



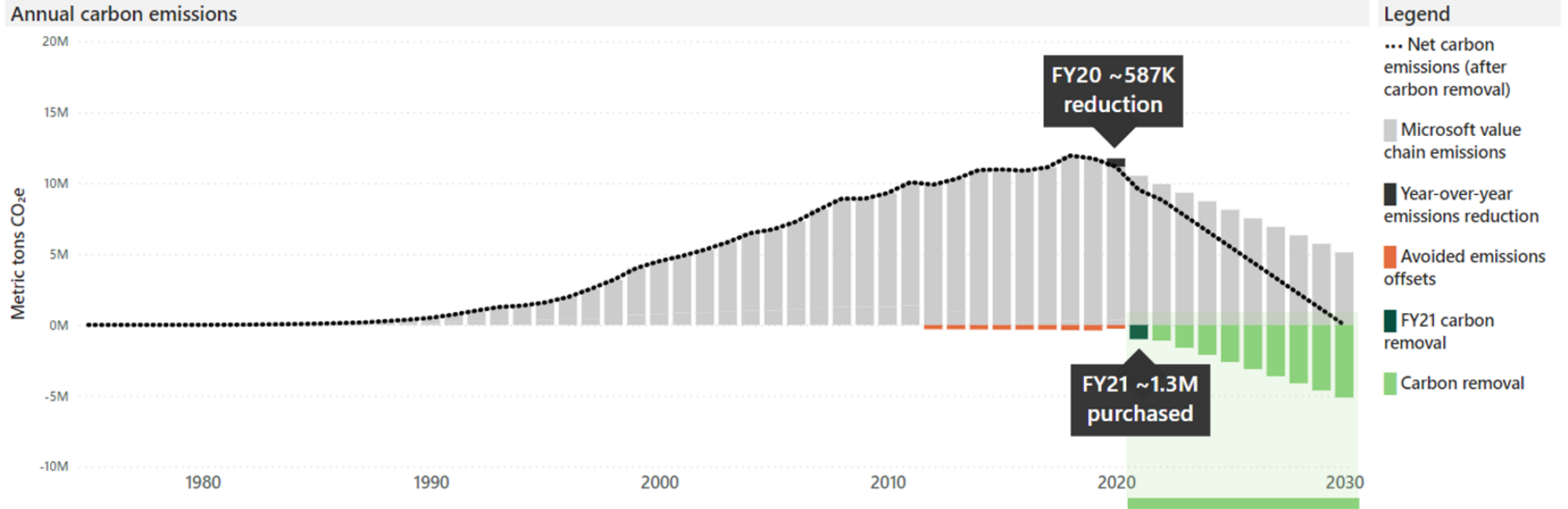
Microsoft Carbon Removal

Prof. Alberto Arribas
May 2021



Carbon removal in Microsoft's carbon negative pathway

1. Drive down our operational and electricity-related emissions to near zero by middle of decade
2. Reduce supply chain and product use emissions by more than half by 2030
3. Remove the rest by 2030, and remove all historical emissions by 2050

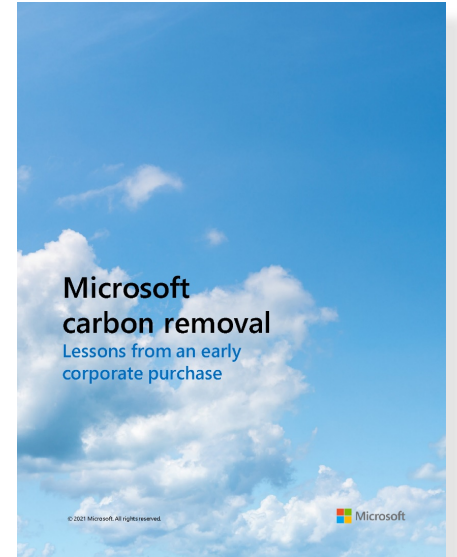


Microsoft completed a Request for Proposals for carbon removal in 2020

We received proposals from 79 applicants representing 189 projects in over 40 countries. We published project information from all proposals.

Of 55M metric tons proposed for this year, **only ~2M met our prerequisites**. We purchased more than 1.3M metric tons from 15 organizations. Demand is far outstripping high-quality supply.

We assess projects based on their durability - how long they guarantee that carbon stays out of the atmosphere. **More than 99 percent of our total volume was from short-term natural solutions (<100 yrs)**, which we plan to shift to long-term engineered solutions (>1,000 yrs) in the coming decade.



aka.ms/carbonremovalwhitepaper

aka.ms/msftcarbonprojectsubmissions

We can't meet our carbon negative commitment without carbon removal.

Clear accounting of carbon removal is vital.

Additionality, durability, and leakage are crucial criteria but lack clear standards.

Corporations do not yet have an easy way to source affordable, high-integrity carbon removal.

We can't do it alone. We need other corporate buyers to accelerate market development.

First-year selected projects

Forestry

- Green Diamond – Klamath East and West (Oregon)
- The Nature Conservancy - Washington Rainforest Renewal Project (WA), Clinch Valley (VA), Cumberland Forest (KY, TN, VA)
- SilviaTerra Natural Capital Exchange (US Southeast)
- Natural Capital Partners CommuniTree (Nicaragua)
- Climate Care Oxford – Jubilación Segura (Peru)
- Rabobank – Acorn (Brazil, Colombia, Peru)
- Shell Energy – TIST (India)

Soil

- Land O'Lakes -- Soil Carbon Best Practices (US)
- Regen Network -- Soil Organic Carbon Sequestration (Australia)

Biochar

- Carbofex (Finland)
- Carbon Cycle (Germany)
- ECHO2 (Australia)

Direct air capture

- Climeworks (Iceland) – also supported by Microsoft Climate Innovation Fund

Bioenergy with carbon capture and storage

- Charm Industrial Bio-liquid Geologic Sequestration (Oklahoma)



Under construction: Climeworks' new large-scale direct air capture and storage plant "Orca" (Credit: Climeworks)

Challenges & Opportunities

	Natural climate solutions	Engineered solutions
Definition & examples	<ul style="list-style-type: none">• Short-term storage in forest, soils, and ecosystems (years to decades)• Tree planting, regenerative agriculture practices that remove carbon.	<ul style="list-style-type: none">• Permanent geologic storage (centuries to millennia)• Direct air capture (DAC), carbon mineralization, bioenergy with carbon capture and storage (BECCS), biochar, other speculative bets.
Challenges	<ul style="list-style-type: none">• Unclear accounting• Project integrity• Physical risks (fire, drought, disease, logging)	<ul style="list-style-type: none">• High costs (\$\$\$)• Limited scale
Opportunities	<ul style="list-style-type: none">• Quality standards• New approaches to risk management & verification (e.g., soil sampling)• Socioeconomic benefits (e.g., small landowner engagement)	<ul style="list-style-type: none">• R&D• Infrastructure• Financing mechanisms• Insurance

There is a broad and growing community of supportive stakeholders: project developers, brokers, NGOs, academia, corporate buyers, policymakers.



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