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EXPLORING THE POLICY LANDSCAPE OF CARBON DIOXIDE REMOVAL

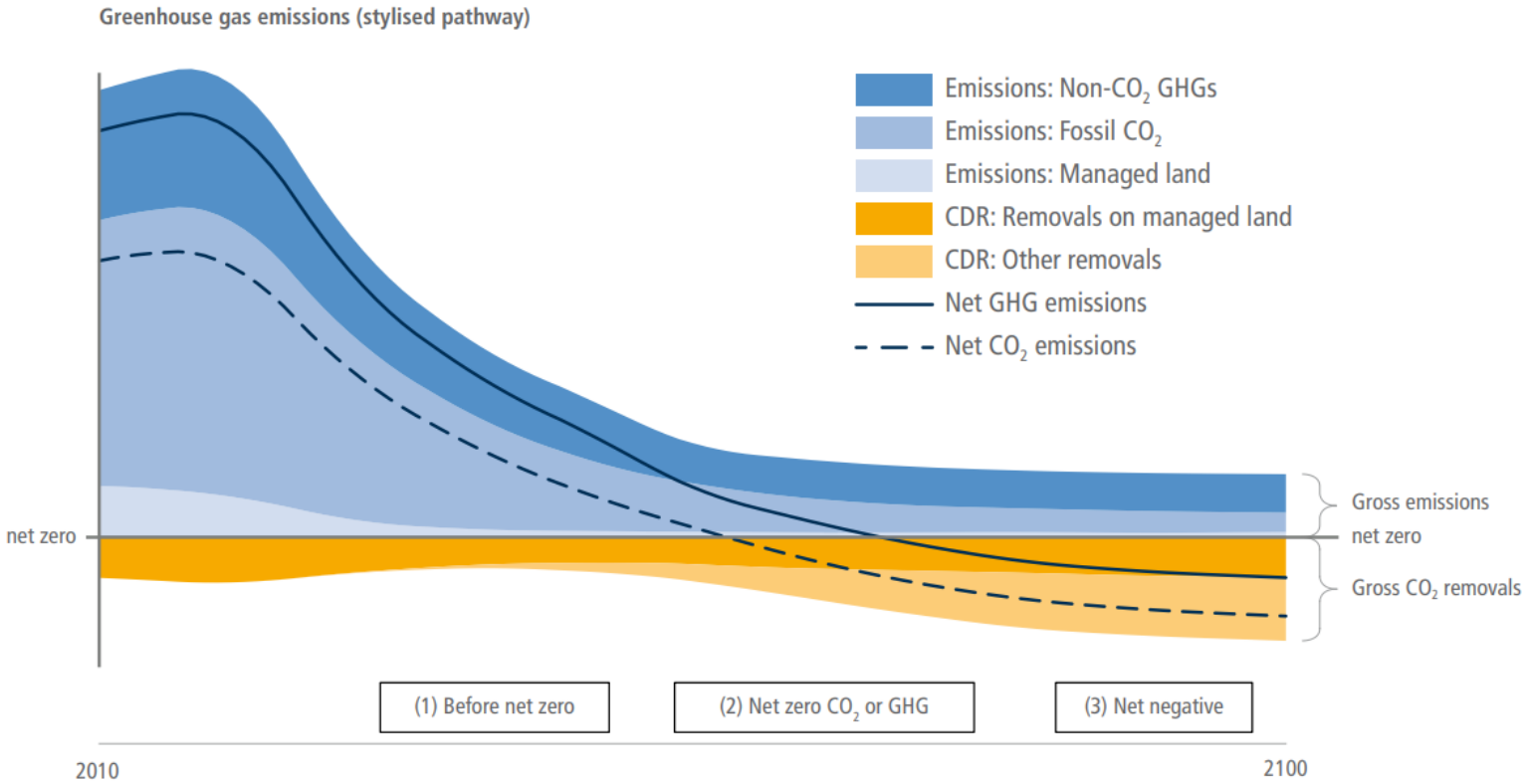
Carbon removal needs and options

KATIE LEBLING, WORLD RESOURCES INSTITUTE

AGENDA

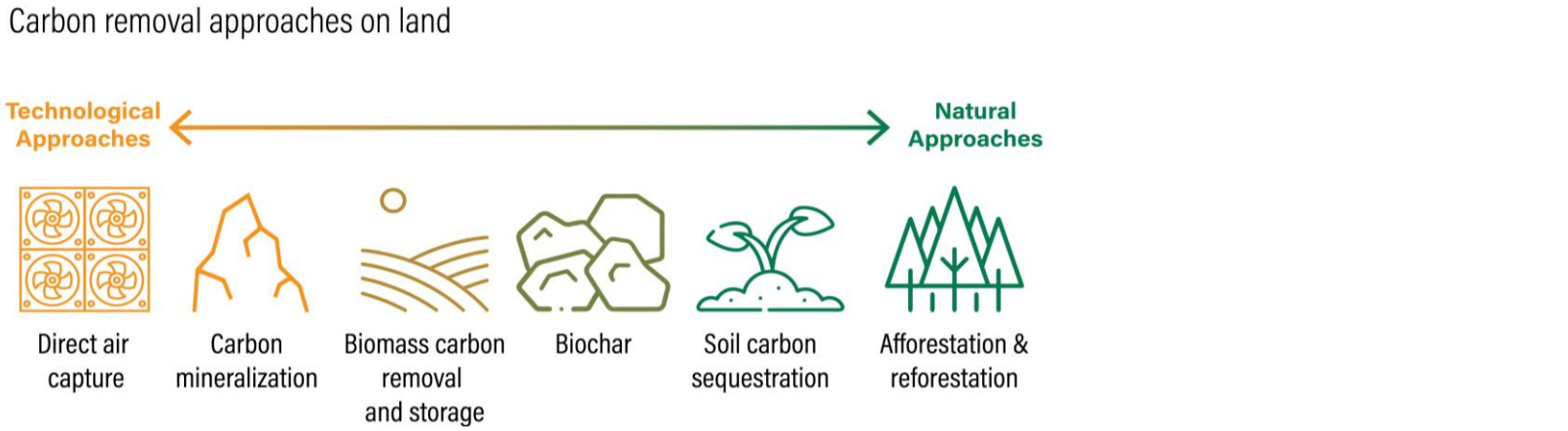
1. What is CDR?
2. Why do we need it?
3. What are some of the main CDR approaches?
4. How much do we need?
5. Why policy is critical?

NECESSITY OF CARBON REMOVAL



Source: IPCC, 2022

CARBON REMOVAL INCLUDES MANY THINGS



DIRECT AIR CAPTURE (DAC)

Direct air capture

- Uses chemicals that react with CO_2 in the air to capture it
- CO_2 must be stored somewhere (e.g., underground)
- Energy intensive; requires scaled up renewable and zero-carbon energy
- Handful of projects operational; largest is in Iceland, removing 36,000 tCO_2/yr
- Megaton-scale projects in development in the US

Solid sorbent DAC system

Photo source: Katie Lebling

CARBON MINERALIZATION

Carbon mineralization

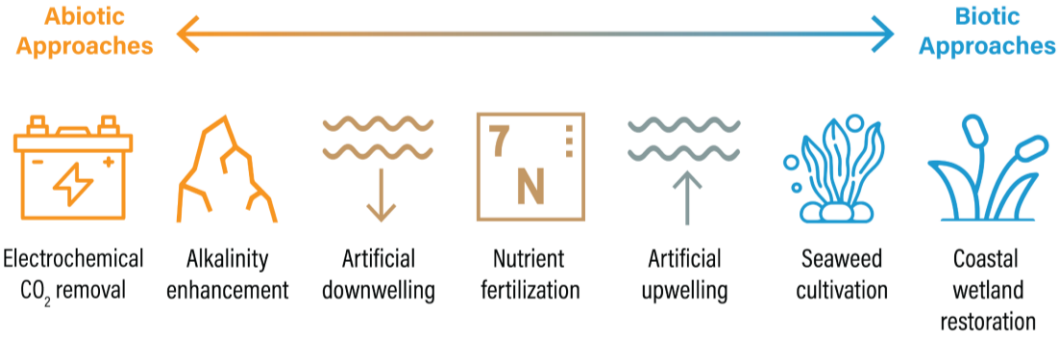
- Accelerates naturally occurring rock weathering that takes up CO_2
- Can be done in many ways – e.g., applying alkaline rock dust on croplands, coastal areas, ocean; using mine tailings or industrial waste; or as an underground storage option for CO_2 captured elsewhere

Basalts react with CO2 dissolved in water, forming solid carbonates

Agricultural liming, which is similar in application to enhanced rock weathering on croplands

Photo sources: Katie Lebling; Jack Hill / Openverse

MARINE CARBON REMOVAL



- Wide range of ocean CDR approaches, some analogous to CDR options on land
- All are at early stages of development or demonstration and face knowledge gaps around efficacy and ecological impacts

Green olivine sand can be used for coastal alkalinity enhancement

Photo source: iStock

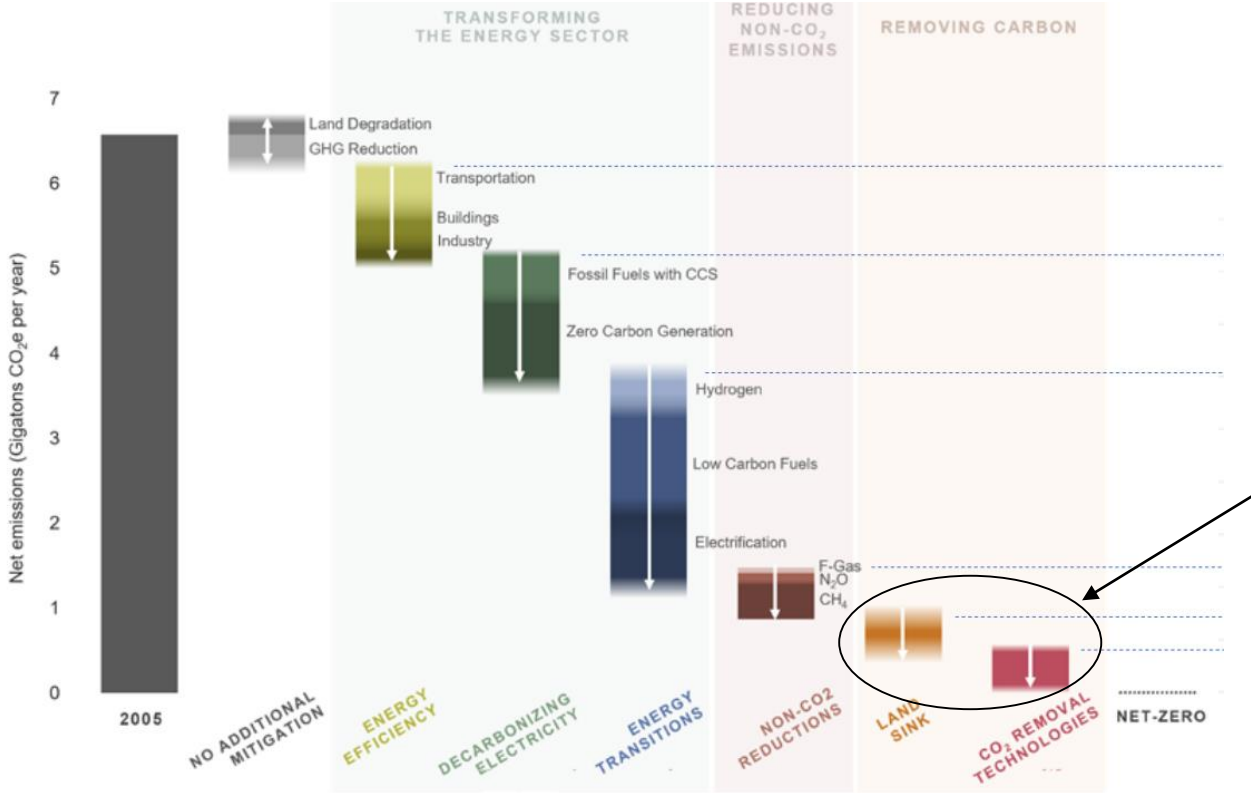
BIOMASS CARBON REMOVAL AND STORAGE

- Uses biomass, which contains CO_2 captured through photosynthesis, and prevents the carbon from being released
- Options include: pyrolysis to bio-oil, gasification with hydrogen production, biochar, biomass burial
- Sourcing biomass that does not cause habitat conversion or displace food production is critical to net-negativity

Biomass waste can be used for carbon removal

Photo sources: Emilian Robert Vicol / Flickr

U.S. NEED FOR CARBON REMOVAL



"Contributions from land sink enhancement range from 1-6%. Contributions from CO2 removal range from 6-8%"
Total: ~0.5-0.9 Gt

The Long-Term Strategy of the United States, 2021

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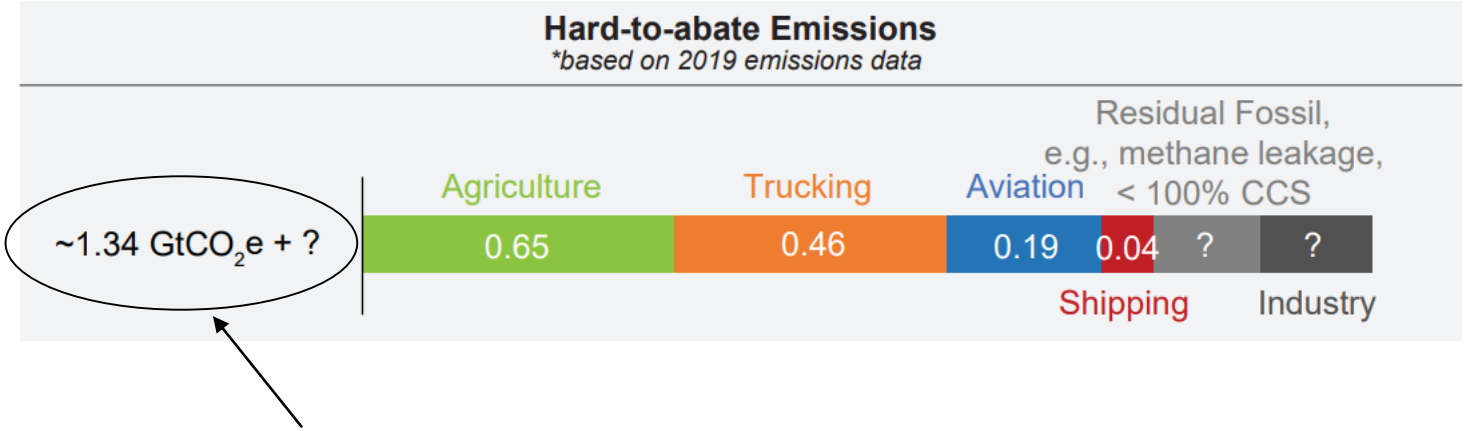
U.S. NEED FOR CARBON REMOVAL



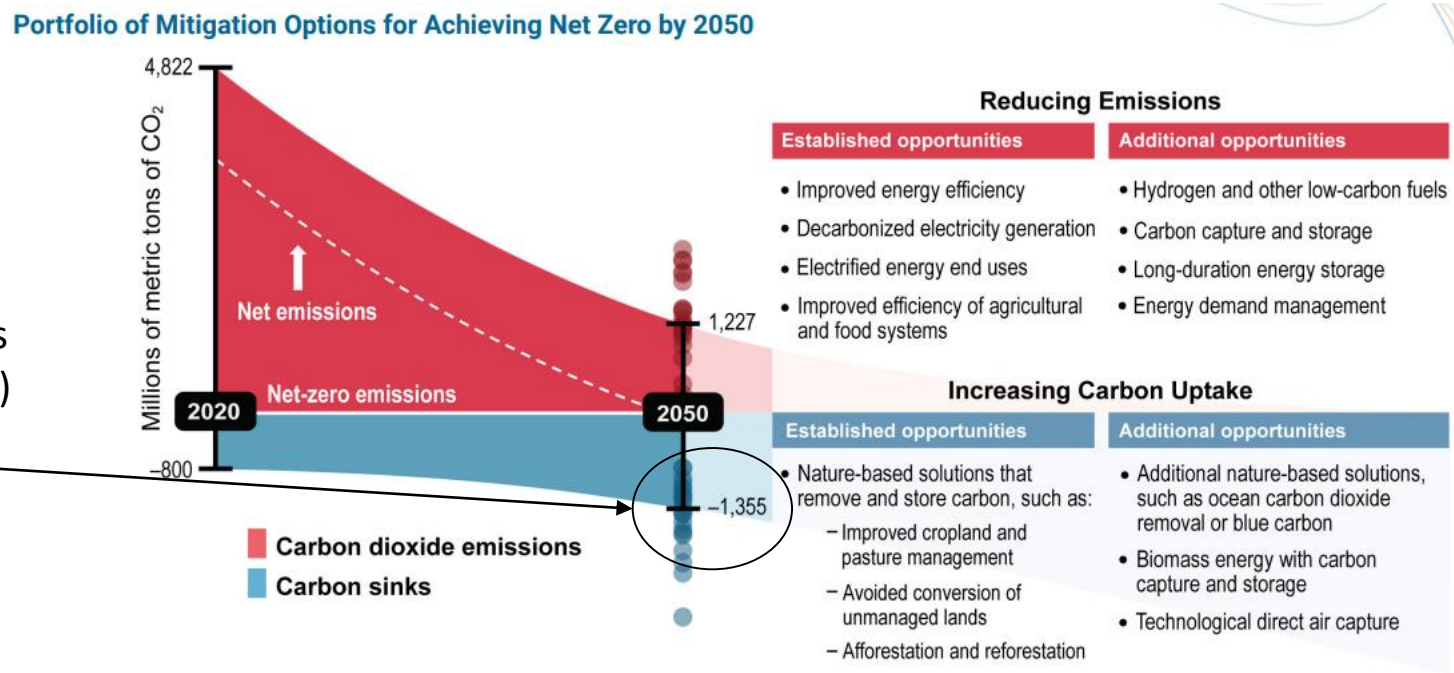
At least 1.34 Gt, based on a bottom-up assessment of residual emissions

Total: ≥1.34 Gt

Department of Energy, Office of Fossil Energy and Carbon Management Strategic Vision, 2022

U.S. NEED FOR CARBON REMOVAL

Contributions from nature-based carbon sinks and other opportunities (mCDR, BiCRS, DAC)
Total: ~0.5-1 Gt



U.S. Global Change Research Program Fifth National Climate Assessment, 2023

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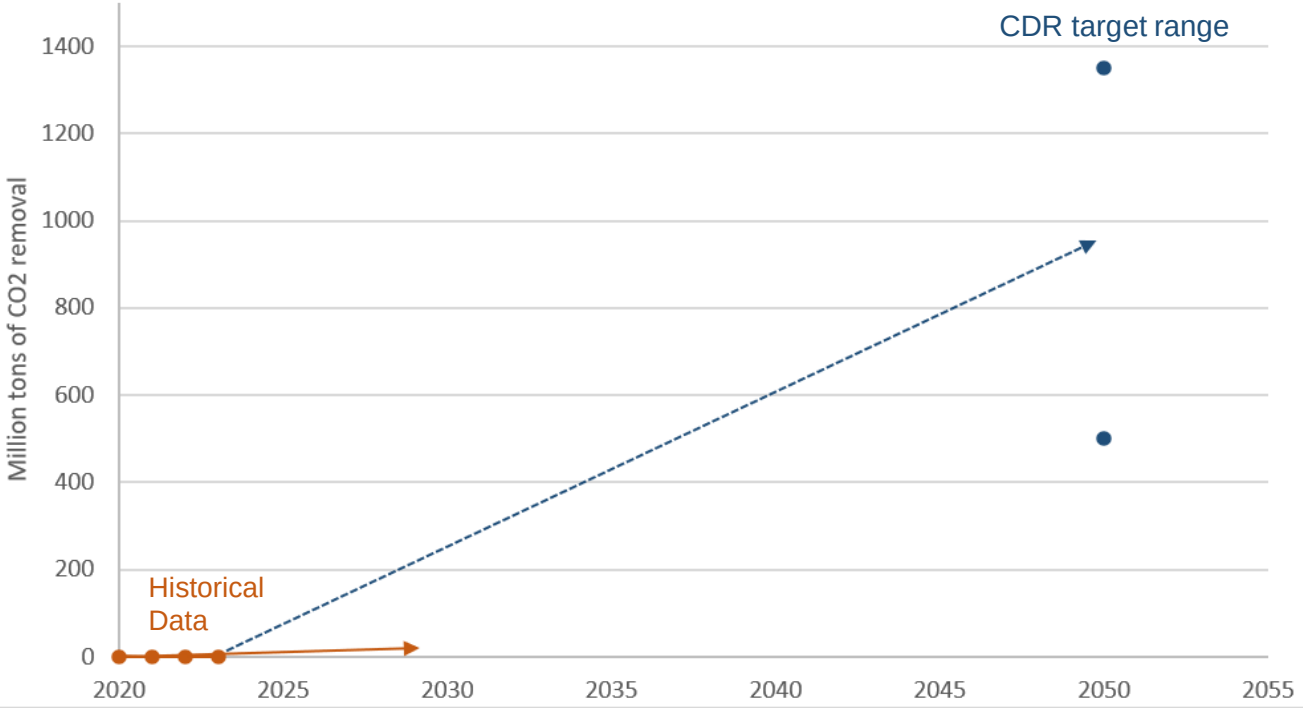
WHERE ARE WE TODAY?

Historical rate of change in scaling CDR vs. rate of change needed to reach national climate goals



Source: Historical data based on Systems Change Lab; targets basted on ranges included in the U.S. LTS, Fifth National Climate Assessment, and FECM Strategic Vision.

WHY POLICY IS CRITICAL FOR CDR

1. CDR is largely a public good
2. It doesn’t have a built-in market
3. Policy is needed to create supply and demand faster than it would otherwise happen

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THANK YOU!