

Enhanced Weathering and Mineralization

Current Landscape

Enhanced Rock Weathering (ERW) and Mineralization have recently carved a niche for themselves in the engineered carbon removal (CDR) space, with notable co-benefits for soil health and crop productivity. The sector is developing science and processes and has seen the **filing of 12 patents of which 2 have been granted**.

Investments

The sector has garnered attention from institutional investors and corporate players, signaling growing confidence in the scalability and long-term potential of these technologies. Total funding raised by ERW developers stands at **USD 231.5 million**, of which USD 176.5 million come from equity investments and the remaining from grants.

Notable equity investments include **USD 69 million** raised by **Neustark** and **USD 58.2 million by Terradot**. A key milestone in the space is the awarding of two major grants by XPRIZE Carbon Removal—**USD 50 million to Mati Carbon** (grand prize winner) and **\$5 million to UNDO** (third runner-up)—underscoring the sector's growing strategic and scientific relevance.

Offtake Agreements

As of June 2025, total offtake volumes reached **740,822 tonnes**, with 2024 marking a significant surge—380,285 tonnes contracted across 20 deals. Collectively, Frontier (331,231 tons), Google (200,000 tons), and Microsoft lead the race.

cCarbon Viewpoint

Although ERW and mineralization are still awaiting their first large-scale credit issuance under major registries, the current surge in capital deployment and offtake deals suggests more projects coming online in the coming months. Studying the issuances over the coming year will provide an indication of the cost of ERW credits, that cCarbon presently estimates in the USD 200–500 per tonne range, with the potential to decline to below USD 250 per tonne by 2030 as the market scales.

Looking ahead, the trajectory of ERW will depend on continued scientific validation, streamlined material supply chains, effective farmer engagement strategies, and the establishment of robust policy and verification frameworks.

Sector Statistics*

ERW Capital Raised Till Date

Equity	USD 176.5 million
Debt	-
Grant	USD 55 million

ERW Offtake Commitments Till Date

Tech sector	0.29 Million tCO ₂ e
Services	0.35 Million tCO ₂ e
Other sectors	0.11 Million tCO ₂ e

Top Buyers of ERW credits (tons CO₂e)

Frontier	331,231
Google	200,000
Microsoft	79,000

Top Sellers of ERW credits (tons CO₂e)

Terradot	302,000
Lithos Carbon	168,640
Neustark	105,600

Key Companies Profiled in This Market Compass

Mati Carbon	Houston, USA
Terradot	San Francisco, USA
Lithos Carbon	San Francisco, USA
UNDO	London, UK
InPlanet	Munich, Germany
Eion	Princeton, USA
Alt Carbon	Bengaluru, India
Neustark	Berne, Switzerland
Silicate	Dublin, Ireland

* All data presented in this report is limited to the period up to June 2025

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State of Sector



cCarbon

State of the Sector

Defining Enhanced Rock Weathering (ERW) and Mineralization

Enhanced Rock Weathering (ERW) and **Mineralization** are **carbon dioxide removal (CDR)** methodologies that accelerate natural geological processes to capture and store atmospheric CO₂ in stable mineral forms, offering a long-term solution for mitigating climate change.

Enhanced Rock Weathering is a process that accelerates the natural weathering of silicate rocks, such as basalt or olivine, which react with CO₂ in the atmosphere to form stable carbonates. In its natural state, weathering occurs over thousands of years, but **Enhanced Rock Weathering** aims to speed up this process by applying finely ground rocks to soil or through other means that expose the rock to air and water. As the rocks react with CO₂, they chemically convert it into a mineral form, effectively locking it away in the soil or ocean for long periods.

Mineralization is the process of capturing atmospheric CO₂ and converting it into a solid, stable form by reacting it with materials like concrete to form carbonates. While **Enhanced Rock Weathering** is a specific form of mineralization, the broader term can also include other processes where CO₂ is permanently stored in mineral forms, such as in **mineral carbonation** techniques. These methods focus on increasing the rate of mineralization by enhancing or optimizing natural mineral reactions.

This report does not consider enhanced weathering in marine systems like ocean/river alkalinity enhancement. These are covered in our Marine Market Compass

Current State

The enhanced weathering and mineralization carbon removal sector is entering a formative stage marked by growing diversification and early consolidation. While still pre-commercial in terms of credit issuance, the sector has gained substantial momentum in both investment and offtake activity. Major buyers like Microsoft, Google, and Frontier have anchored market confidence through sizable commitments, even in the absence of standardized methodologies or third-party verified credits.

A cluster of developers—including Terradot, Neustark, Lithos Carbon, and UNDO—are shaping early market dynamics, often combining field deployment with lab-scale MRV innovation. Investor interest is being driven by the promise of long-term permanence, co-benefits to agriculture, and compatibility with existing infrastructure such as croplands, construction materials, and coastal zones. However, key gaps remain in standardized measurement protocols, regulatory alignment, and real-world scaling.

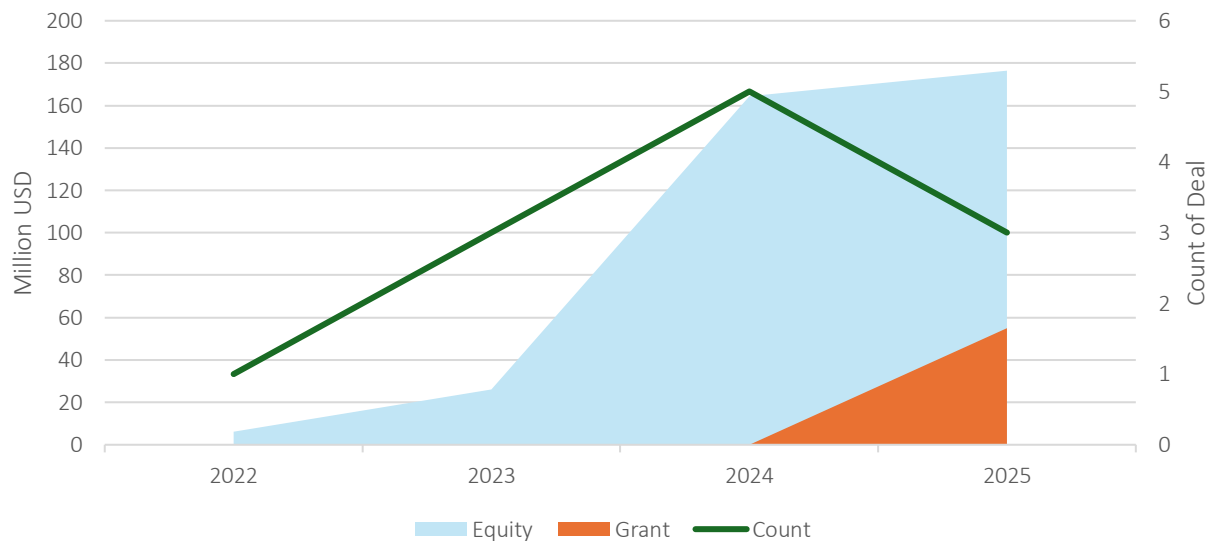
Key methodologies to-date have been documented by:

- Puro for Enhanced Rock Weathering
- Isometric for Enhanced Weathering in Agriculture

Investment Landscape

The Enhanced Weathering and Mineralization (EWM) sector has garnered significant attention from both institutional investors and corporate players, with a clear upward trend in funding, signaling growing confidence in the scalability and long-term potential of these technologies. The total funding raised by ERW developers stands at USD 231.5 M, of which USD 176.5M comes from equity investments and the remaining from grants.

Figure 1: Investments by Funding Type



Source: cCarbon research

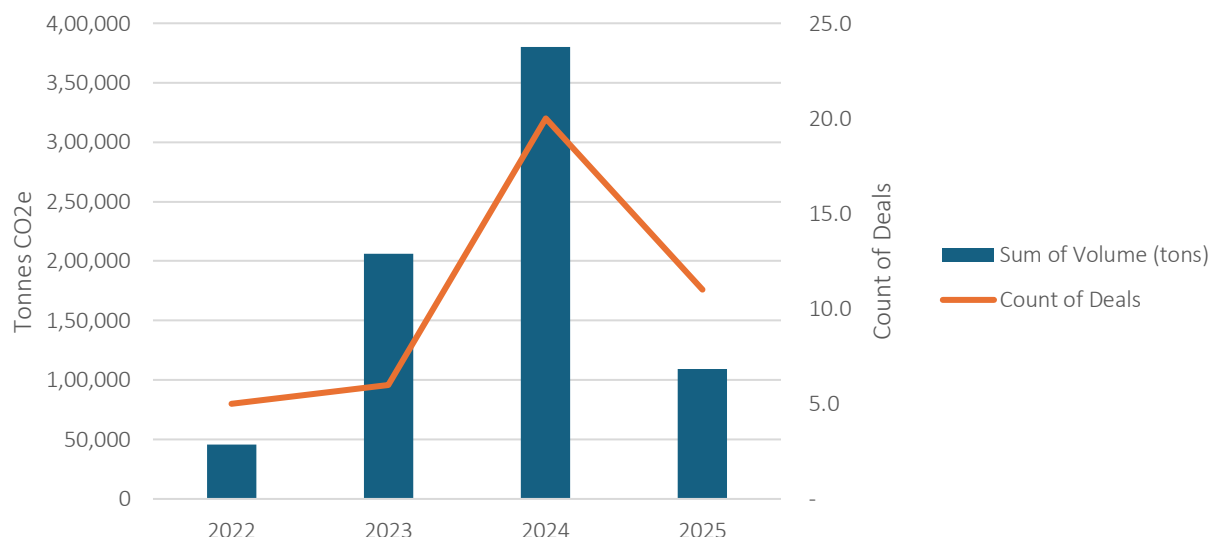
Investments in this segment are led by equity funding with participation from both corporate and institutional investors. Investments in 2024 and 2025 underscore the continuing trend of corporate involvement. Notably, Neustark, a leading mineral carbonation developer, secured \$69 million in equity funding from Decarbonization Partners representing one of the largest equity investments in Enhanced Weathering and Mineralization to date. In another announcement, Terradot raised \$58.2 million in December 2024, led by prominent investors such as Microsoft’s Climate Innovation Fund, Google, and Cisco.

In May 2025, two key grants from XPRIIZE marked significant milestones in advancing mineralization technology. The \$50 million grant to Mati Carbon and the \$5 million grant to UNDO reflect growing support for projects focused on scaling Enhanced Weathering methods to naturally capture and store atmospheric CO₂.

Offtake Deals

The Enhanced Rock Weathering (ERW) market has progressed rapidly, driven by large-volume commitments from major technology and financial players, alongside growing diversification in developer portfolios. As of June 2025, total offtake volumes reached 740,822 tonnes, with 2024 marking a significant surge—380,285 tonnes contracted across 20 deals.

Figure 2: Offtake Deal Volumes



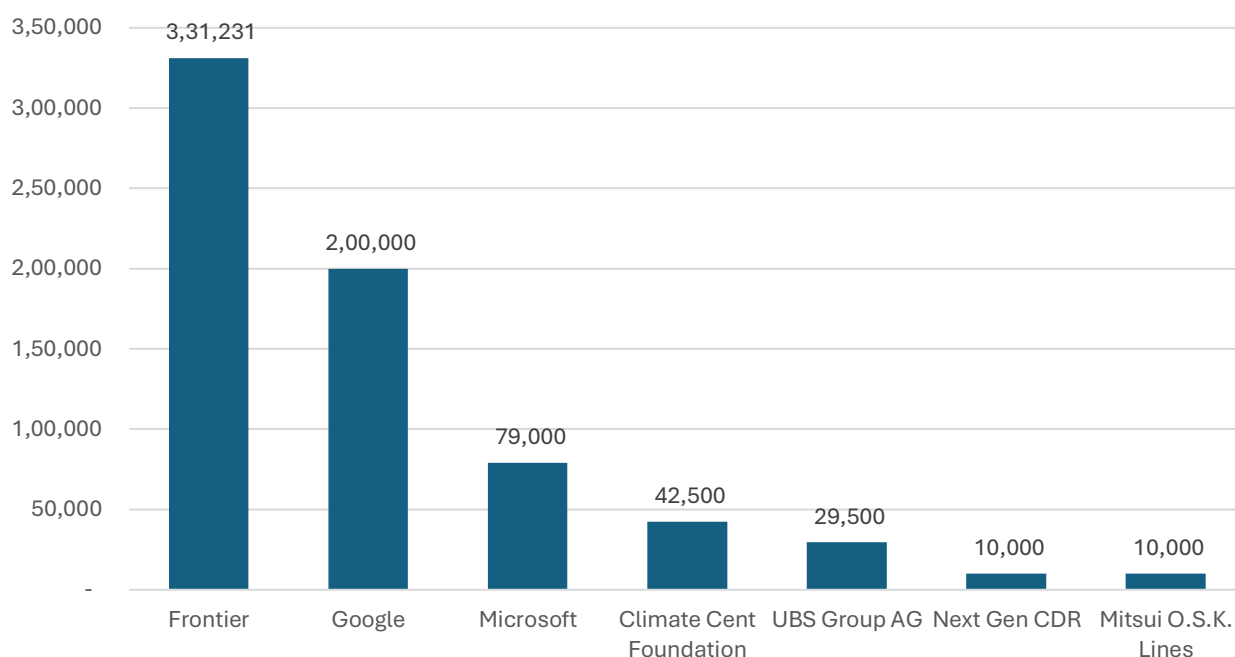
Source: cCarbon research

Microsoft has steadily emerged as a leading buyer in the engineered carbon removals space, with a growing focus on Enhanced Rock Weathering (ERW). Since its initial purchase from UNDO in April 2023, the company has expanded its commitments significantly. In 2024 alone, Microsoft signed multiple ERW deals—27,600 tons with Neustark in February, followed by 34,400 tons in September across UNDO (15,000 tons), Lithos Carbon (11,400 tons), and Eion (8,000 tons). In April 2025, Microsoft diversified further into mineralization with a 12,000-ton agreement with Terradot, underscoring its long-term interest in high-durability carbon removal solutions.

Frontier remains the most active facilitator of ERW offtake agreements, supporting a broad spectrum of developers. Its landmark 154,240-ton deal with Lithos Carbon in December 2023 still ranks as one of the largest ERW contracts to date. The momentum continued in 2024, with smaller but diversified purchases from Alt Carbon, Flux, Exterra Carbon, and Anvil (totalling 5,500+ tons), and culminated in a major 78,707-ton deal with Eion in March 2025. Additional contracts with Mati Carbon and Terradot in early 2025 further highlight Frontier’s strategic commitment to building a diversified and resilient ERW ecosystem.

Google made a bold entrance into the ERW market in December 2024 with a high-profile 200,000-ton agreement with Terradot, immediately positioning itself as one of the largest buyers in the space. The deal was complemented by Frontier’s own 90,000-ton offtake from Terradot that same month, signaling strong institutional confidence in the developer’s capacity and credibility.

Figure 3: Top Buyers by Offtake Volume

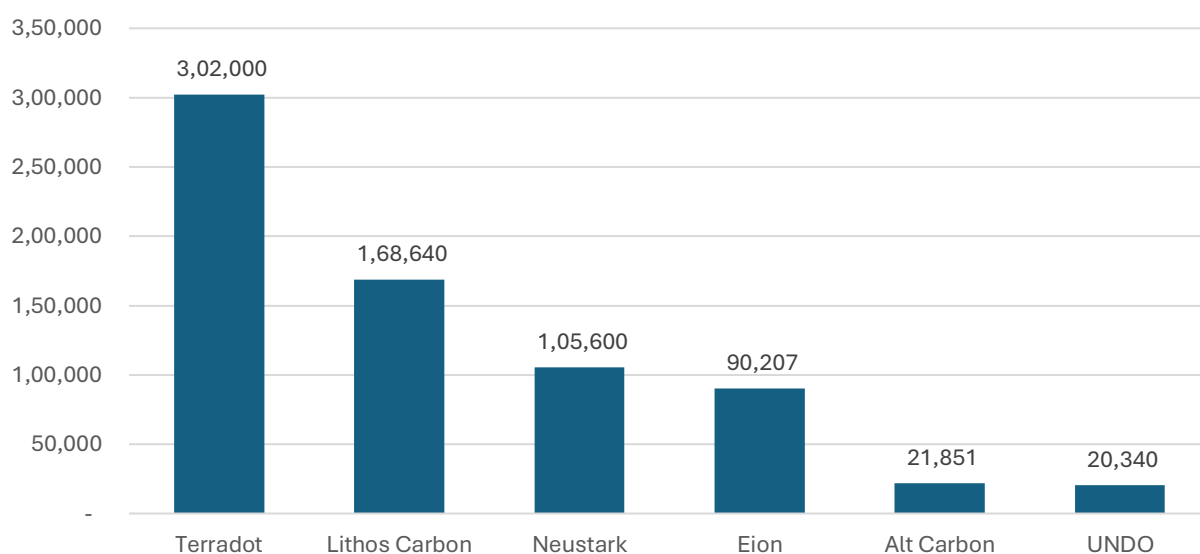


Source: cCarbon research

Collectively, Frontier (331,231 tons), Google (200,000 tons), and Microsoft lead the ERW offtake landscape, both in volume and strategic breadth reflecting a growing corporate appetite for high-integrity, durable carbon removal. The expanding buyer ecosystem—which now includes Stripe, Shopify, Mitsui, and Wild Assets—signals that ERW is rapidly gaining acceptance as a scalable solution in the broader carbon removal market.

On the developer side, Terradot emerges as the clear frontrunner with 302,000 tons committed, followed by Lithos Carbon and Neustark at 168,640 and 105,600 tons respectively. This suggests a rapidly growing ecosystem of ERW project developers, with a few key players leading the charge in scaling supply.

Figure 4: Top Developers by Offtake Volume



Source: cCarbon research

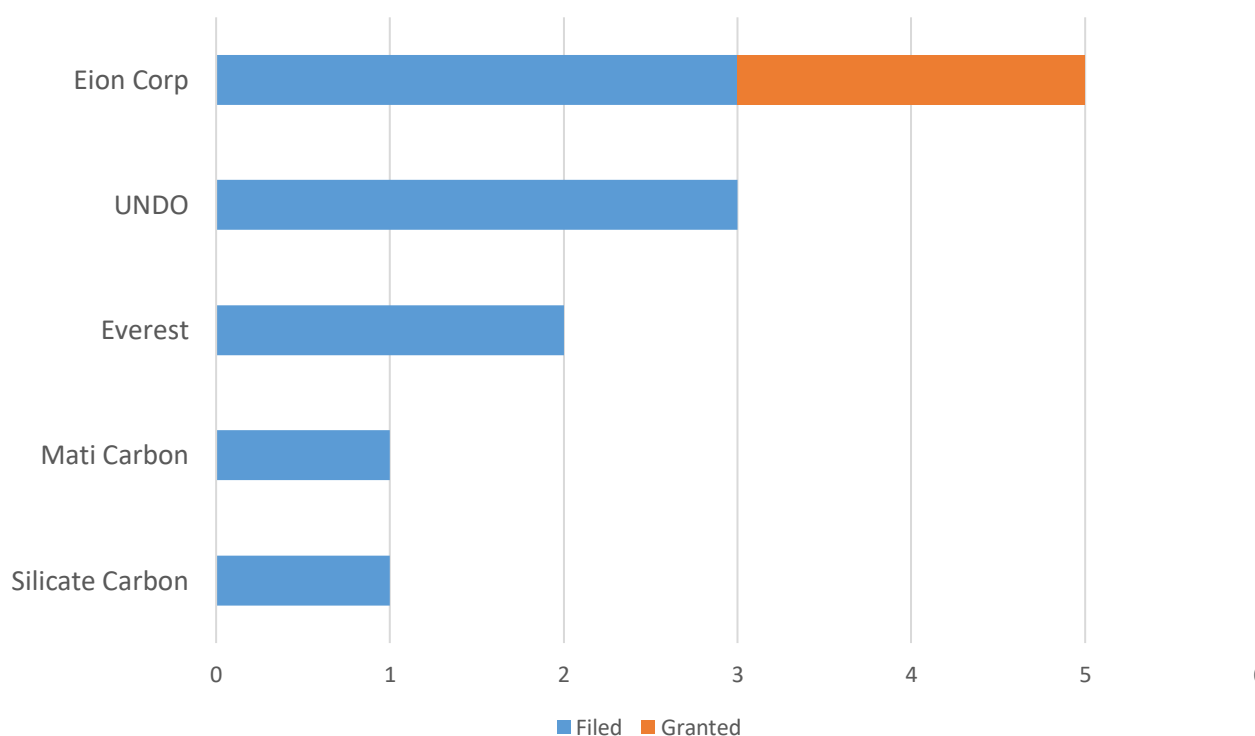
Table 1: Enhanced Weathering Market Summary

Total EW offtake volume	~ 0.74 million TCO ₂ (contracted)
Total retired EW credits	
Price Range (Voluntary Market)	\$225-\$500/TCO ₂ e
Top Buyers	Microsoft, Frontier Buyers, Milkywire
Verification Standards	Puro (no issuances)

Patents

The chart highlights early patent activity among leading Enhanced Rock Weathering (ERW) companies with 2 patents granted out of 12 filed, signaling growing innovation across the sector. Eion Corp stands out as the only player to have secured granted patents, with two filings successfully approved, reflecting a more advanced intellectual property position. UNDO, Everest, Mati Carbon, and Silicate Carbon have all filed patents, but none have received grants as of now.

Table 2: Patents Granted & Filed



Source: Europe Patent Register, US Patent and Trademark Office, UK Government, as of May 2025

Illustrative Key Players

Mati Carbon

Mati Carbon delivered the first engineered ERW carbon removal credits from the Global South, marking a significant milestone. The company has deployed over 130,000 tons of basalt across India, enabling the removal and verification of over 1,000 tonnes of CO₂. With operations in Chhattisgarh, Madhya Pradesh, and Jharkhand, Mati has engaged more than 16,000 smallholder farmers and generated \$1.5 million in added income through yield improvements and lower input costs. In 2025, it plans to expand into three new Indian states and double its basalt deployment to 300,000 tons. Internationally, Mati has initiated trials in Zambia through a partnership with the Mukuni Trust and in Tanzania alongside Engineers Without Borders to explore the co-benefits of ERW on degraded lands and low-yield farms.

Terradot

Founded at Stanford in 2022, Terradot has quickly emerged as a flagship ERW firm with \$58.2 million in funding from high-profile investors including Google and Microsoft, both making their first direct ERW investments. The company has sold nearly 302,000 tonnes of CO₂ removal, with a \$27 million deal from Frontier and a 200,000-tonne commitment from Google—its largest to date. Operating in Brazil, Terradot has deployed 50,000 tonnes of rock over 2,000 hectares and is scaling through partnerships with EMBRAPA. The company emphasizes MRV innovation using soil pore water chemistry and watershed-scale sampling and aims to digitally integrate ERW into industrial systems.

Lithos Carbon

Lithos has secured the largest ERW offtake agreement to date, with Frontier committing \$57.1 million for the removal of 154,240 tonnes of CO₂ by 2028, half of which is expected to be delivered by the end of 2025. The company operates across 80+ farms in nine U.S. states, with 160,000 acres on a waitlist. Its Yale-developed MRV method uses geochemical changes in soil as proxies for carbon removal, allowing for low-cost, high-fidelity monitoring. Lithos sources waste basalt from existing quarries and substitutes it for ag-lime, providing both agronomic and climate benefits. With strong recognitions including XPRIZE finalist and Fast Company's Most Innovative Companies list, Lithos is on track to achieve \$100/tCO₂ by 2030 while scaling toward multi-gigaton potential.

UNDO

UNDO has treated over 19,000 hectares with 290,000 tonnes of basalt, delivering ERW solutions across 339 farms. The company backs its impact with peer-reviewed science from Newcastle University showing 15% yield increases and improved soil pH. It pioneered field GPS tracking with its SADL logger and introduced a soil sampling app linked to its NEWTON platform. Its MRV practices align with the Puro Standard, and UNDO is developing a new technique with Queen's University. Microsoft has signed a removal agreement with UNDO, marking the first Puro-certified ERW credit sale. UNDO also engages in high-visibility outreach—from climate school programs to events like Royal Ascot—and has won several awards, including XPRIZE Carbon Removal Finalist and CleanTech Breakthrough Company of the Year.

InPlanet

Founded in August 2022, InPlanet is building global ERW capabilities with operations spanning multiple continents. As of early 2024, the company had spread 50 kilotons of rock powder and is targeting 200 kilotons by early 2025. Backed by €6.5 million in seed funding and \$7.6 million in equity investments, InPlanet has

scaled its team to 50 people from 16 countries. The company is becoming a critical player in developing affordable and geographically diverse ERW deployment, especially in tropical regions.

Eion

Eion pioneered soil-based MRV using trace elements as indicators of weathering, a method validated in Global Change Biology and used in its delivery of verified credits to Stripe. The company applies olivine-based feedstock (CarbonLock) on cropland and tests environmental safety rigorously. Eion collaborates with academic institutions such as UIUC and co-founded the International Science-in-Industry ERW Working Group. The company has secured 500,000 tons/year of olivine from Sibelco's hydro-powered Norwegian quarry and distributes via traditional ag channels. With \$33 million in offtake deals and \$15 million in equity funding, Eion combines robust MRV, agronomic benefits, and scalable logistics to lead the ERW market.

Alt Carbon

Alt Carbon made headlines with a \$12 million seed round—the largest ever for a climate tech company in India—and has drawn attention from global stakeholders like Mitsubishi Corporation and MOL Group. Its flagship Darjeeling Revival Project aims to restore 500,000 hectares by 2030, with a vision to scale to 1 billion tonnes/year CO₂ removal across South Asia by 2040. The company became the first Indian ERW firm to secure prepurchase agreements from Frontier and NextGen CDR. Its in-house MRV platform, FELUDA, was developed by IISc Bangalore scientists, and it launched the Darjeeling Climate Action Lab to support regional MRV capacity. Alt Carbon stands out for coupling climate mitigation with ecosystem and cultural restoration at scale.

Neustark

Neustark is a climate tech company pioneering permanent carbon removal by storing CO₂ in recycled mineral waste, such as demolished concrete. Founded in 2019 and based in Berne, Switzerland, Neustark has deployed its technology across Switzerland and Europe, capturing and storing significant volumes of CO₂ each week. With offices in Berne, Zurich, and Cologne, the company is now scaling its operations globally with the goal of removing one million tons of CO₂ by 2030. Neustark has already signed offtake agreements crossing 100,000 tonnes with various organizations including Microsoft and Climate Cent Foundation.

Silicate

Silicate is one of 20 finalists in the \$50 million XPRIZE for Carbon Removal, recognized for its innovative approach to enhancing a natural geological process called weathering to remove carbon dioxide from the atmosphere. By applying highly reactive silicate and carbonate minerals to agricultural soils, Silicate captures and stores CO₂ as dissolved bicarbonate for thousands of years. This process not only sequesters carbon but also improves soil health by adjusting pH levels and contributes to combating ocean acidification through ocean alkalization.

Appendix

Equity Investments

Date	Investor	EW Developer	Value of the Deal (M USD)	Link
May, 2025	Lachy Groom	Alt Carbon	\$ 12.0	Link
Dec, 2024	Lead, John Doerr; Individuals, Sheryl Sandberg & Tom Bernthal, George Roberts; Strategics, Microsoft's Climate Innovation Fund, Google, Cisco; and Venture Funds, Floodgate, and others	Terradot	\$ 58.2	Link
Dec, 2024	Carbon Removal Partners, Ponderosa Ventures, and the Carbon Drawdown Initiative	Everest Carbon	\$ 3.0	Link
Oct, 2024	led by Counteract and included participation by ReGen Ventures, ANIMO, Connecticut Innovations, Ponderosa Ventures, Newlab, Echo River Capital, and the Carbon Drawdown Initiative	CREW Carbon	\$ 5.3	Link
Oct, 2024	Growmark, AgFunder, Ridgeline, Trailhead Capital, Overture Partners, Mercator Partners, Exelon Foundation, and others	EION	\$ 3.0	Link
Jun, 2024	Decarbonization Partners	Neustark	\$ 69.0	Link
Nov, 2023	FoodLabs, Salvia, Mudcake, Carbon Removal Partners, and Übermorgen Ventures.	InPlanet	\$ 6.3	Link
May, 2023	Led by Lowercarbon Capital and AENU	UNDO	\$ 12.0	Link
Jan, 2023	Carbon Removal Partners, Übermorgen Ventures, Trellis Road, Katapult VC, and Carbon Drawdown Initiative	InPlanet	\$ 1.4	Link
Oct, 2022	led by Union Square Ventures and Greylock Partners with participation from Bain Capital Ventures, and climate and agriculture funds Carbon Removal Partners, Fall Line Capital, the Carbon Drawdown Initiative, and Cavallo Ventures	Lithos Carbon	\$ 6.3	Link

Source: cCarbon Research- [CROM\(Carbon Removal and Offset Monitor\)](#)

Grants

Date	Donor	EW Developer	Value of the Deal (M USD)	Links
May, 2025	XPRIZE	Mati Carbon	\$ 50.0	Link
May, 2025	XPRIZE	UNDO	\$ 5.0	Link

Source: cCarbon Research- [CROM\(Carbon Removal and Offset Monitor\)](#)

Offtake Deals

Date	Purchaser	EW Developer	Volume (tons)	Links
Mar, 2022	Shopify	CarbonBuilt	5,200	Link
Mar, 2022	Shopify	44.01	2,882	Link
Aug, 2022	UBS Group AG	Neustark	29,500	Link
Oct, 2022	BMO Financial Group	CarbonCure	5,750	Link
Dec, 2022	Frontier	Cella	2,198	Link
Apr, 2023	Microsoft	UNDO	5,000	Link
Aug, 2023	Climate Cent Foundation	Neustark	29,500	Link
Aug, 2023	Climate Cent Foundation	Neustark	13,000	Link
Dec, 2023	Frontier	Lithos Carbon	154,240	Link
Dec, 2023	Zürcher Kantonal Bank	Neustark	4,200	Link
Feb, 2024	Microsoft	Neustark	27,600	Link
Feb, 2024	Carbonx Climate	Lithos Carbon	3,000	Link
Apr, 2024	MaRS Discovery District	Arca	29	Link
Apr, 2024	NextGen CDR	Neustark		Link
Sep, 2024	Microsoft	UNDO	15,000	Link
Sep, 2024	Microsoft	Lithos Carbon	11,400	Link
Sep, 2024	Microsoft	Eion	8,000	Link
Sep, 2024	British Airways	CUR8	5,500	Link
Sep, 2024	Frontier	Alt Carbon	1,851	Link
Sep, 2024	Frontier	9 different companies including Alt Carbon, Capture6, Silica	1,266	Link
Sep, 2024	Frontier	Flux	1,142	Link
Sep, 2024	Frontier	Exterra Carbon Solutions	1,050	Link
Sep, 2024	Frontier	Anvil	357	Link
Sep, 2024	Milkywire Climate Transformation Fund	Flux		Link
Oct, 2024	Next Gen CDR	Alt Carbon	10,000	Link
Nov, 2024	Auto Trader	UNDO	340	Link
Nov, 2024	AXA Switzerland	InPlanet	1,950	Link
Nov, 2024	AXA Switzerland	Neustark	1,800	Link
Dec, 2024	Google	Terradot	200,000	Link
Dec, 2024	Frontier	Terradot	90,000	Link
Jan, 2025	Frontier	Mati Carbon	420	Link
Jan, 2025	Adyen	InPlanet		Link

Mar, 2025	Frontier	Eion	78,707	Link
Apr, 2025	Microsoft	Terradot	12,000	Link
Apr, 2025	Perdue AgriBusiness	Eion	3,500	Link
Apr, 2025	Wild Assets	Tambora	4,440	Link
Apr, 2025	Mitsui O.S.K. Lines	Alt Carbon	10,000	Link
May, 2023	Stripe, Inc.	UNDO		Link
Jun, 2025	Milkywire Climate Transformation Fund	KarbonetiQ		Link
Jun, 2025	Milkywire Climate Transformation Fund	InPlanet		Link
Jun, 2025	Milkywire Climate Transformation Fund	ZeroEx		Link
Jun, 2025	Milkywire Climate Transformation Fund	Silicate and Northwestern University		Link

Source: cCarbon Research- [CROM\(Carbon Removal and Offset Monitor\)](#)

About Market Compass

Market Compass is a **benchmark report** about various low-carbon and carbon-removal interventions empowering carbon market stakeholders, policymakers, and investors with credible & actionable intelligence.

The Market Compass builds a **bottom-up view of a sector** by aggregating plant and production pathway information. It builds on the cCarbon database that includes the following parameters:

- Project/ plant capacities
- Project ownership
- Project/ plant performance
- Investment raised
- Offtake commitments
- Issuance and retirement
- Technology Readiness
- Patents and IP
- Project/ plant economics

cCarbon has created a Market Compass for the following sectors:

Carbon Removal

- Bio-energy with Carbon Capture and Storage (BECCS)
- Biomass Carbon Removal and Sequestration (BICRS)
- Enhanced Rock Weathering (ERW)
- Direct Air Capture
- Af/Reforestation
- Marine carbon dioxide removal
- Soil Carbon

Sustainable Fuels

- Renewable Natural Gas
- Renewable Diesel
- Sustainable Aviation Fuel

Over 2000 plants and projects are captured in the cCarbon database.

Companies Participating in Market Compass

Companies participating in the Market Compass benchmarking can access the following from cCarbon:

- **Gain industry visibility** – Be recognized by global investors, carbon buyers, and policymakers.
- **Benchmarked position** – Understand how the technology stacks up across performance dimensions.
- **Showcase innovation** – Highlight company's unique capabilities, scalability, and R&D strengths (Receive discounted access to participate in cCarbon convenings).
- **Access curated intelligence and trends** shaping the ecosystem.

To be featured in a Market Compass report or to learn more, write to us at InSights@cCarbon.info

CDR Resources From cCarbon

1. Public database: [Carbon Removal and Offsets Monitor](#) is a free resource developed by Carbon to share announcements and analysis occurring in the CDR sector.
2. **Offsets and CDR Essential** market intelligence subscription
 - a. Detailed [Trendsheets](#) on Buyers, Investments, and Offtakes
 - b. [Periodic articles](#) with analysis and views
 - c. [Monthly reports](#) synthesizing market happenings
 - d. [Webinars](#) to get the latest expert view

Learn more at <https://www.ccarbon.info/essential-membership/>

3. **Offsets and CDR Pro** market intelligence subscription that include everything in Essential and also have the following:
 - a. [CDR Core Market Dashboard](#) that covers analysis on demand, supply, investments
 - b. Forecasts on compliance and voluntary offset markets
 - c. APIs to access the database

Learn more at <https://www.ccarbon.info/membership-plans/>

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Learn more at <https://www.ccarbon.info/events/>

About cCarbon

cCarbon (pronounced 'see-carbon') specializes in providing business intelligence, analytics, and forecasts for global environmental markets. Founded in 2012, we offer comprehensive coverage across global compliance and voluntary carbon markets, sustainable fuels markets, and other environmental commodity markets.

Organizations seeking in-depth research for decarbonization, compliance strategies, climate investments, and forecasting environmental markets, can leverage our suite of analytics and data tools or work with our experienced analysts to tailor solutions that meet their needs.

cCarbon is a division of **cKinetics**, a US-based, global sustainability specialist, providing solutions for investors, businesses and policy makers.

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