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CDR.fyi

Bridging the Gap: Durable CDR Market Pricing Survey

Purchaser and Supplier Expectations in 2025 and 2030

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Introduction

The durable carbon dioxide removal (CDR) sector is a fast-growing but small subset of the global carbon market. At the close of 2024, about 520,000 credits had been delivered since CDR.fyi's first recorded transactions in 2019. By comparison, more than 110 million non-CDR credits were retired on the Verra registry in 2024 alone.

Meanwhile, broad recognition from organizations, such as the Intergovernmental Panel on Climate Change and the Science Based Targets initiative, that durable CDR is a crucial tool in the pursuit of net zero-emissions has added demand for supply contracts ahead of industry growth.

One carbon credit represents one metric ton of mitigated CO2 equivalent emissions. While many greenhouse gas mitigation methods reduce or avoid emissions, durable CDR removes atmospheric CO2 for hundreds of years or more.

To date, 13 million metric tons of durable CDR credits have been contracted for present or future delivery. Only 4% of that supply has been delivered, according to CDR.fyi data.

Under these nascent circumstances, credit price discovery, access to capital and project development involve more challenges than established industries.

Both CDR.fyi and OPIS provide transparency in carbon markets and collaborated on a Durable CDR Pricing Survey in 2024 to advance that shared goal.

The survey results indicated that industry participants have much work ahead to find common ground between the two sides of the growing market. On average, supplier and purchaser respondents expressed a wide gap in price expectations for most CDR methods in 2025 and 2030.

However, previous purchasers of credits generally reported stronger prices than purchasers that had yet to enter the market.

On the sell side, previous suppliers of credits generally reported lower 2030 prices compared to those who had yet to sell. But previous and expected suppliers price points were mixed for 2025 prices, depending on the CDR project method.

On average both buyers and sellers estimated that prices would fall – in some instances, dramatically – in five years.

CDR.fyi Perspective: Durable CDR Market Pricing

Today's significant CDR buyers are still "innovators" with the market yet to reach the "early-adopter" stage. Regular market dynamics are expected to govern the purchase behavior of the next group of buyers. Even among the innovators, very few have bought the highest-priced tonnes. Based on CDR.fyi market data, only 32 purchasers have paid over$500/mt, and 98.5% of purchases above $1,000/mt are from Frontier Buyers and the Milkywire Climate Transformation Fund buyers. These are entities who deploy their funds with making catalytic impacts on scaling carbon removal among their purchasing decision considerations.

In most cases, purchasers will choose the lowest-cost options that allow them to credibly claim they are reaching their climate targets[1]. This behavior would favor durable biomass-based methods in the short to medium term. High-cost CDR suppliers, on the other hand, will need to find a way to reduce their costs and pricing significantly to secure large-scale offtake agreements, and potentially their survival.

Based on CDR.fyi market data, only 32 purchasers have paid over $500/mt, and 98.5% of purchases above $1,000/mt are from Frontier Buyers and the Milkywire Climate Transformation Fund buyers.

Given purchaser price expectations, suppliers cannot rely on economies of scale alone to reduce costs, nor can they rely on purchasers to fund their trajectory along the scaling curve. Instead, cost reductions will mainly depend on innovation-driven R&D, iteration through modular approaches, and low capital expenditure strategies.

The Google-Holocene deal is a good example of a supplier forward-selling their technological learning and scaling curve at a price that is palatable for the purchaser.[2] Deployments may remain limited to equity-financed projects or smaller pre-purchases from altruistic buyers. This will be particularly challenging for suppliers of high, fixed-cost methods such as DACCS, leading to the likelihood of significant consolidation in the next few years.

1 The Science-based Targets initiative (SBTi) requires permanent carbon removal for remaining emissions to reach net zero, but currently, there is little official guidance on exactly what methods will be counted as permanent. Companies claiming net zero without third-party certification may use removals with lower durability. However, claims may become regulated, as is happening in the EU.

2 CDR.fyi, "The Google - Holocene Deal: Pricing the Future," CDR.fyi Blog, September 25, 2024. https://www.cdr.fyi/blog/the-google-holocene-deal.

Durable CDR Averaged Pricing Results and Methods

This survey points to durable CDR being higher-priced than purchasers expect. That suppliers of all kinds state Breakeven prices of $140-$340/mt and Reasonable Profit at $180-$430/mt for 2030 will be a bit of a reality check for many purchasers and perhaps suppliers alike.

Price development is highly heterogeneous: suppliers' responses indicate that some methods will struggle to decrease their prices further post-2030.

Durable CDR Market Pricing Survey: Averaged Results

2025	Too Cheap Purchaser	Below Cost Supplier	Good Value Purchaser	Breakeven Supplier	Expensive Purchaser	Reasonable Profit Supplier	Too Expensive Purchaser	High Profit but Risky Supplier
BECCS	$106	$160	$169	$232	$290	$301	$396	$403
Biochar	$59	$112	$94	$143	$155	$187	$207	$257
DACCS	$229	$504	$458	$670	$558	$822	$712	$1,006
Enhanced Weathering	$114	$210	$187	$272	$271	$349	$350	$474
mCDR	$114	$97	$246	$155	$430	$263	$572	$382
Mineralization	$116	$233	$181	$316	$300	$420	$410	$532
Other Biomass	$71	$175	$122	$214	$238	$254	$308	$308

2030	Too Cheap Purchaser	Below Cost Supplier	Good Value Purchaser	Breakeven Supplier	Expensive Purchaser	Reasonable Profit Supplier	Too Expensive Purchaser	High Profit but Risky Supplier
BECCS	$93	$163	$153	$212	$248	$265	$340	$357
Biochar	$49	$105	$85	$136	$130	$180	$178	$254
DACCS	$160	$236	$272	$341	$458	$436	$598	$599
Enhanced Weathering	$92	$198	$149	$252	$238	$328	$330	$462
mCDR	$112	$136	$217	$187	$374	$325	$494	$493
Mineralization	$95	$172	$160	$228	$272	$289	$365	$377
Other Biomass	$64	$106	$112	$139	$195	$194	$269	$281

Source: CDR.fyi and OPIS Durable CDR Pricing Survey

CDR.fyi Perspective: Methods Analysis

BECCS

In CDR.fyi's 2024 analysis of BECCS in Sweden, costs were estimated to be well over $200/mt.[3] That analysis aligns well with suppliers' reported 2025 Breakeven cost of $232/mt in the CDR.fyi and OPIS Durable CDR Pricing Survey. Suppliers stated their Reasonable Profit 2025 price for BECCS at $301/mt. Most BECCS plants are built for scale from the outset (see, for example, Stockholm Exergi's planned 800,000 tpa plant and Ørsted's 430,000 tpa plant), with economies of scale to some extent already priced in. The tech is relatively mature, meaning large future price decreases are unlikely from technological breakthroughs. However, estimates in the academic literature puts BECCS costs at $60/mt-$140/mt and storage costs at $10/mt-$20/mt.[4] Smaller BECCS deployments (such as CO2 capture from biogas separation) are likely a bit more expensive than large-scale BECCS, but

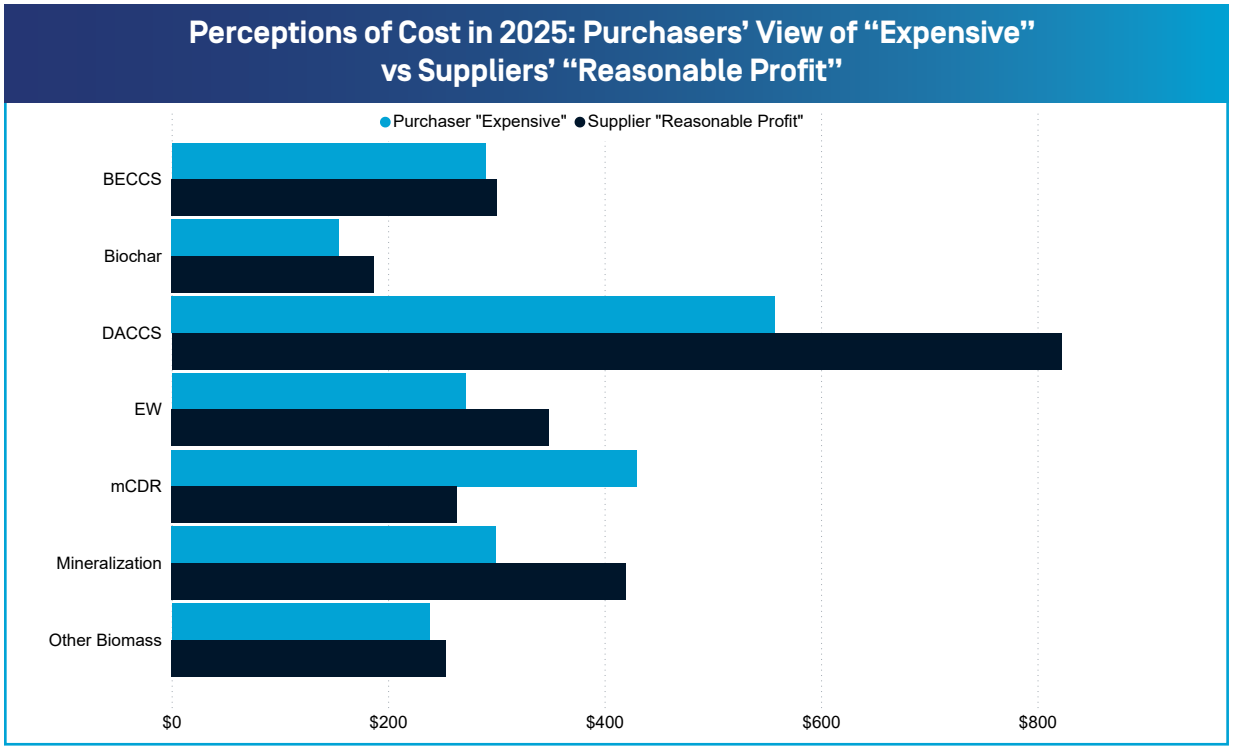
3 CDR.fyi, "Details on Sweden's BECCS Support - What will be the effect on climate?," CDR.fyi Blog. August 23, 2024. https://www.cdr.fyi/blog/details-on-swedens-beccs-support.

4 Bednar, Johannes, Robert Höglund, Kenneth Möllersten, Michael Obersteiner, and Eve Tamme. "The role of carbon dioxide removal in contributing to the long-term goal of the Paris Agreement." IVL Swedish Environmental Research Institute, December 2023. https://www.researchgate.net/publication/376645246_The_role_of_carbon_dioxide_removal_in_contributing_to_the_long-term_goal_of_the_Paris_Agreement.

projects are smaller and more modular and thus can easily get built even without massive offtake agreements. In time, the biggest cost decreases for BECCS probably will come from cheaper storage.

BIOCHAR CARBON REMOVAL (BCR)

This is the method with the highest level of current market engagement and, similarly, the highest number of survey responses. Fifty-three suppliers provided Breakeven estimates for biochar at an average of $143/mt and $136/mt in 2025 and 2030, respectively, with Reasonable Profit coming in at $187/mt for 2025 and $180/mt in 2030. Fourteen suppliers estimated their Breakeven price at $100/mt or less in 2025, whereas seven needed more than $180/mt. For some suppliers that can get a good price for the sales of heat, electricity, physical biochar and byproducts, biochar carbon credits may form only a small part of their revenues, giving them the ability to undercut other suppliers on credit prices. Long-term biochar credit generation may become limited by demand for the physical biochar as just burying biochar, or long-term storing it, likely would incur costs instead of revenues, making biochar economically unattractive compared to other uses of the biomass. There is also a limit to how much biochar can be used in soils before they are saturated. There is evidence of increasing cost pressure on biochar suppliers, especially those based in the Global North, due in large part to higher competition for biomass. Potential avenues for these suppliers to explore in future include serving local short-term spot demand, getting good deals on their heat, and or electricity production or leveraging their expertise to develop operations in lower-cost regions.



Source: CDR.fyi and OPIS Durable CDR Pricing Survey

OTHER BIOMASS STORAGE

Other Biomass Storage includes geological injection and sequestration of bio-oil and slurry, as well as less costly biomass burial. The cost of geological sequestration is dependent on having suitable wells close to the biomass. Biomass Direct Storage, which is stored in a way that keeps it completely dry or completely wet, is the least costly durable CDR method. That said, it can also require long-term monitoring and carries with it a relatively higher risk of reversal. What

determines who can scale the method the fastest and cheapest is their access to biomass, expertise in project execution and access to the necessary infrastructure.

DIRECT AIR CARBON CAPTURE AND SEQUESTRATIONS (DACCS)

DACCS stands out as the method with the biggest price drops expected by both suppliers and purchasers. The initial deployments are prototypes, with prototype pricing. For most DAC suppliers, price drops in the coming few years will be due to R&D and scaling up from tens or hundreds of tonnes. In the long run, further cost and price decreases would be expected from economies of scale.

ENHANCED WEATHERING (EW)

Enhanced weathering is likely to remain expensive if it continues to depend on a high number of measurements and the removal can't be modelled. There is still a lot of terra incognita on how well EW works and how to best measure it. For large-scale deployments and low-cost MRV, a better understanding is needed of favorable conditions and compatibility between rock and soil types. Real-world data often deviates significantly from lab studies, and not in a positive direction. Furthermore, it takes years to get the results from today's trials. EW likely has the potential to cost around or below $100/mt in some well-suited geographies with specific rock types, but other places may be wholly unsuited to EW due to factors such as local climate/ soil conditions or lack of suitable rocks in proximity.

MINERALIZATION

Mineralization is a heterogeneous category that incorporates methods of transforming captured CO2 into products such as CO2 storage in concrete, which can have different sources of the CO2, and therefore widely differing capture costs, as well as surface soil mineralization in which the minerals like steel slag or mining tailings directly take up CO2 from the atmosphere in a different manner than enhanced weathering. Contracted volumes to date have been very low, though the number of respondents suggest there will be more to report on in future.

MARINE CDR (mCDR)

mCDR is likewise a heterogeneous category that incorporates CDR methods such as Macro Algae, Ocean Alkalinity Enhancement (which shares similar challenges as EW), and Direct Ocean Removal, which is very similar to DACCS. Intriguingly, it is one of the few methods where purchasers have higher price expectations than suppliers, indicating the potential for market movement as volumes scale and verification becomes more broadly understood and accepted. That said, pricing perceptions may be affected should a large, forward-sell deal be announced, similar in structure to the Google-Holocene deal.

Supplier versus Purchaser Expectations

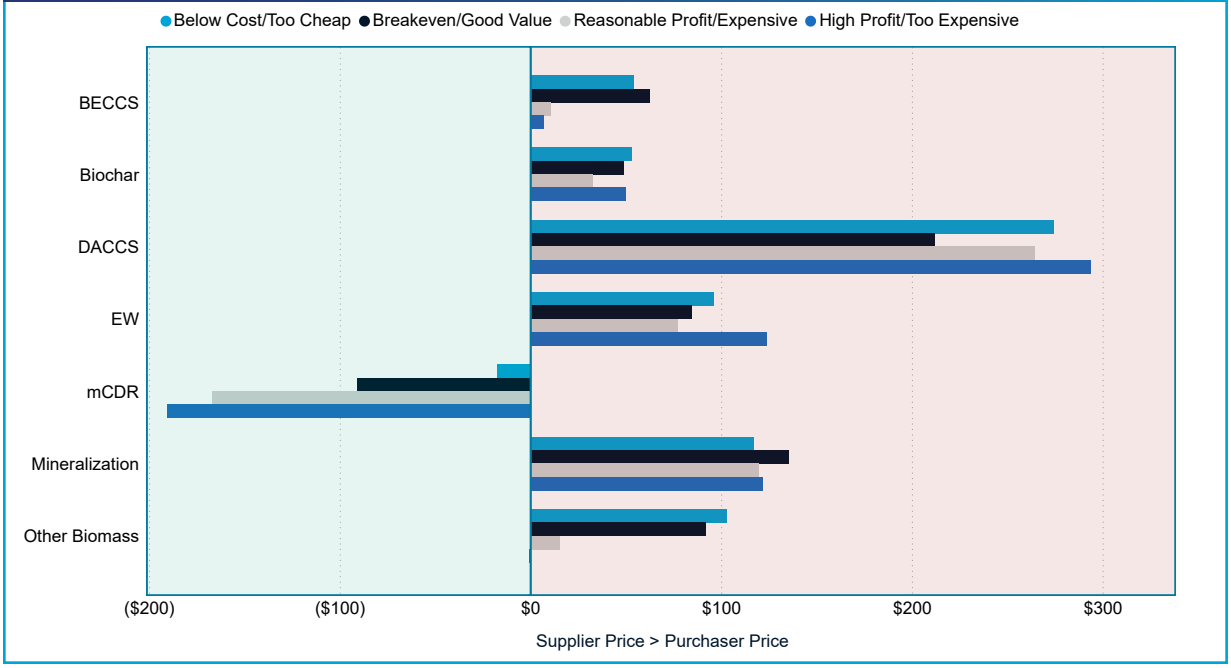
Suppliers and purchasers, on average, exhibited a gap in their perceptions of most CDR prices. Buyers' Cheap/Good Value estimates tended to fall below suppliers' Breakeven. The same goes for buyers' Expensive/High Side versus suppliers' Reasonable Profit.

This trend was visible in price expectations for both 2025 and 2030. However, the wide spreads in 2025 averaged price expectations for DACCS, mCDR, Mineralization and Other Biomass narrowed noticeably in 2030.. For 2025, the greatest mismatch between suppliers' Breakeven versus buyers' Cheap/Good Value prices was exhibited in DACCS (a gap of $212), Mineralization (a gap of $135), and Other Biomass (a gap of $92).

The greatest spreads for 2030 suppliers' Breakeven versus purchasers' Cheap/Good Value price expectations were among EW ($102) and DACCS ($69).

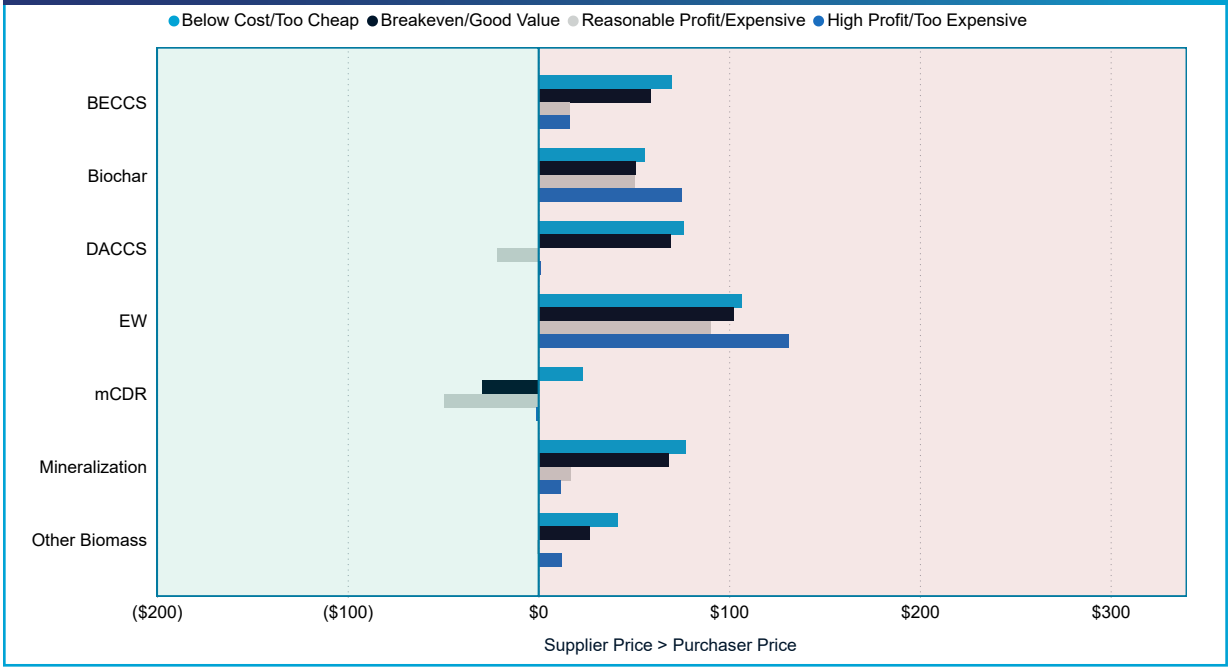
Buyers did not, however, undershoot sellers' prices across the board. When it came to marine CDR (mCDR) 2025 perceptions, purchasers came in above suppliers for all price comparisons.

2025 Price Spreads: Difference in All Supplier versus Purchaser Expectations



Source: CDR.fyi and OPIS Durable CDR Pricing Survey

2030 Price Spreads: Difference in All Supplier versus Purchaser Expectations



Source: CDR.fyi and OPIS Durable CDR Pricing Survey

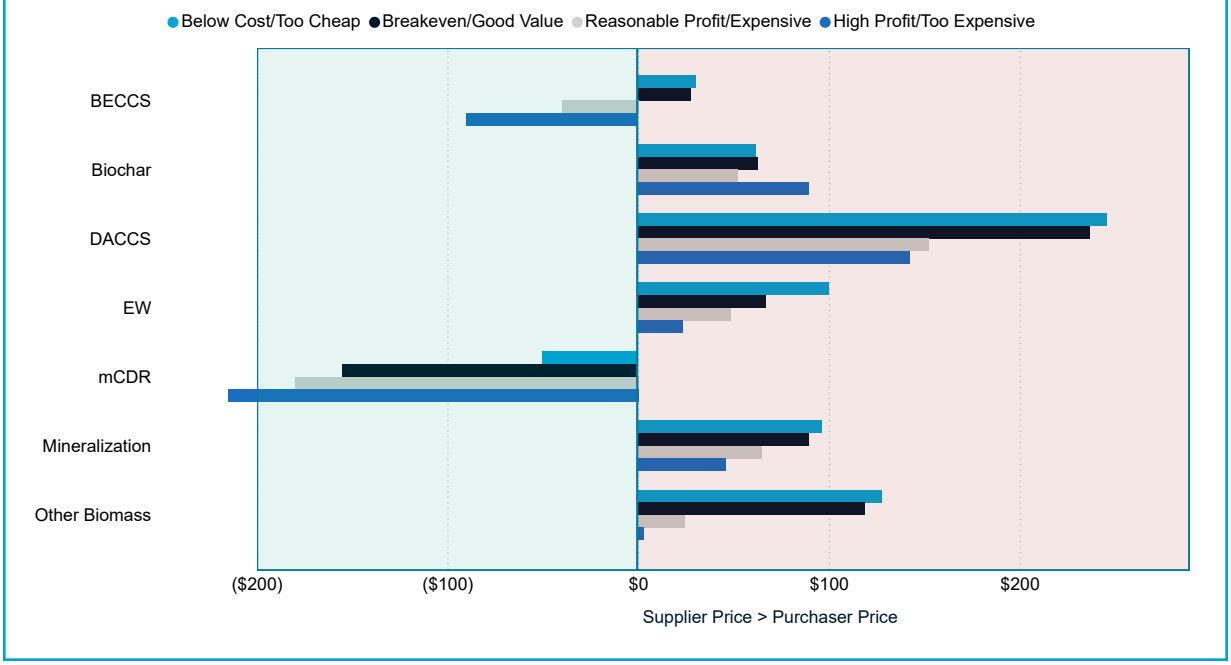
A more nuanced picture emerges when data from prospective market participants is taken out. Matching up prices from sellers and buyers that have already sold or purchased credits in the market, the gaps in perception decrease for some CDR methods but increase for others.

Looking ahead to 2030, however, experienced buyers and sellers come closer together with their expectations for all CDR methods except biochar.

For example, the Breakeven versus Cheap/Good Value spread for 2025 BECCS shrinks from $63 among all respondents to $28 for those that say they have already bought or sold credits. The same pairing for Mineralization narrows from $135 to $90, while EW shrinks from $85 to $67.

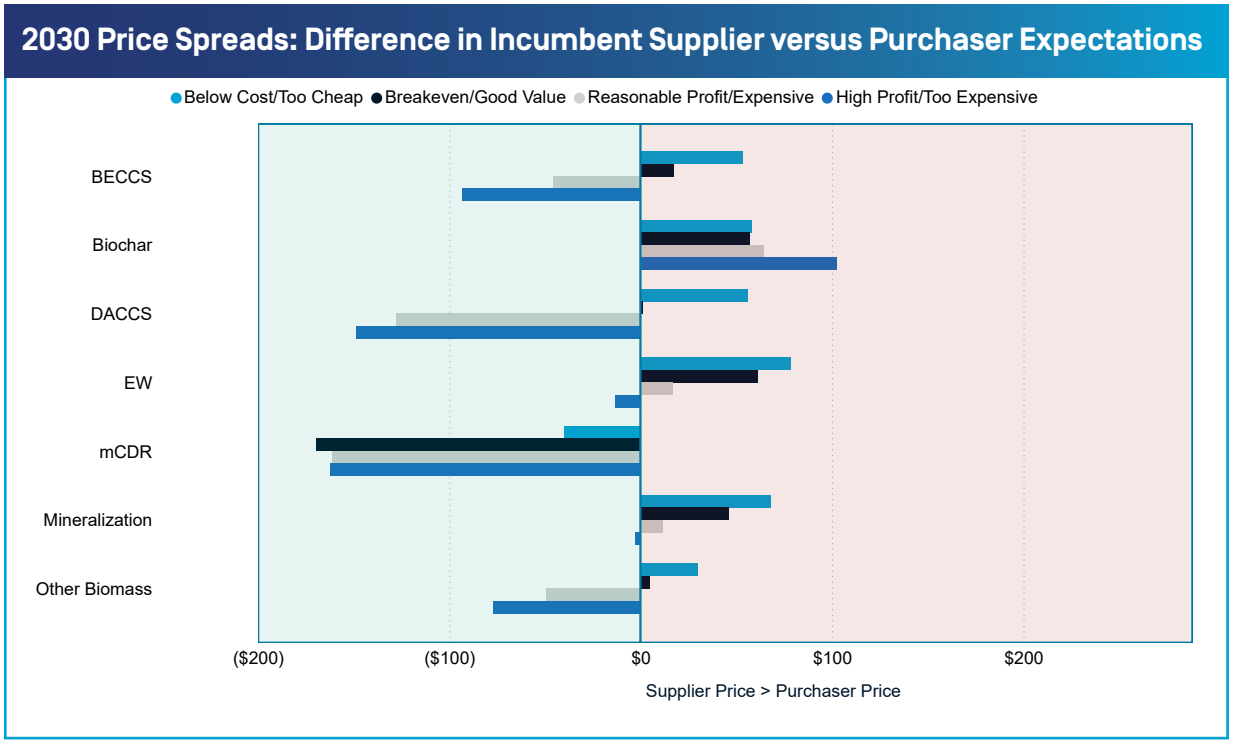
But some spreads widen when averaging only responses from previous buyers and sellers. The Breakeven versus Cheap/Good Value spread for 2025 Biochar increases from $49 to $62. The DACCS spread increases from $212 to $237.

2025 Price Spreads: Difference in Incumbent Supplier versus Purchaser Expectations



Source: CDR.fyi and OPIS Durable CDR Pricing Survey

Looking ahead to 2030, however, experienced buyers and sellers come closer together with their expectations for all CDR methods except biochar. These respondents reflected a Breakeven versus Cheap/Good Value spread in 2030 of $17 for BECCS, $5 for Other Biomass, $1 for DACCS, $61 for EW, and $46 for Mineralization. Looking at the Reasonable Profit versus Expensive/High Side price comparison, suppliers, on average, come in above purchasers for BECCS, Other Biomass, mCDR and DACCS. The spread for biochar expectations from previous market participants increases from $51 to $64.



Source: CDR.fyi and OPIS Durable CDR Pricing Survey

Veterans versus Prospects

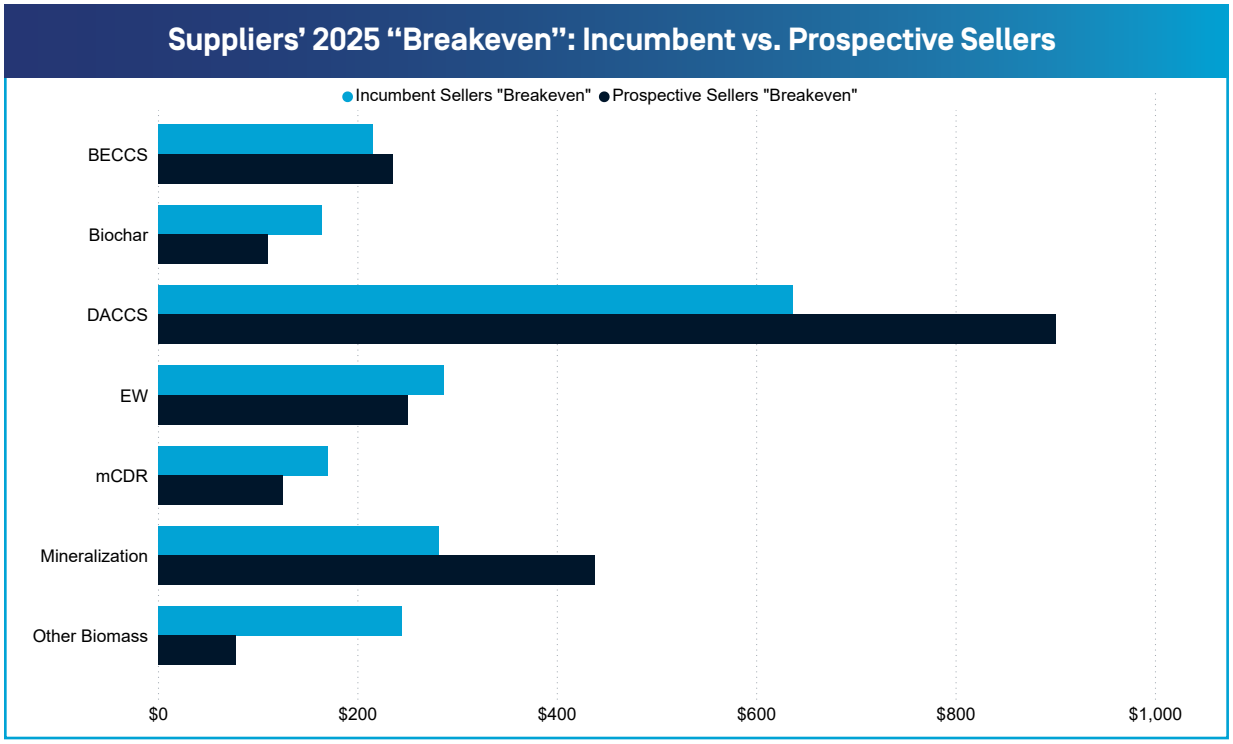
Both the supplier and purchaser survey asked respondents whether they had previously sold or bought CDR credits, respectively. Respondents that had already engaged with the sell and buy side of the CDR market tended to state different prices from those that had yet to do so, but the gap between the two went higher or lower depending on CDR method and, in some cases, the price point in question.

For 2025, veteran Biochar suppliers stated their Breakeven price point $54/mt higher on average compared to suppliers that had yet to close any trades. But BECCS incumbent suppliers came in $21/mt below prospective suppliers on average when stating their Breakeven.

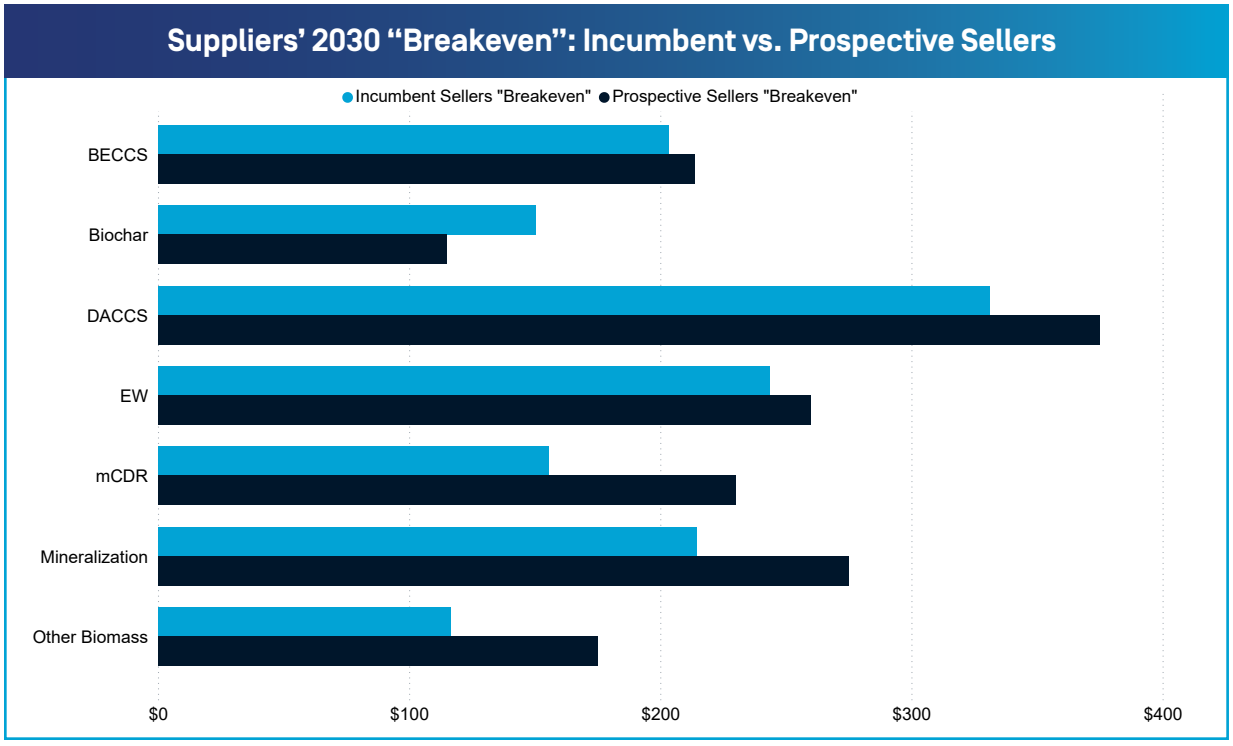
Veteran BECCS and DACCS suppliers expressed lower prices across the board compared to new entrants. The same goes for Mineralization, with the exception of the 2030 High Profit but Risky price. Incumbent biochar suppliers, on average, reflected higher prices for all categories.

Other Biomass and mCDR incumbent suppliers expressed higher average 2025 prices, but lower average 2030 prices compared to prospective suppliers.

EW supplier veterans and rookies were split on 2025 prices, but the former averaged lower expectations for 2030 prices.



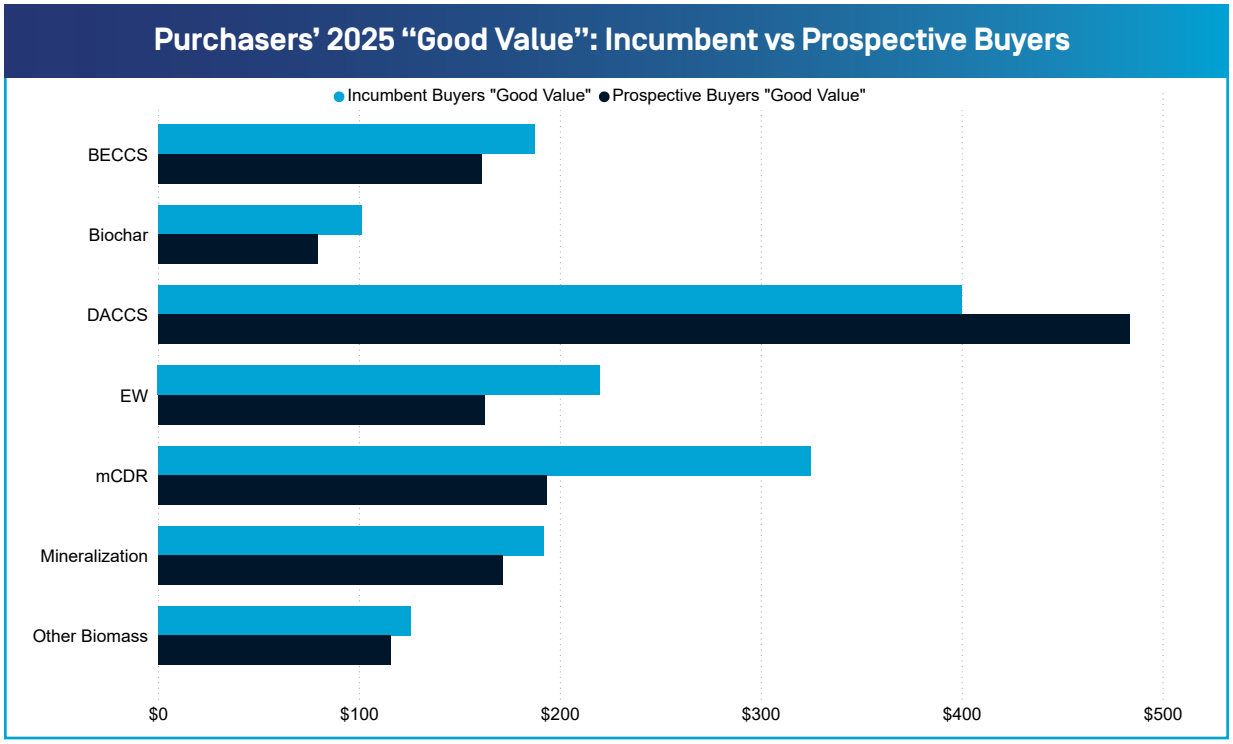
Source: CDR.fyi and OPIS Durable CDR Pricing Survey



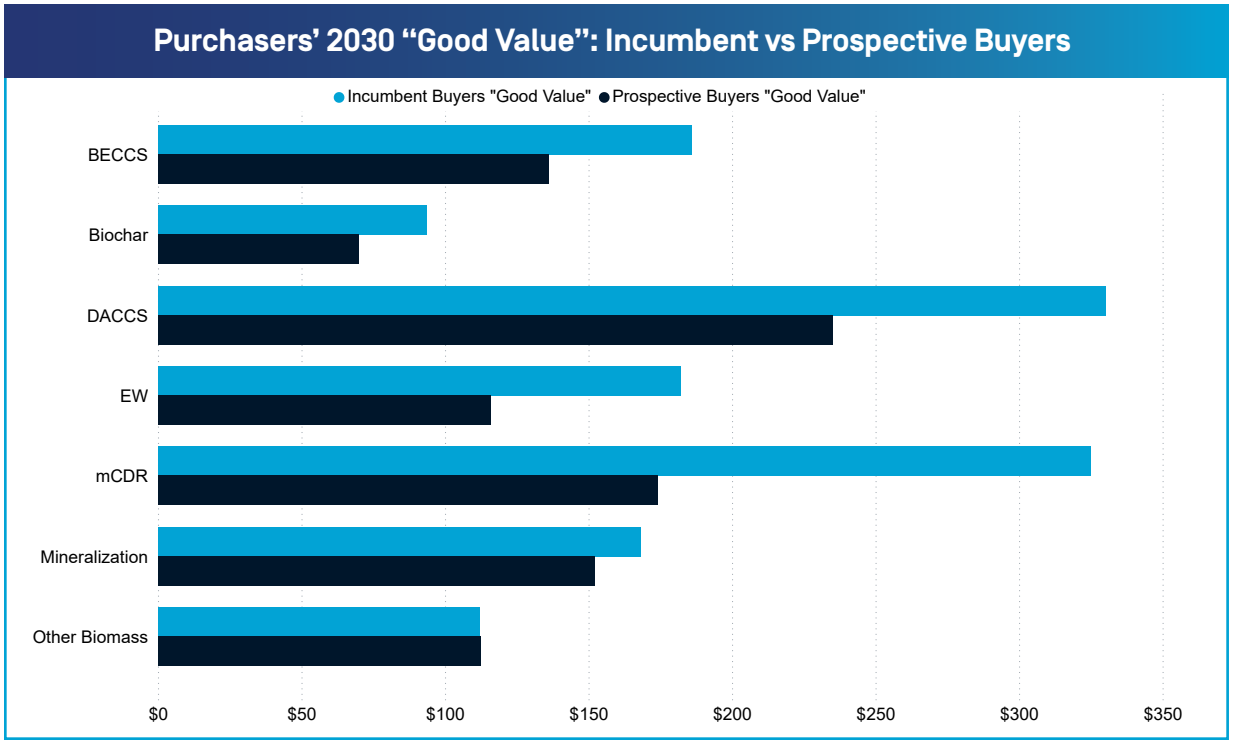
Source: CDR.fyi and OPIS Durable CDR Pricing Survey

Across the methods, incumbent purchasers mostly reported higher prices for 2025 and 2030 than prospective buyers. However, the spread between their price expectations was narrow in most cases.

Incumbent buyers stated higher Cheap/Good Value prices for every CDR method except DACCS in 2025 and higher prices for all 2030 Cheap/Good Value projections except for Other Biomass, where respondents' averages were within $1 of each other.



Source: CDR.fyi and OPIS Durable CDR Pricing Survey



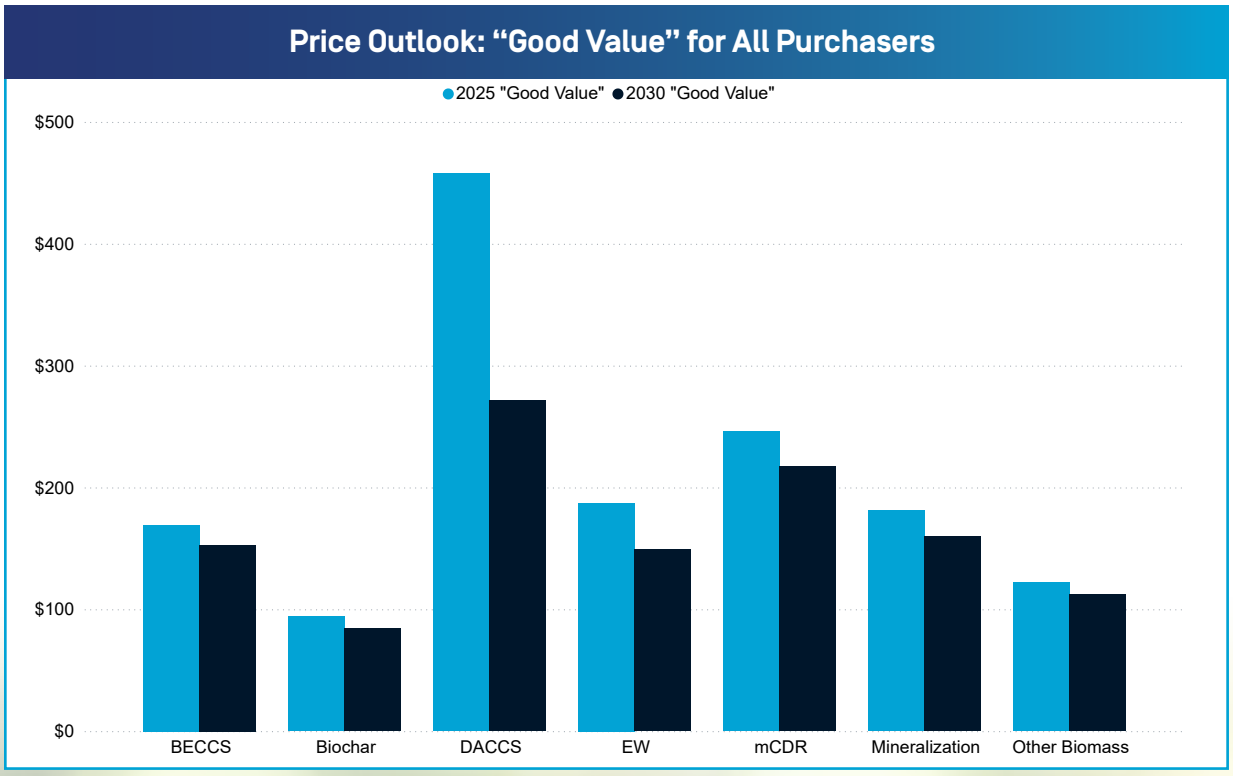
Source: CDR.fyi and OPIS Durable CDR Pricing Survey

Buyer Insights

Buyers broadly expected prices for all CDR methods would fall by 2030. Greatest discounts were expected to occur for DACCS credits, whose Cheap/Good Value price point was projected to fall roughly 41% to $272/mt from an average of $458/mt.

The second largest expected decline in the Cheap/Good Value category was for Enhanced Weathering, which purchasers said would weaken $38/mt to $149/mt in 2030.

Other expected price drops were more modest. Purchasers said Cheap/Good Value prices for Mineralization would drop $22/mt to $159/mt in 2030, while price expectations for Biochar were $10/mt lower at $84/mt.



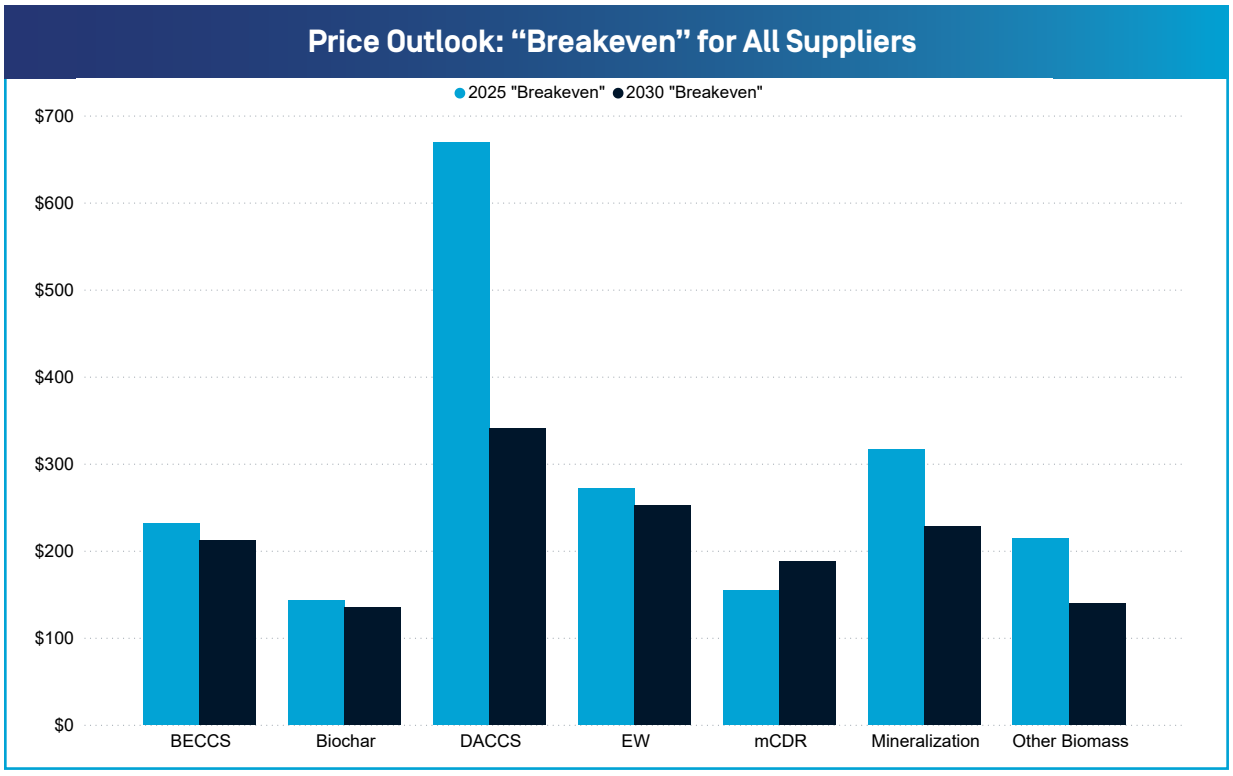
Source: CDR.fyi and OPIS Durable CDR Pricing Survey

Supplier Insights

Like buyers, suppliers also expected prices to fall by 2030, with the exception of mCDR. Suppliers said that their forward mCDR Breakeven prices are expected to reach $187/mt, up from $155/mt this year.

Projected drops in the Breakeven price point were steeper for DACCS, Mineralization, and Other Biomass methods. Suppliers on average projected a 50% fall in DACCS prices to $341/mt from $670/mt.

Suppliers were somewhat aligned with buyers in their expectations for Biochar and BECCS. Purchasers expected a drop of $7/mt and $20/mt off current credit prices by 2030. Buyers anticipated discounts of $9 for Biochar and $16 for BECCS in five years' time.



Source: CDR.fyi and OPIS Durable CDR Pricing Survey

Conclusion

Carbon removal is still far from a commodity, and this is reflected in the survey answers. Different methods have very different costs, and the early innovator buyers are currently also willing to pay different amounts for different types of CDR. However, as noted in this report, that may change, with the next wave of buyers being more focused on price. This may lead to purchases concentrated on the cheapest methods today.

At the same time, no single CDR method will be sufficient to meet the world's CDR needs. Biomass-based methods, for example, are inexpensive and effective but are restricted by access to sustainable biomass. Enhanced weathering is constrained by mining, access to rock, and suitable farmland. DACCS is limited by the availability of affordable energy. The world needs a mix of CDR methods if we are to remove over 5 Gt per year by 2050 and meet our global climate targets.

This points to the role of governments. If voluntary buyers are unlikely to buy down the cost of more expensive removal methods, governments may decide to step in to incentivize the

market. Maintaining and broadening programs like the United States' 45Q tax credit of $180/mt for DACCS would further support fair-value transactions. The market would be further supported by establishing contracts for difference and developing compliance markets that accommodate various pricing methods, such as centralized purchasing systems that allocates CDR allowances.

Survey Overview and Methodology

CDR.fyi and OPIS partnered to conduct a pricing survey for durable carbon dioxide removal (CDR) market participants from October 28 to December 13, 2024. The surveys asked suppliers and buyers to identify four price points related to specific CDR methods. For the purposes of the survey and this report, durable CDR is defined as having a permanence of hundreds to thousands of years, and aligns largely with the engineered CDR sector.

Suppliers and buyers were asked whether they had ever sold or bought credits from projects that involved:

- Biochar Carbon Removal (BCR),
- Bioenergy with Carbon Capture and Storage (BECCS),
- Other Biomass Removal and Sequestration (Bio-Oil Sequestration, Biomass Direct Storage),
- Direct Air Carbon Capture and Storage (DACCS),
- Enhanced Weathering (EW),
- Mineralization (Ex-situ, In-situ, Microbial, Surficial), and
- mCDR (Direct Ocean Removal, Marine Biomass Sinking, Microalgal Capture and Storage, Ocean/River Alkalinity Enhancement).

Survey Respondents

	Purchasers'	Suppliers'
BECCS	14	17
Biochar	21	53
DACCS	11	18
EW	9	6
mCDR	6	7
Mineralization	12	9
Other Biomass	13	14

Respondents were also asked whether they planned to buy or sell credits from the above project methods for 2025 and 2030 delivery.

Suppliers were asked the price at which credits from all the project types listed above would be:

- "too low, where you would lose money on every sale" (Below Cost);
- "just at your cost, where you're breaking even but not making any profit?" (Breakeven);
- "reasonable, where you're making a fair profit while still offering a good value to buyers?" (Reasonable Profit); and
- "too high, where profits are substantial but you believe it may deter potential buyers?" (High Profit but Risky).

Buyers were asked the point at which credits from projects listed above would be:

- "priced so low that you feel the quality can't be very good?" (Too Cheap);
- "a bargain, a great buy for the money?" (Cheap/Good Value);
- "starting to get expensive - not out of the question, but you'd have to give some thought to buying them?" (Expensive/High Side); and
- "so expensive that you would not consider buying it?" (Too Expensive).

The survey questions for purchasers were based on the Van Westendorp Price Sensitivity Meter and modified to create equivalent questions for suppliers. The number of respondents per CDR method is reflected in the chart above.

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CDR.fyi

CDR.fyi is a Public Benefit Corporation (PBC) with a mission to accelerate carbon removal, an essential element of achieving net zero. CDR.fyi, operating globally with contributors on five continents, partners with CDR participants to ensure accurate, trusted reporting for purchases, deliveries, retirements, and projects, bringing transparency and accountability to the durable carbon removal market.

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