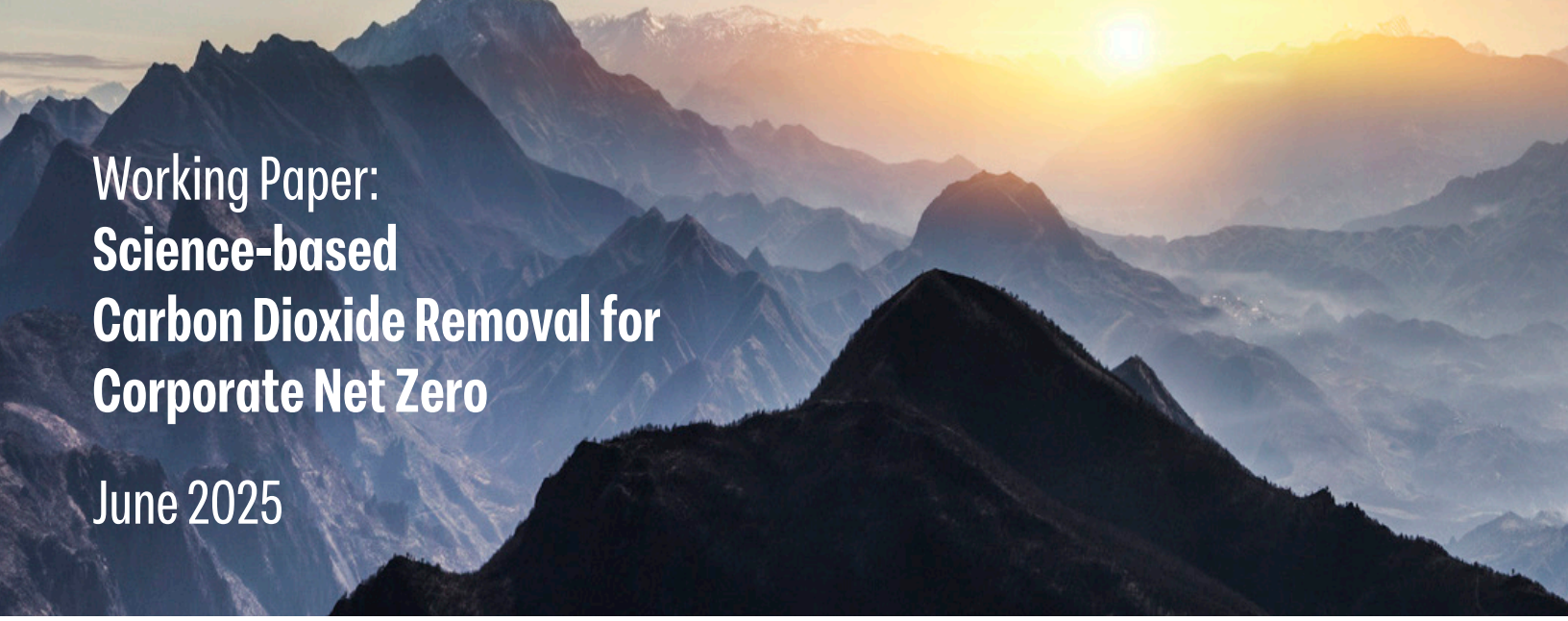


Working Paper: Science-based Carbon Dioxide Removal for Corporate Net Zero

June 2025

Executive Summary

The Science Based Targets Initiative (SBTi) is considering how to further integrate a science-based approach to carbon dioxide removal (CDR) into the v2 Corporate Net-Zero Standard.

To inform this work, a group of expert academic and civil society organizations has developed the following design recommendations that SBTi can adopt to create a science-based framework. These recommendations reflect an independent review of the best available scientific evidence and an extensive stakeholder outreach effort to understand the perspectives of industry, including corporations with SBTi net-zero targets.

CORE PREMISES

The need for scaled, durable CDR in 2050. Carbon dioxide removal will be needed globally to reach net zero in 2050. Furthermore, high-durability CDR (1,000+ years of durability) will be needed to sustain net zero over time and to minimize global temperature increase.

The value of all forms of CDR on the road to 2050. Low-durability CDR methods are affordable and scalable today in many cases, which may be useful to minimize risks associated with overshoot and climate tipping points. However, they carry higher risks of reversal and the need for replacement in perpetuity if being used to compensate for long-lived emissions in a science-based manner. High-durability CDR methods typically have a lower risk of reversal, making it an important solution for compensating for long-lived emissions, but most approaches need support to down-cost and scale. On the road to 2050, CDR of all durability levels has a role to play.

The scale limitations of every individual approach and the need for a portfolio. To reach the scale of CDR required, targeted actions across the CDR ecosystem are needed. Cultivating a portfolio of high-durability CDR approaches is especially important due to the scaling limits all CDR pathways face. All of this will take time. As a consequence, funding is required now for all known high-durability CDR pathways to support further technology development and deployment to enable scaled deployment at a reasonable cost in mid-century.

Design Recommendations for SBTi

The design recommendations in this paper address the following topics:

- **Topic 1:** Increasing ambition
- **Topic 2:** Interim removal targets to address residual emissions
- **Topic 3:** Minimum durability thresholds
- **Topic 4:** CDR quality criteria
- **Topic 5:** Fostering innovation
- **Topic 6:** Addressing Scope 3 emissions
- **Additional design considerations**

Topic 1: Increasing ambition

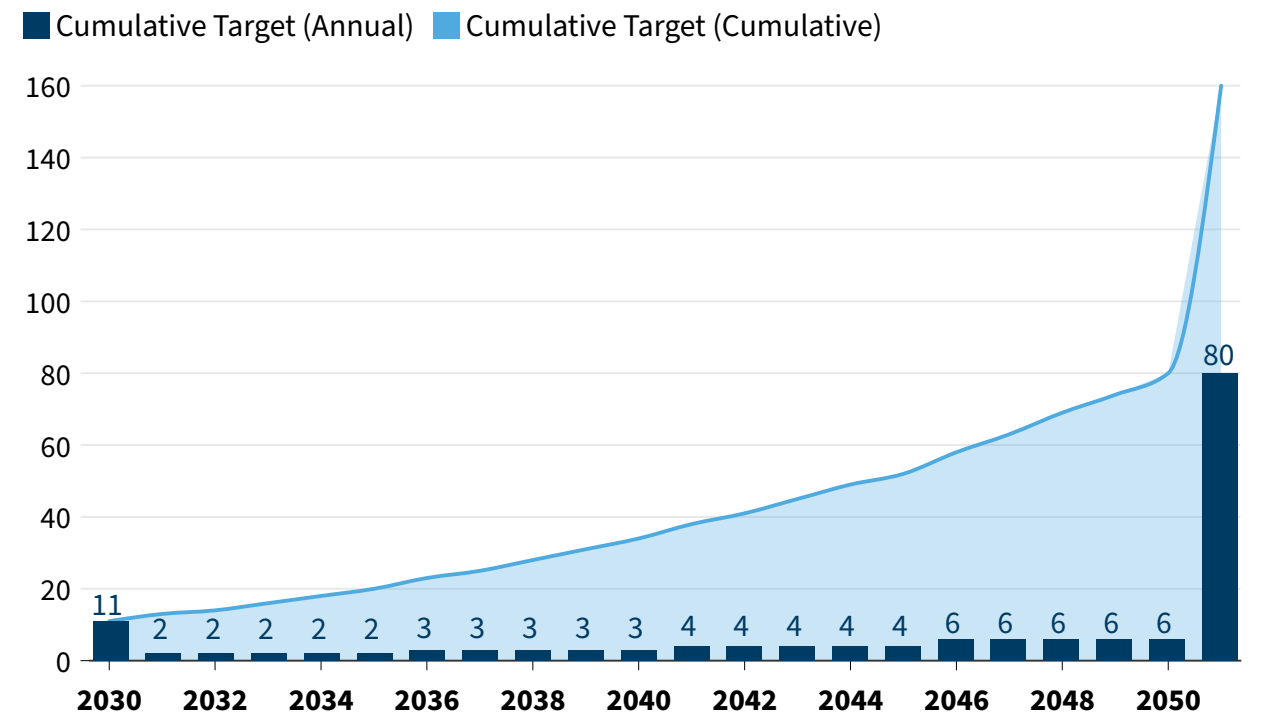
CORE POSITION: Interim removal targets should require gradually increasing *annual* targets for CDR procurement, rather than *cumulative* targets, to provide a clear demand signal to the market for the volumes that will be needed to serve SBTi companies at net zero.

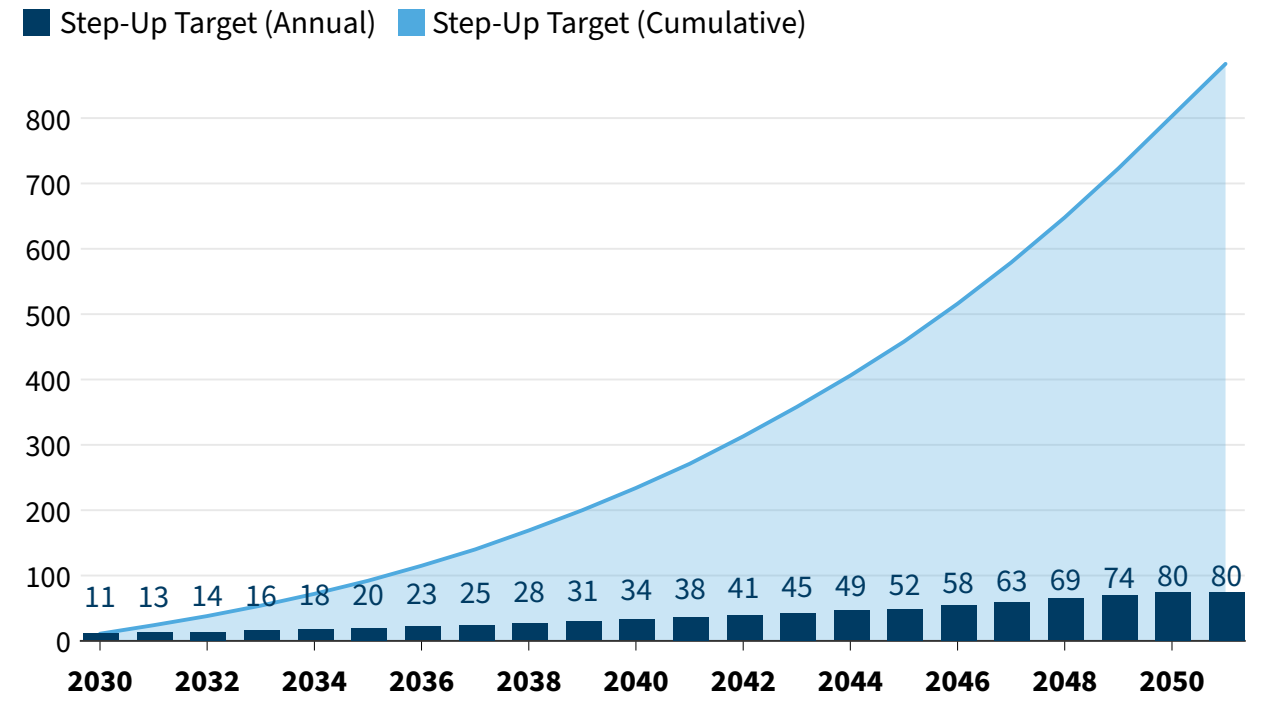
SBTi's Explanatory Guide for the CNZSv2 addresses this topic on slide 52 and clarifies that the interim removal targets proposed in the draft are ***cumulative totals*** starting in 2030 rather than annual removal targets that steadily increase over time.

This approach (called the *Cumulative Target Approach* in the Position Paper) would lead to **just one year's worth of demand for CDR spread over the course of 20 years**. This approach represents roughly 90% less demand compared to an approach that requires companies to purchase gradually increasing amounts of CDR over time to reach 100% of their projected residuals by the net-zero target year (called the *Step-Up Target Approach* in the Position Paper).

Exhibit 1 illustrates the yearly demand signal for both the *Cumulative Target Approach* and the *Step-Up Target Approach*. For the *Cumulative Target Approach*, the first year of procurement is the largest, with annual demand dropping roughly 80% in 2031. In 2051, when a company must compensate for 100% of reversals, demand spikes dramatically. When you include Scope 3 residuals, the spike will be even more significant. The *Step-Up Target Approach*, in contrast, requires slowly increasing amounts of removals that result in a more progressive increase in demand and avoids dramatic shifts in required removals.

Exhibit 1. Demand signal from the Cumulative (top) and Step-Up (bottom) Target Approaches (millions of tons CO_2e)





Note: *These charts represent the CDR requirements for 800 Mtpa of Scope 1 emissions, an estimate of the Scope 1 emissions from all SBTi companies with net-zero targets and the like-for-like minimum durability threshold phased in by 2030 (see Topic 3). The Exhibit assumes companies purchase CDR yearly. The Cumulative Target Exhibit also assumes that the cumulative amount of removals through 2050 must equal a company's residual emissions, which then must be matched on an annual basis starting in 2051.*

Source: RMI analysis.

Topic 2: Interim removal targets to address residual emissions

CORE POSITION: Interim removal targets should be *required* starting in 2030 for companies with net-zero targets. If companies begin procuring and retiring removal credits before 2030, they should be *recognized* for doing so.

While emissions reductions must continue to be the top priority for companies working toward net zero, investing in scaling and deploying CDR now is likely to lower long-run costs of addressing climate change, compared to delaying deployment (see full Position Paper for citations). **SBTi's goal should be to guide companies toward a sound long-term investment strategy for achieving net-zero targets**. Because of this, interim removal targets should be required, rather than optional, and should be met with high-quality removals, rather than allowing accelerated mitigation toward removal targets.

Topic 3: Minimum durability threshold

CORE POSITION: To fully address the atmospheric impact of residual emissions in a science-based way at the point of net zero, removals should be matched to emissions on a "like-for-like" basis such that the durability of the removals counterbalances the atmospheric lifetime and warming effect of the original emissions. We propose to phase in like-for-like by 10 years before a company's net zero date to create a more gradual ramp up while still charting a course to a science-based framework.

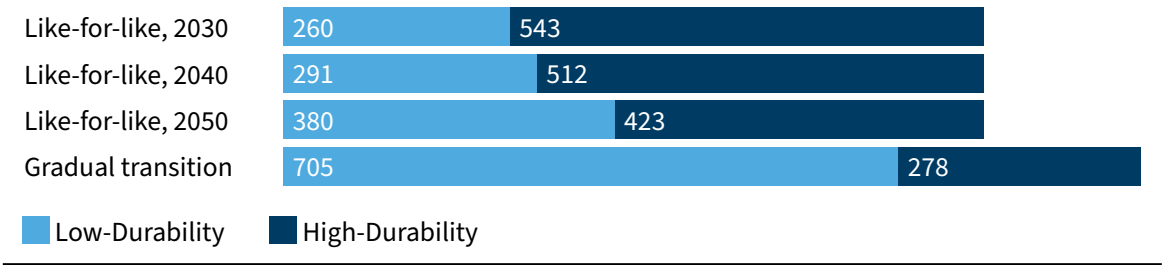
Durable net zero requires a like-for-like approach to the durability of removals. Otherwise, any net-zero state attained will not be sustainable over the long-term. Although a like-for-like approach is the most scientifically-grounded approach to carbon removal, concerns exist over the feasibility of implementation by 2030 because of the increase in demand for high-durability CDR this approach would create.

To address these concerns, this paper considers alternative options to phase in like-for-like gradually over time starting in 2030 and reaching full implementation after 2030. Prior to reaching the "phase-in year", a decreasing percentage of CO2 and SF6 emissions may be compensated for with low-durability CDR (see Table 3 in the Position Paper for additional details).

Exhibit 2 below compares four approaches to minimum durability threshold and shows that delaying the phase-in of like-for-like to 2040 would result in only a modest reduction (31 Mt) in overall demand for high-durability CDR between 2030 and 2050 compared to the overall demand stimulated.

A 2050 phase-in year would result in a significantly higher shift in demand to low-durability CDR, but high-durability CDR would still make up the majority of demand from 2030-2050. A gradual transition approach would result in a greater overall demand for removals from 2030-2050, but the majority of this would be for low-durability CDR.

Exhibit 2. Comparing the distribution of low- and high-durability of CDR required from 2030 to 2050 in the Like-for-like 2030, 2040, and 2050 approaches and the gradual transition approach



Note: *Exhibit is illustrative and assumes the Step-Up Target Approach (see Topic 1).*
Source: RMI Analysis

Phasing in a like-for-like approach as early as possible will generate more demand for high-durability CDR in the near term, but a later phase-in lowers overall cost due to the higher affordability of low-durability CDR methodologies. A delayed phase-in of like-for-like could also allow more time for **early-stage** CDR approaches to develop, strengthening the supply of high-durability CDR when the like-for-like principle comes into effect. Additional analysis on the impact of the minimum durability threshold on individual corporations can be found in the Position Paper.

When setting minimum durability thresholds under a like-for-like framework, SBTi must ensure that minimum durability thresholds are aligned with the GWP factor used to convert non-CO2 emissions to CO2 equivalent. For example, SBTi should use GWP20 factors if using removals of less than 100 years will be allowed. Alternately, SBTi could use GWP100 factors and set the minimum durability threshold at 100 years.

Topic 4: CDR quality criteria

CORE POSITION: CDR used to meet interim removal targets must be verified by an unconflicted third party and comply with other widely accepted quality criteria.

We agree with SBTi's preliminary view that "*Removal activities used by companies to address residual emissions shall adhere to high-integrity quality and sustainability criteria*." SBTi should identify external standards or frameworks for CDR quality to reference well before 2030 to ensure that corporations can use it to inform their offtake decisions, which will need to be made in advance for 2030 delivery. Some quality characteristics that SBTi should consider include additionality, net negativity, reverse traceability, data transparency, and adherence to sustainability, environmental impact, and equity criteria.

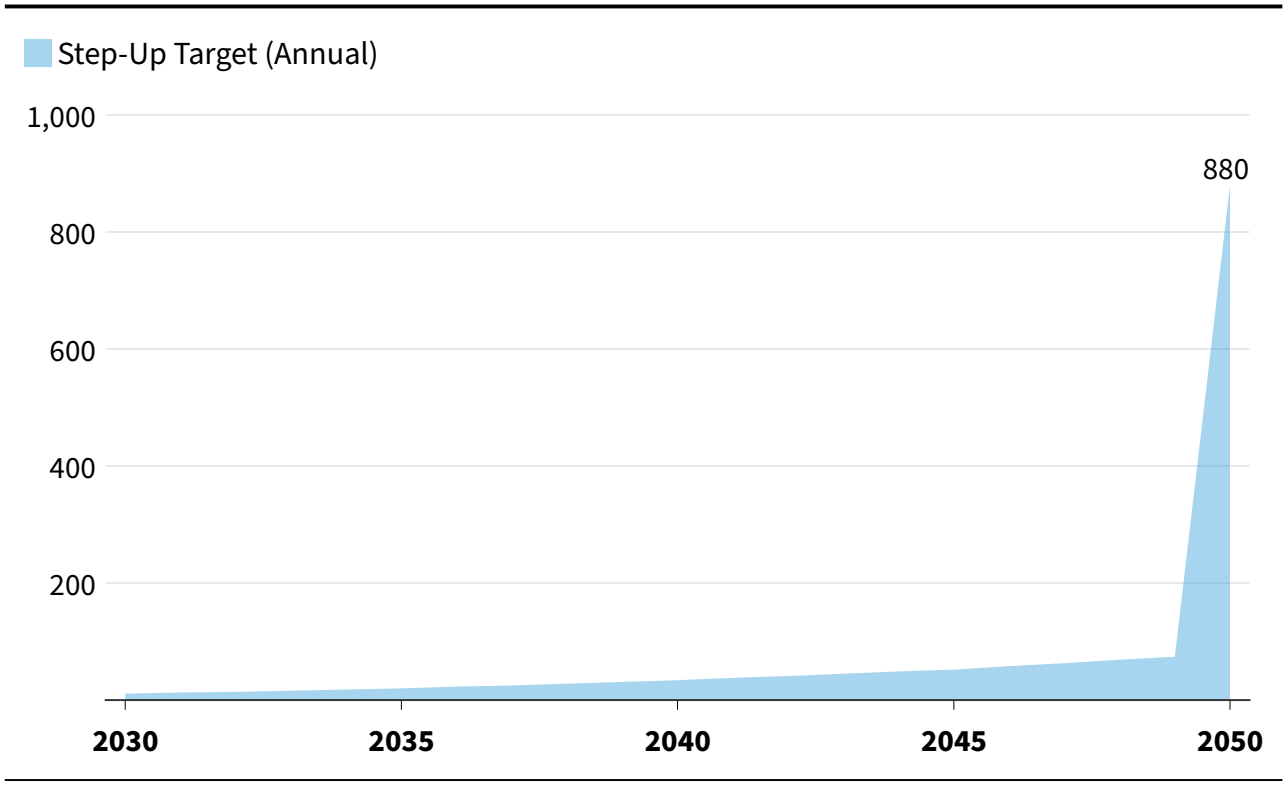
Additionally, we encourage SBTi to allow for CDR suppliers to align with multiple quality frameworks to ensure that SBTi does not become an additional administrative burden on projects and allow suppliers maximum flexibility while maintaining high quality. Additional details on existing criteria can be found in Topic 4 of the Position Paper.

Topic 5: Addressing Scope 3 emissions

CORE POSITION: SBTi should require aviation emissions in companies' Scope 3 to be addressed by interim removal targets. Additionally, SBTi should recognize companies that choose to include Scope 3 emissions within their Interim Removal Targets and express intent to review the question of removals that address Scope 3 emissions in the future.

Companies cannot achieve net-zero targets without addressing residual emissions in Scope 3. SBTi currently requires that corporations counterbalance Scope 3 residual emissions with CDR at the point of net zero. As a result, a significant amount of demand for CDR will be delayed until 2050, which may impact the industry's ability to scale and cost-down CDR over time, and will result in a significant spike in demand in 2050 (see Exhibit 3).

Exhibit 3: CDR demand including Scope 3 demand beginning in 2050 (million tons of CO2e)



Note: *This chart models a scenario that assumes 800 Mtpa of Scope 1 emissions and 8000 Mtpa of Scope 3 emissions for all SBTi companies with net-zero targets, assuming a 2050 target year. We model annual CDR purchases under a 2030 like-for-like framework using the Step-Up Approach. See Topics 3 and 1, respectively, in the full Position Paper for full details.*
Source: RMI analysis.

At the same time, SBTi raised valid concerns about the prospect of requiring corporates to include Scope 3 residual emissions in their interim removal targets, including the uncertainties involved in projecting long-term residual emissions in Scope 3.

To manage the trade-offs, and recognizing that SBTi has indicated that Scope coverage is not under consideration during the consultation, we recommend that:

- SBTi encourage and recognize companies for setting removals targets for their Scope 3 emissions
- Express intent to review the issue of Scope 3 residual emissions in a future update cycle for the Standard, with the intent to phase-in coverage of Scope 3 emissions.

Topic 6: Fostering Innovation

CORE POSITION: The world will need a portfolio of CDR approaches; investing in innovation and learning through deployments is therefore critical to achieving long-term climate targets, but procurement from nascent approaches may not yet meet all quality criteria. SBTi should support the need for innovation in CDR, for example, by recognizing purchases and investments in nascent CDR approaches under the Beyond Value Chain Mitigation category.

To balance the need to support innovation while building trust in the field and stimulating demand for more mature CDR approaches, we propose that SBTi recognize purchases from or investments in nascent CDR pathways under the Beyond Value Chain Mitigation category. Using BVCM will ensure that interim removal targets will be met with credible, high quality CDR credits. This option may also resonate with corporates because it creates flexibility and allows them to advance innovation and learning with their procurements.

Additional important design considerations

In addition to the topics addressed above, recommend SBTi consider the following.

- **The use of CDR to address hard-to-abate emissions and overshoot.** Allow the use of CDR in other situations related to hard-to-abate emissions and missing progress milestones. The use of CDR must meet the durability and quality criteria proposed in Topics 3 and 4. SBTi must clearly define hard-to-abate emissions and hard-to-abate sectors.
- **Allowable vintage of credits.** Credits must be retired in the year for which a company is seeking to counterbalance emissions, but companies may use credits that have been delivered in previous years, up to 5 years
- **Geographic flexibility for credits.** Companies should be free to procure credits from outside of the country where the emissions are occurring, as long as credits meet quality criteria to avoid burden-shifting and double-counting.

Conclusion

The need for large volumes of high-quality CDR at the point of net zero is clear, as is the need to start scaling up gradually now to meet the long-term needs at a reasonable cost. While SBTi is just one vector for driving this change, it is an important one. As the leading standard setter for voluntary corporate action, SBTi has the opportunity to provide critical science-based guidance to ambitious corporations to help catalyze further growth in CDR.

Acknowledgements

RMI led the writing of this working paper in collaboration with a diverse group of civil society and academia stakeholders, with input from industry. Any errors are solely attributable to the author team. The individuals and organizations below contributed to the development of this work:

Organizations:
AFEN
Carbon Removal Canada
Isometric
Carbon Removal India Alliance
Carbon Gap
Carbon Removal Alliance
Climeworks
Rethinking Removals
Inherit Carbon Solutions
Carbon Balance Initiative
Cascade Climate
Carbon180

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Steve Smith (University of Oxford)
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Kyle Clark-Sutton, Elizabeth Healy, Science-based Carbon Dioxide Removal for Corporate Net Zero: Recommendations for CDR Integration into SBTi's Corporate Net-Zero Standard v2, RMI, 2025, **https://rmi.org/a-joint-position-statement-on-carbon-dioxide-removal-in-sbtis-draft-corporate-net-zero-standard**.