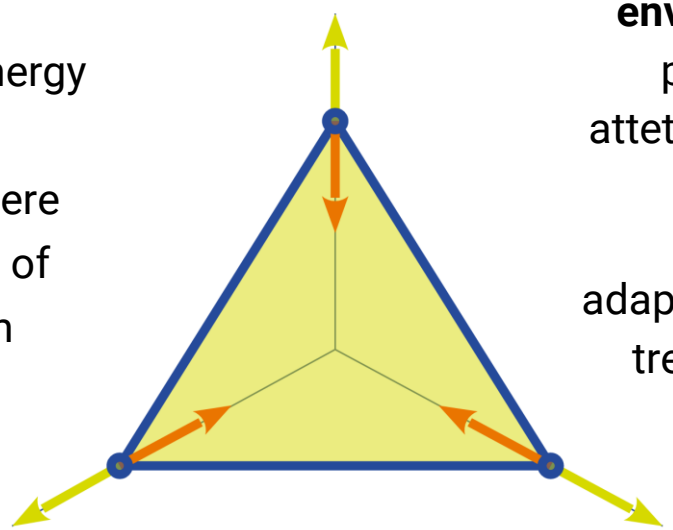


Source: Zeke Hausfather – Climate Research @ Stripe.

Can we combine these seemingly mutually exclusive apsects of biomass?

The IPCC report foresees massive quantities of permanent CDR through biomass utilization (mostly BECCS). However, the amount of biomass currently used for energy production(~52 EJ) is not even half the foreseen BECCS potential. In addition, there are a lot of people calling for a reduction of biomass usage in favor of natural carbon sinks and biodiversity protection.

The problem is that we will need those negative emissions, and the currently viable alternatives (e.g., DAC) require a lot of energy.



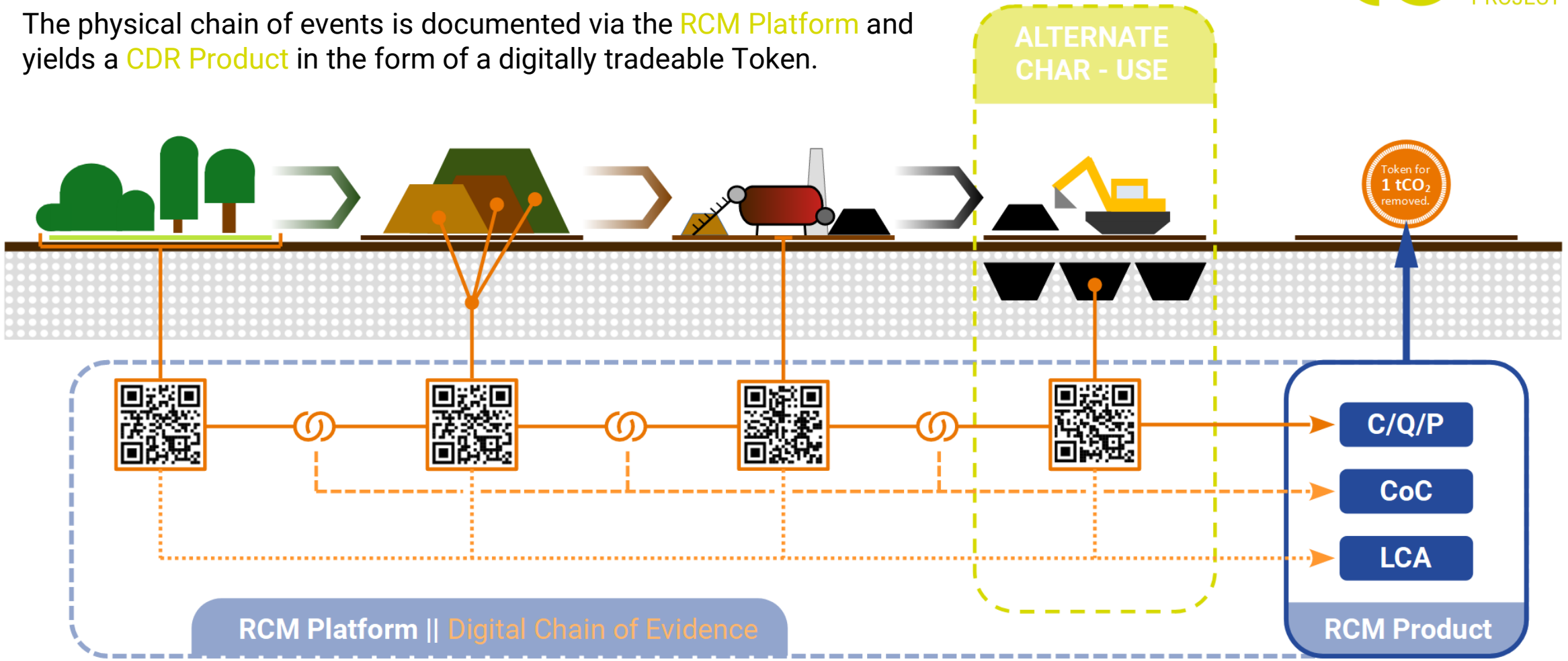
With the right amount of documentation and oversight, **enabling/guaranteeing social and environmental sustainability**, we think that it is possible to unite the aspects and draw more attetion to the required **net primary productivity**.

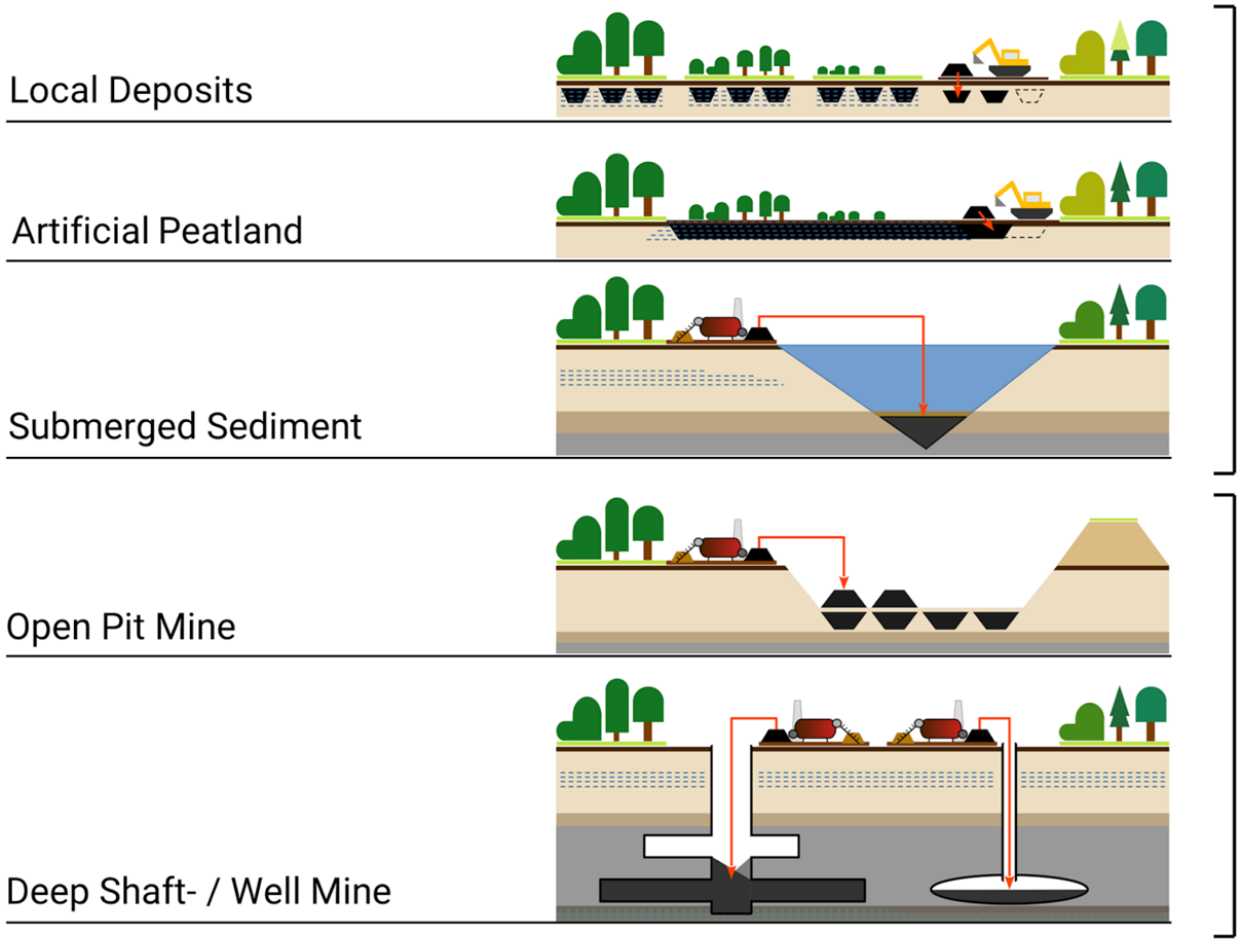
Periodic, sustainable extraction from locally adapted and near-natural ecosystems (e.g., local tree species) would be preferable to extensive use of agricultural land for energy crops. In the same way, a healthy soil structure is crucial for productivity, but the potential for permanent CDR is much greater in combination with technical processes (CCS, pyrolysis).

Reverse Carbon Mining in a Nutshell

REVERSE CARBON MINING PROJECT

The physical chain of events is documented via the RCM Platform and yields a CDR Product in the form of a digitally tradeable Token.





RCM Storage Options and additional Benefits

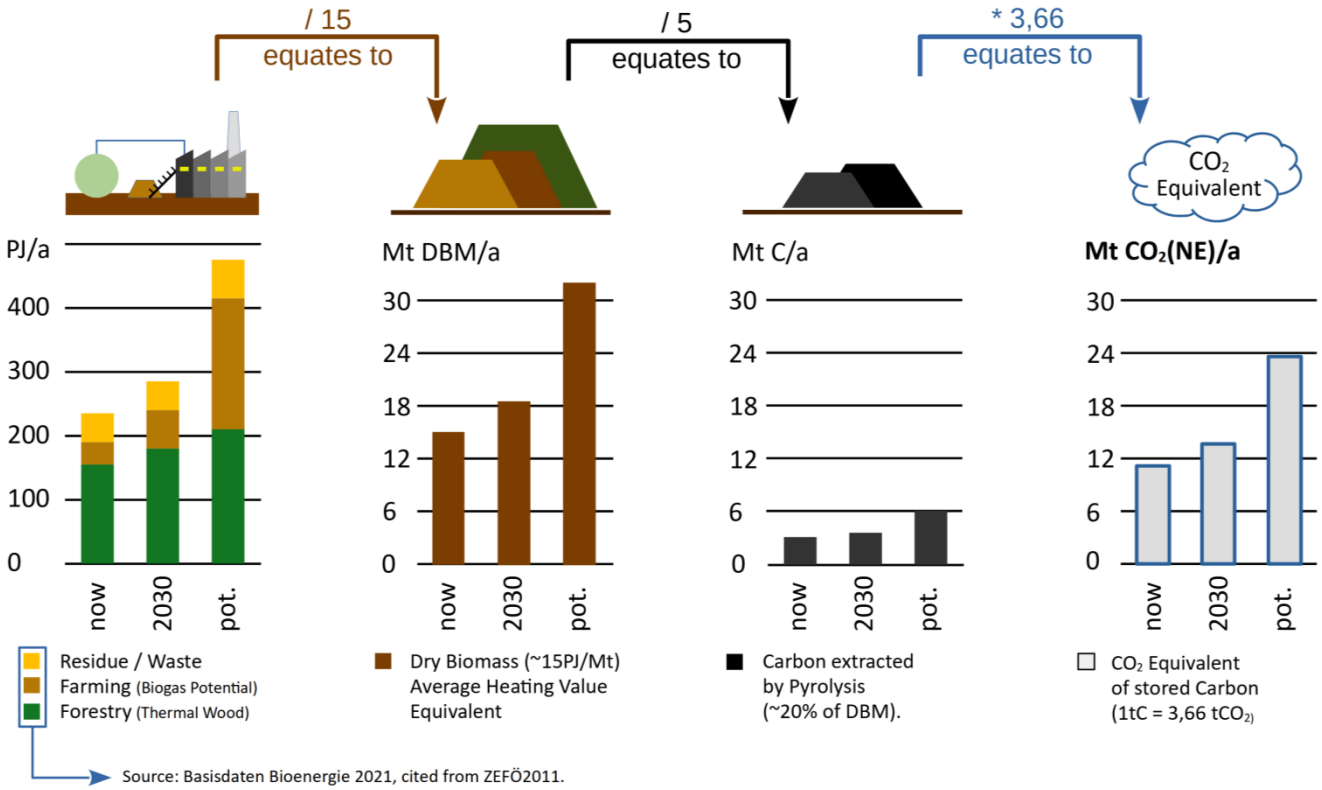
There are several options to durably store the RCM derived carbon:

The ideal solution is to store the char in decentralized underground pits as close as possible to the processing facility and the source of biomass. As this is currently not permitted under **EU waste legislation** we need to work with exemptions (mine reclamation). However, we do think that this will be resolved in the long run, since there is no scientific reason against.

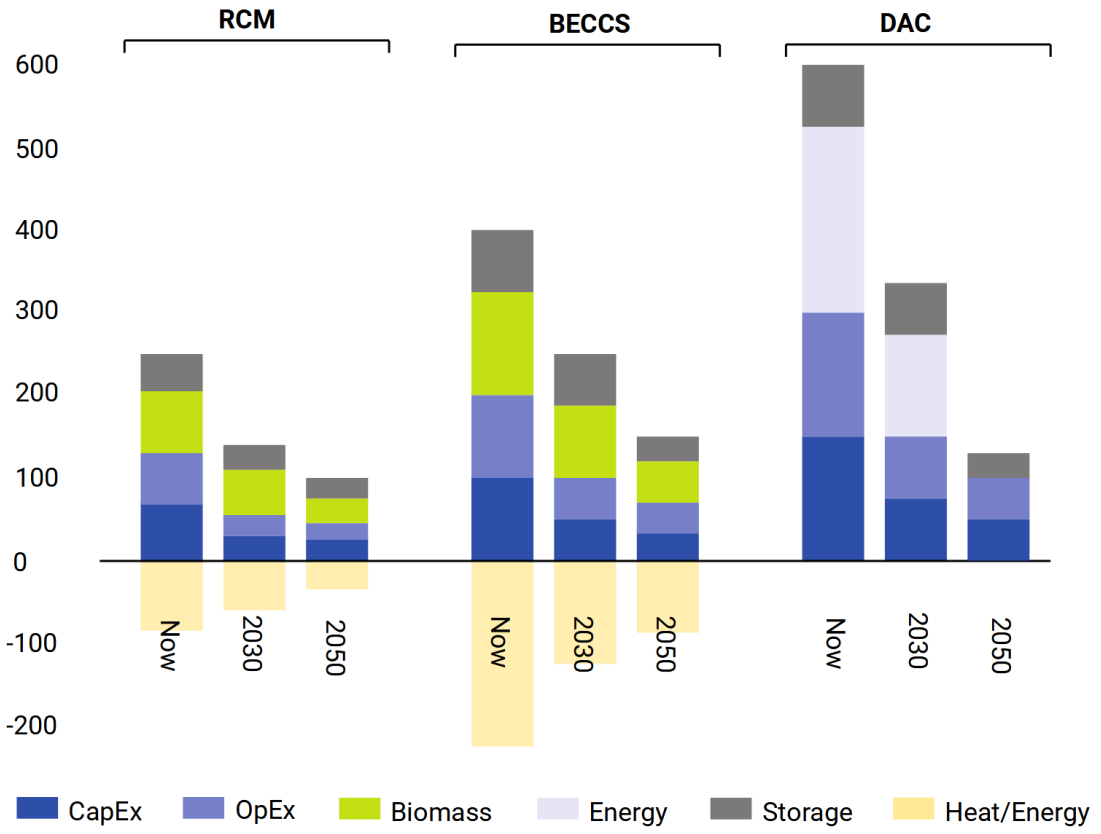
In addition, there are beneficial effects of char deposits for contaminated areas (mining sites, road run-off, spills …)

Pyrolyzing and permanently storing the carbon of 10% of the worldwide **Net Primary Production** could yield a CDR amount of >10 Gt CO2/a. That would cover most of the permanent CDR required in the IPCC climate models.

The Austrian potential can be estimated from the Bio-Energy potential. If we pyrolyze the currently already utilized Biomass instead of burning it, we'd still get about halve the energy, but could already offset **10% of the national emissions**.



Cost per ton CO2 removed in direct comparison.



CDR … Carbon Dioxide Removal
RCM … Reverse Carbon Mining

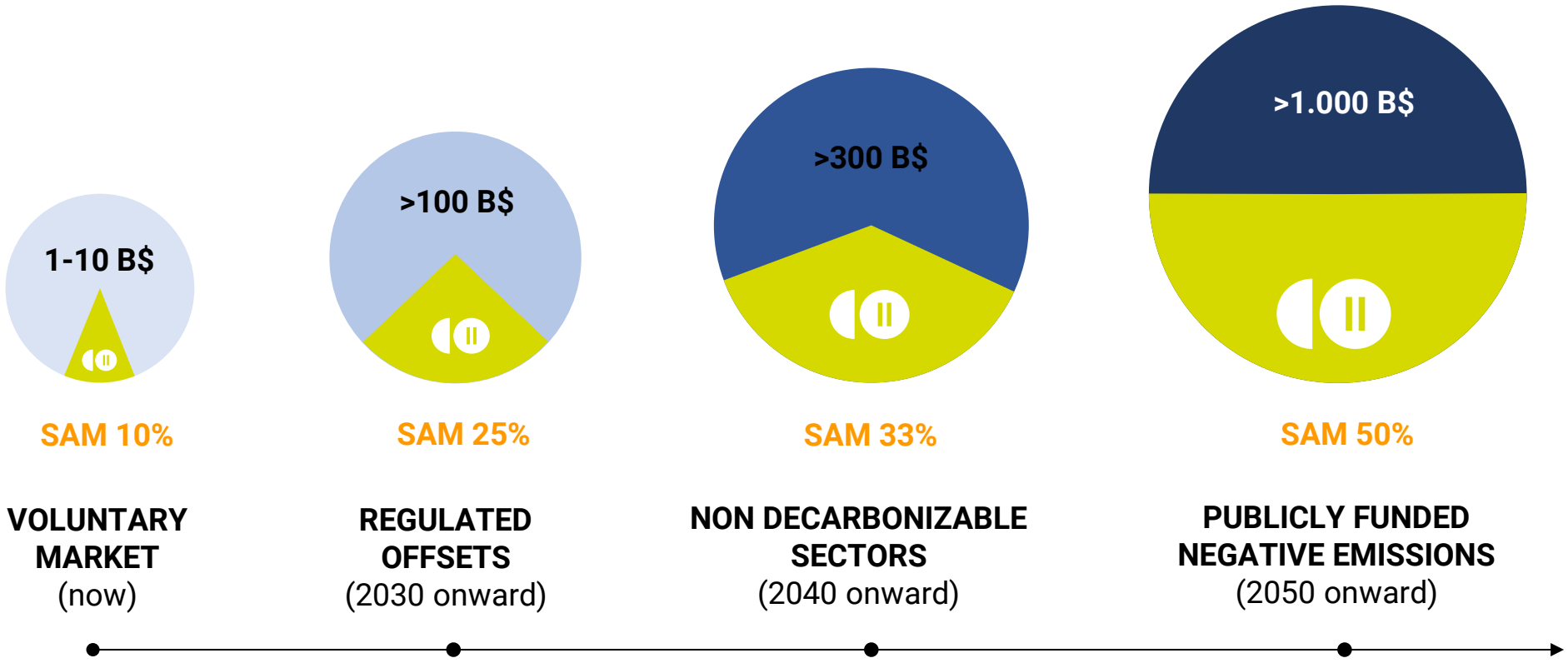
BECCS … Bio-Energy with Carbon Capture and Storage
DAC … Direct Air Capture

Clear advantages of RCM are:

- A **wider variety of biogenic material** can be utilized (if char properties are not critical), reducing source material costs.
- Pyrolysis is much **less technologically complex** than CCS, drastically reducing the Capital/Invest expenses.
- The **additional energy** from BECCS vs. Pyrolysis does not make up the difference in investment costs (70-90% BECCS vs. 50% Pyrolysis). At least not for small and medium facilities. Making energy from Biomass, and then CDR from this energy would be very inefficient.
- **Burying char** requires much less effort than permanently storing gaseous CO2. Especially in densely populated areas like central Europe.
- Overall carbon **removal efficiency** of BECCS and RCM is very close if the char is buried (60% vs 50% of source material carbon content).
- DAC will only be competitive if/where energy is practically free (here depicted for 2050).

NEGATIVE EMISSIONS AND OFFSET MARKETS DEVELOPMENT

Serviceable Available Market for a truly permanent CDR Product.



INITIATORS / PROJECT TEAM

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