Chapter 3

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Buffer vessel from a modern biomass plant. By Kontrast-fotodesign

Chapter 3 | Demonstration and upscaling

Demonstration projects, new firms and investments, workforce development and expectations of growth are key to scaling up CDR. Steady development is evident in many areas – but so, too, are recent reversals in policy support and company targets.

Key insights

- The number and capacity of demonstration plants have grown dramatically in recent years, and support for projects is strengthening in many countries – but it has weakened in the United States due to uncertainty surrounding its DAC Hubs Program.
- Investment in CDR companies rebounded in 2025 – and its share of all climate-tech funding grew to 2.6%. This trend is driven by a surge in grants from public and quasi-public institutions and debt financing, highlighting the volatility of the CDR innovation ecosystem.
- CDR companies require a diversified, skilled workforce, with substantial variation in the number and type of job postings across methods. There is high demand for engineering and technical roles as well as for sales, operations and finance.
- CDR companies and industry groups have announced capacity targets that show the ambition to reach 5.29 Gt per year of novel CDR capacity by 2050. Still, some targets have been revised downwards, highlighting uncertainty about whether long-term company goals will be realized.
- Meeting long-term goals for novel CDR, including those implied by publicly stated company ambitions, will require fast scale-up rates. These rates are not unprecedented, but they are at the high end of historical examples of technology scale-up.
- A broad range of indicators suggest that, despite recent reversals, the CDR innovation ecosystem is advancing towards the market growth phase, as evidenced by new demonstration projects and large investments in startups, but stable policy support will be crucial to future upscaling.

CDR demonstration and upscaling sit at the intersection of innovation and widespread deployment. As technologies transition from the early-stage research and development phase (see Chapter 2) towards the market growth phase (see Chapter 7), this chapter captures the critical intermediate stage in which technical viability meets market reality. With this focus, we examine CDR activities by both established companies and startups as drivers of CDR upscaling. We track this progress through several key indicators including:

- Public funding of demonstration projects that provides essential early-stage support to de-risk novel technologies;
- Investment in CDR companies that reflects market confidence and capital mobilization to enable deployment; and
- Company announcements of capacity targets that reveal industry ambitions and expected growth pathways.

We also discuss emerging needs to support upscaling, including workforce development, business and sales models, and subnational policies and programmes.

3.1 Evolving public demonstration programmes

The demonstration of novel technologies is an important stage in technology innovation. Demonstration and pilot projects enable real-world experimentation outside the lab and learning opportunities in the settings where technologies may be widely adopted. Demonstration projects are typically larger in scale than pilot projects and are sometimes referred to as "first-of-a-kind" (FOAK) projects. Government funding provides stability and support for technologies that have not yet been widely adopted and may benefit from additional testing outside the lab before commercial-scale operations.

This section is focused on public funding for pilot and demonstration projects. Some programmes and technologies included in this section are not necessarily CDR but rather enabling technologies that may be directly relevant to the development of CDR, such as carbon storage and transport. The final destination for captured carbon is not always specified for demonstration projects, but these projects can still provide lessons for CDR. In this section, we refer to methods such as BECCS or DACCS broadly, even if the fate of the captured carbon is not specified. The first subsection summarizes projects that have either begun or announced the start of operations between 2020 and 2030. The second subsection describes public funding programmes in countries that either have dedicated public funding for demonstration projects or have provided such funding on another basis. Beyond national governments, subnational governments – including, critically, cities – also have a role in upscaling CDR, through funding support and other policies (see Box 3.2).

Trends in demonstration projects

Demonstration projects provide opportunities for stakeholders across the public and private sectors to test, understand and improve novel technologies before commercialization and after lab-scale testing.[1] Most novel CDR projects now in operation, with the exception of biochar, are in the demonstration phase. Because learning is a motivation for demonstration projects, global collaboration across countries is particularly important.

Mission Innovation is a global initiative that supports technology innovation through research, development and demonstration, with an objective of accelerating progress towards meeting the Paris Agreement goals. The programme aims to foster learning and cooperation among Mission Innovation member countries to support the development of clean energy technologies that contribute to net-zero goals. Mission Innovation was launched in 2015 with its membership comprising the European Union and 15 individual countries – a number that has now grown to 22. Among Mission Innovation's seven specific focal areas is the CDR Mission. The CDR Mission was launched in 2021 and is co-led by the United States, Saudi Arabia and Canada. An additional five countries are core CDR Mission members, and two countries and the European Commission are part of the CDR Mission support group.

One pillar of the CDR Mission is the CDR Launchpad, which is a coalition of governments that have committed to supporting CDR demonstration projects. Countries that are a part of the Launchpad have pledged to build at least one CDR project with a removal capacity of at least 1,000 tonnes of CO_2 per year by 2025, share data on these projects, and provide a combined total of US$100 million for pilot and demonstration projects globally. Canada, the European Commission, Iceland, Japan, Norway, the United Kingdom and the United States have all joined the CDR Launchpad. The Mission Innovation CDR Launchpad represents the only dataset specifically focused on tracking announced CDR demonstration projects, although data is limited to Launchpad members.

Because data on demonstration and pilot projects is patchy and not kept in a centralized repository, we have gathered information from multiple sources to create our own dataset. Specifically, we have collated data from the Mission Innovation CDR Launchpad[2] (last updated in October 2024), updates from the 16th Clean Energy Ministerial[3] and 10th Mission Innovation Ministerial meetings, the International Energy Agency (IEA) carbon capture, utilization and storage (CCUS) Projects Database and the *IEA State of Energy Innovation 2025* report.[4,5] Our dataset includes 46 announced projects that span many CDR technologies: BECCS, DACCS, enhanced weathering, biochar, mineral products and DOCCS (see Figure 3.1). Approximately 80% of these projects have an announced removal capacity in excess of 1,000 tonnes per year.

Demonstration projects announced, under construction or in operation, 2020–2030

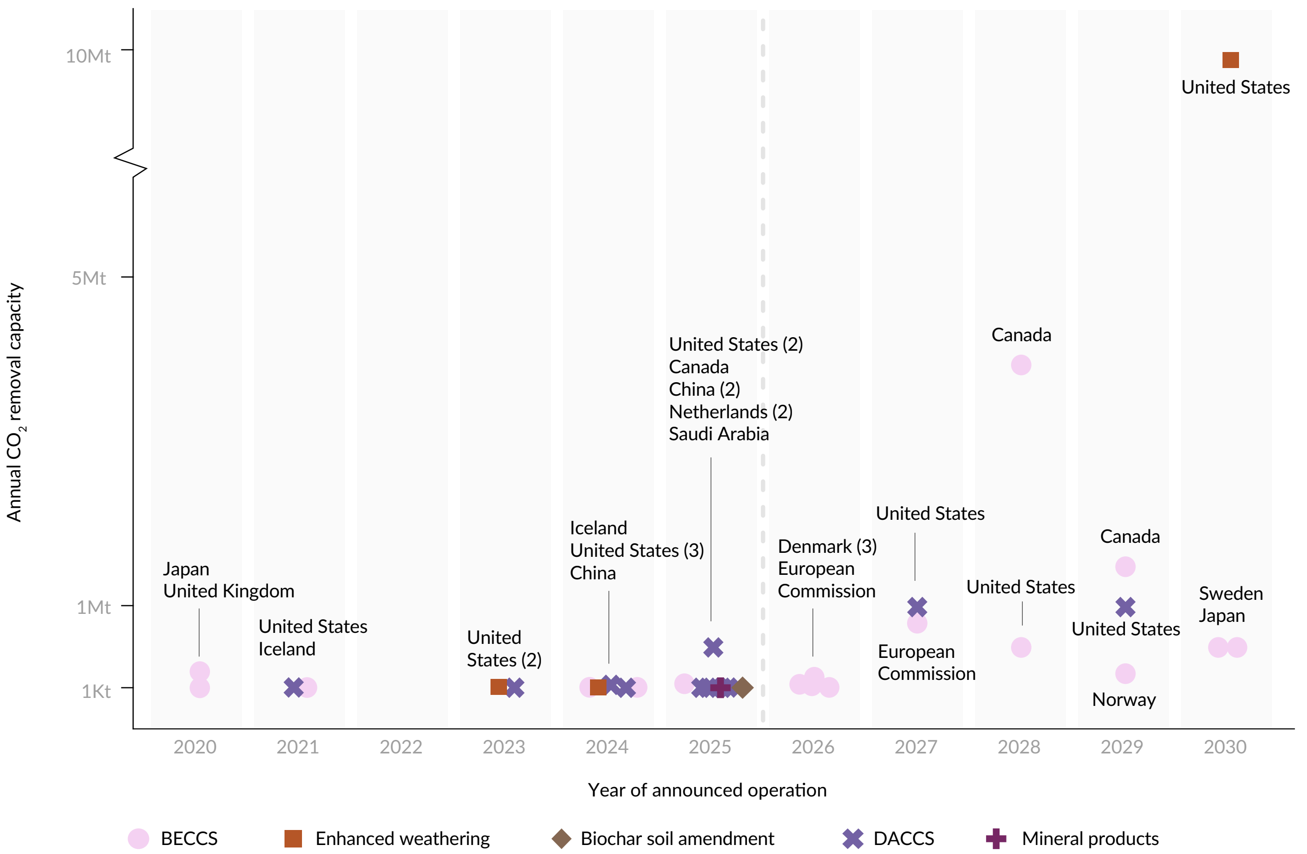


Figure 3.1 *Removal capacity and year of announced operation for demonstration projects. This figure includes only demonstration projects that have reported both a removal capacity and a year; other projects have been announced but lack one or both of these data points. Demonstration projects with an announced year of operation before 2026 are only shown if they are operational or under construction. The Mikawa Plant in Japan is shown, although the captured CO_2 is not yet being durably stored, and the Nian'da biochar project in China is shown, although it is a prototype. The number of projects per country is one unless otherwise noted in parentheses.*

The removal capacity of announced demonstration projects has increased over time (see Figure 3.1). Projects use a variety of novel CDR methods, but BECCS is the most common type of project after 2025. Five DACCS projects and five BECCS projects with a removal capacity of at least 1,000 tonnes are in operation or under construction. The largest announced demonstration project is the Eion enhanced weathering project in the United States, with a planned removal capacity of 10Mt by 2030.

The State of CDR 2nd Edition used Mission Innovation data from February 2024, which at that time was the latest available. Since then, nine new projects and seven updates have been added to the Mission Innovation CDR Launchpad. Although the Launchpad data was last updated in October 2024, it remains the most current available source. Projects were updated either through a change in their projected annual removal capacity or their year of first operation. One DACCS venture, Project Bison, was planned to be built in Wyoming, United States, but was paused and therefore not included in the most recent Mission Innovation data. In a press release, the chief executive officer of CarbonCapture, the company developing the project, stated that competition for clean power from data centres and the cryptocurrency industry in Wyoming was the reason for the pause.[6] CarbonCapture has also moved a DACCS pilot plant, originally announced in the United States, to the Deep Sky Alpha centre in Canada.

Iceland and the United States have built operational novel CDR projects with removal capacity greater than 1,000 tonnes. The Deep Sky Labs DACCS project in Canada is under construction but is not yet operational. The carbon capture component of the BECCS Mikawa Plant in Japan is operational, but the removed CO_2 is currently not being stored underground. China, which is part of the CDR Mission but is not a member of the CDR Launchpad, has built a biochar pilot prototype with a removal capacity of 1,500 tonnes per year. Six other demonstration projects are currently operational, but each is below the 1,000-tonne removal capacity threshold. These projects all provide lessons for other countries and projects moving forward, a particularly important goal for demonstration projects. Thirteen additional projects were announced with an initial goal to begin operation by 2025 but have not yet been built. While some of those projects have begun front-end engineering studies, are undergoing lab testing or have announced a delay, most were announced without much additional information and their status is unclear. In all, we estimate that 59% of the demonstration projects that announced removal would begin in 2025 were either in operation or under construction by early 2026.

Government funding of CDR demonstrations

Because novel technologies carry no guarantee of success – especially before they are ready to be widely deployed – government support can be important to reduce investment risks. National and regional governments have developed various strategies to support CDR demonstration projects. Some have focused on programmes that specifically support CDR, while others fund CDR demonstration projects through broader clean energy, carbon management or carbon capture programmes.

The IEA estimates that US$5 billion in R&D funds for CDR projects has been announced globally.[6] This includes programmes that began between 2019 and early 2025, with funding to be dispersed through 2040. Our tracking of public research, development & demonstration (RD&D) is updated through early 2026 and totals US$5.4 billion, which includes funding awarded to two DAC hubs in the United States (see Box 3.1). If the US DAC Hubs Program is fully funded, total announced RD&D funding between 2019 and early 2026 would reach US$7.9 billion. Some of this funding has been awarded to projects that capture carbon from ambient air but do not necessarily include plans to durably store carbon.

Since *The State of CDR 2nd Edition*, total government funding for CDR demonstration projects has grown substantially. The number of countries that have provided financial support for demonstration programmes has also grown. We present profiles of funding for CDR demonstration projects for 12 countries and the European Union, an increase of six countries since the last edition. To our knowledge, this is a complete list of countries and regions with public funding for CDR demonstration projects as of February 2026. Each has funded CDR demonstration projects through either a state-owned enterprise or a public programme. The discussion in this chapter focuses specifically on funding for demonstration projects; research and development efforts and other CDR policy mechanisms are further described in Chapter 2 and Chapter 5.

The types of funding efforts supporting CDR are diverse. Programmes with small carveouts for CDR projects, such as Emissions Reduction Alberta in Canada and the CLIMIT programme in Denmark, allocate climate funding to specific CDR projects. In contrast, programmes like the Innovation Fund in the European Union and the DAC Hubs Program in the United States provide much larger sums to support demonstration projects. Two programmes together provide 70% of global funding for CDR demonstration and pilot projects: the US DAC Hubs Program at 44% (if all originally allocated funding is awarded) and the reverse auction programme in Sweden, which focuses on operational subsides for BECCS projects, at 25%. Given the large contributions of these two programmes, DACCS and BECCS are receiving a majority of public funding support for demonstration projects. Despite a global trend of increased governmental support for CDR demonstration projects, support at the national level is highly variable. For example, in Sweden, US$3.8 billion will be awarded to BECCS projects between 2026 and 2046. On the other hand in the United States, support for CDR – including the future of the US DAC Hubs Program – is uncertain and greatly clouds the overall picture of global RD&D funding for CDR projects (see Box 3.1).

Australia

Australia has several funding streams, mostly focused on carbon capture and sequestration – although many CDR projects also have received public support.

In 2022, the Australian Government invested A$30 million (US$19 million) to establish the CarbonLock Program, Australia's leading novel CDR research program. Prior to this, in 2021, the Carbon Capture, Use and Storage Development Fund supported six projects totalling A$50 million (US$32 million). This included A$9 million[7] (US$5.8 million) for Energy Developments Pty Ltd., a BECCS project, and A$4 million[7] (US$2.6 million) for the AspiraDAC pilot project. In 2024, through the Carbon Capture Technologies Program,[8] the Australian Government invested A$65 million (US$42 million) in seven demonstration projects. About A$30 million (US$19 million) of this funding was for four DACCS projects.[9] A second round of funding through this program is anticipated to open in 2026.

At the state government level, the Government of Western Australia is funding CDR projects through the A$34 million (US$22 million) Lower Carbon Grants Program. The effort has funded[10] the CSIRO Carbon Capture Material Acceleration Centre with A$5 million (US$3 million) and the Biomass Projects Pty Ltd. biochar project with A$9 million (US$6 million). The Government of Western Australia is also funding pilot projects focused on carbon sequestration under the A$15 million (US$10.5 million) Carbon Innovation Grants Program[11] and mineral carbonation projects through the A$2.5 million (US$1.6 million) Accelerated Mineral Carbonation Research Program.[12]

Canada

Canada has several funding streams to support RD&D for CCU, CCS and CDR. Natural Resources Canada (NRCan) received Can$319 million (US$226 million) in funding from 2021 to 2028 to support CCU/S RD&D, including CDR.[13] These monies have supported DACCS, BECCS and enhanced mineralization projects, although most have focused on research and development with some funding allocated for pilot and demonstration projects.[14] For example, NRCan provided Can$5.3 million (US$3.8 million) to support a front-end engineering design study for a demonstration plant at the former Hinton Pulp Mill in Alberta,[15] which also received Can$3 million (US$2 million) in additional funding from Emissions Reduction Alberta to support BECCS demonstration. In 2024, NRCan provided Carbon Engineering with Can$5 million (US$3.6 million) in funding to demonstrate all-electric DACCS systems.[16] In 2026, NRCan launched a new call for proposals for a CCU/S front-end engineering and design (FEED) study, for which CDR projects are eligible;[17] the goal is to support projects in advancing from late-stage demonstration to final investment stages.

In addition, Emissions Reduction Alberta provided Can$5 million (US$3.6 million) to Deep Sky Alpha, the world's first direct air capture innovation and commercialization centre.[18] Deep Sky provides CDR companies with infrastructure such as land, energy and storage capacity, as well as support for permitting and removal credit sales.

China

CDR activities in China are concentrated at the research and pilot scale, with growing coordination across ministries, state-owned enterprises and academic institutions. The Ministry of Science and Technology is a member of Mission Innovation and submitted an update in August 2025 on its CDR policies, programmes and projects. State-owned enterprises are participating in several projects. For example, China National Petroleum Corporation is constructing a 1,000-tonne-per-year DACCS pilot plant and China Energy Engineering Co. Ltd. is operating a 600-tonne-per-year DACCS pilot in collaboration with Shanghai Jiao Tong University.[3]

Denmark

Denmark is supporting CDR projects through two mechanisms – the Carbon Capture Utilization and Storage Fund and the Negative Emissions Carbon Capture and Storage Fund. Both funds have previously supported CDR projects. The CCUS Fund provided DKr 8 billion[19] (US$1.2 billion) in funding to the Ørsted Kalundborg CO_2 Hub, which is a BECCS project. The NECCS Fund has supported an additional three BECCS demonstration plants[20] with a total of DKr 167 million (US$25 million) from the Danish government. The amount of funding actually disbursed through these mechanisms depends on the tonnage of carbon removed.

European Union

Several EU member countries have their own policies and programmes that support CDR demonstration projects. The European Union also provides funding through the European Commission, its executive arm, including via the Innovation Fund. In 2025, Danube Removals[21] received €50 million (US$58 million) from the Innovation Fund to support a large-scale BECCS project. Two projects that include elements of the CDR value chain received funding in 2021: the Silverstone mineral storage project, which includes the storage of captured carbon from direct air capture (DAC) plants, received €4 million (US$5 million) and BECCS Stockholm received €180 million (US$207 million). The Coda Terminal, which encompasses the shipment of captured carbon to Iceland for storage using Carbfix's enhanced mineralization process,[22] received €115 million (US$132 million) in 2022.

Germany

The German parliament approved a 2026 federal budget that includes €98 million (US$113 million) to support CDR projects and an additional €11.5 million (US$13 million) to fund the purchase of carbon removal credits.[23] The government has earmarked another €320 million (US$368 million) to support CDR efforts from 2027 to 2033. It is unclear how much of this funding will be allocated to demonstration projects.

Japan

The New Energy and Industrial Technology Development Organization in Japan supports RD&D efforts in CDR, including demonstration projects, through the Moonshot Research and Development Program.[24] The total funding for the programme is ¥50 billion (US$320 million), of which a small amount has been allocated to CDR projects. This includes DACCS projects and enhanced weathering projects. Japan has also supported the Mikawa BECCS plant,[25] which has the capacity to capture about 180,000 tCO_2 per year.

Japan is also funding biochar, carbon sequestration in wood materials and coastal wetland restoration projects through its Ministry of Agriculture, Forestry and Fisheries. The Development of Negative Emissions Technologies in Agriculture, Forestry and Fisheries Industries programme[26] includes ¥16 billion (US$102 million) to support biochar projects.

Netherlands

The Netherlands has two major programmes to support CDR demonstration and pilot projects. The Demonstration Energy and Climate Innovation programme[27] provides subsidies for pilot and demonstration projects, including for CDR projects. It has a budget for project support of €100 million (US$120 million). The Stimulation of Sustainable Energy Climate Transition (SDE++) programme[28] includes subsidies for energy production and the reduction of CO_2 emissions; BECCS and DACCS plants are eligible to apply for these subsidies. The 2025 budget for SDE++ is €8 billion (US$9.6 billion).

Norway

Norway has several streams of RD&D support for CDR projects. The CLIMIT programme is a partnership between Gassnova and the Research Council of Norway that supports RD&D efforts for CCU/S technologies. The programme has historically been focused on CCU/S projects, although some BECCS and DACCS research has also been funded. In 2025, for the first time, NKr 10 million[29] (US$980,000) was specifically earmarked to support CDR RD&D, including support for industrial projects, though no allocations have been announced.

The first grant to support a DACCS project in Norway was granted in 2023 by Enova, a state body owned by the Norwegian Ministry of Climate and Environment. Enova allocated NKr 36 million[30] (US$3.5 million) to support the Removr DACCS demonstration plant.

Saudi Arabia

Saudi Arabia sponsored a DACCS demonstration unit inaugurated by Climeworks and the King Abdullah Petroleum Studies Research Center in Riyadh in 2025.[31] Separately, Saudi Aramco, a majority state-owned energy company, is funding a pilot DACCS plant in Dhahran that was developed with Siemens Energy and launched in 2025.[32]

Sweden

The Swedish Energy Agency has supported several CDR RD&D initiatives, including pilot and demonstration projects, funded in part through a BECCS reverse auction programme.[33] For example, Stockholm Exergi is due to receive SKr 20 billion (US$2 billion) over 15 years once it begins geological storage of carbon captured at its bioenergy-generation plant in Stockholm, a step planned for 2028.[34]

The Swedish Energy Agency's Industrial Leap initiative[35] includes a funding stream for BECCS demonstration and pilot projects totalling SKr 1.3 billion (US$143 million) for 2025 to 2031. Through this initiative, the agency is funding the Söderenergi BECCS project with SKr 75 million (US$8 million).[36]

United Kingdom

The Greenhouse Gas Removal Demonstrators programme[37] is a multi-departmental initiative in the United Kingdom with £32 million (US$42 million) budgeted from 2021 to 2026. This programme includes the development of CDR demonstration plants with a budget of £23 million (US$30 million). The UK Department for Energy Security and Net Zero administered the DAC and Greenhouse Gas Removal Innovation Programme from 2020 through 2025, totalling £54 million (US$70 million).[38] The programme consisted of two phases, with phase 1 supporting 24 feasibility studies and phase 2 funding 15 pilot and demonstration projects.[39]

The UK Department for Energy Security and Net Zero and the Department for Business, Energy and Industrial Strategy administered the Hydrogen BECCS Innovation Programme from 2022 to 2025. The programme proceeded in two phases, the first focused on scoping and development and the second on supporting demonstration projects. The second phase included £26.2 million (US$34 million) awarded to six projects.

United States

The United States allocated US$3.5 billion towards four large-scale DAC demonstration projects through the DAC Hubs Program.[40] DAC hubs are demonstration projects, either individual projects or several interconnected projects. In 2023, two DAC hubs were issued funding totalling US$1.2 billion to build demonstration plants. Funding for the other two DAC hubs has not been awarded, and their funding status was uncertain as of April 2026. Also uncertain was the status of the two DAC hubs that were awarded funding, as many previously awarded clean energy and climate projects were cancelled in 2025 (see Box 3.1).

The United States has several other public funding streams that support CDR demonstration projects in the country. Through the Carbon Negative Shot strategy, the Department of Energy has a budget of US$100 million for 2024 to 2029 that includes support for five small BECCS pilots and ten enhanced weathering pilots. The CDR Purchase Pilot Prize, which began in 2023, was allocated US$45 million in 2026 that could support demonstration projects by spurring demand for CDR credits. Additionally, the Department of Energy has allocated US$71.5 million to RD&D pathways for CDR technologies and approaches.[41]

Box 3.1 Changes in the funding landscape for CDR demonstration projects

Public funding for CDR demonstration projects has expanded into new regions, including China and Saudi Arabia, but it has contracted in others, and funding instability and uncertainty are emerging as key barriers. An example of expansion is the Swedish government, which is supporting BECCS demonstration and deployment through a robust programme with SKr 36 billion (US$3.6 billion) of funding expected between 2026 and 2046.[42] The EU's institutional framework, in contrast, remained comparatively stable but financially exposed. While the Innovation Fund,[43] Europe's largest mechanism for industrial decarbonization and carbon management demonstration, maintains a robust policy framework that offers broad eligibility for CDR and CDR-enabling services, it lacks a dedicated funding stream for CDR demonstration projects. Furthermore, because the Fund's revenues derive from EU ETS allowance auctions,[44] funding levels remain sensitive to carbon price[45] and auction volume fluctuations, affecting the scale and predictability of grants.

In the United States, the federal funding landscape for CDR has grown increasingly vulnerable. The Inflation Reduction Act in 2022 and the Bipartisan Infrastructure Law in 2021 both specifically supported CDR demonstration projects. The future of the DAC Hubs Program, once the largest funding effort in the world dedicated specifically to CDR demonstration projects, has become uncertain.[46] The Department of Energy terminated more than US$3 billion in previously awarded clean energy and carbon management projects,[47] including several related to CCU/S. In response, some of the intended recipients have filed lawsuits.[48] These developments have further intensified uncertainty in the United States about public funding for climate initiatives, including CDR demonstration projects.

Overall, funding for CDR demonstration projects currently depends less on technological readiness than on institutional continuity. Policy reversals, market-dependent revenue streams and fragile international finance mechanisms have each introduced instability that could limit the capacity of CDR operators to move beyond the pilot stage and upscale over time.

Box 3.2 Upscaling CDR subnationally and in cities

Subnational actors, particularly cities, are playing an increasingly important role in funding, permitting, planning and goalsetting around CDR, as well as in establishing polycentric and multi-level governance networks. For these actors to achieve net-zero goals,[49] CDR is essential, potentially turning them into catalysts of CDR upscaling. Prominent examples of subnational action that may spur urban CDR include a push for 100 European cities to achieve climate neutrality by 2030 with support from the EU's Horizon Europe innovation funding programme mission focused on climate-neutral and smart cities;[50] the separate emissions reductions and carbon removal goals set by the State of California;[51] and the 4 Corners Carbon Coalition,[52] a collaborative effort among local governments in the Western United States to fund CDR projects. Cities can be sites of experimentation and learning, both for peer cities and countries, to understand the benefits and drawbacks of different approaches to CDR scale-up.

In cities, CDR can be integrated directly into the systems that shape urban life, such as planning, infrastructure and governance – rather than treated as a stand-alone intervention that may be missing from the priority lists of urban policymakers and lacking in dedicated funding sources. In this view, CDR becomes a channel for urban-scale synergy actions and co-benefits, aligning climate action strategies with other urban targets such as street-level cooling, air pollution or stormwater management.[53–55] Early estimates suggest that a portfolio of CDR of up to 1 $GtCO_2$ per year[56] is possible – including carbon storage potentials from vegetation, soils and the built environment, as well as the capture potential for decentralized DACCS – and also suggest synergies with other policy objectives as potential alternative entry points.

Cities are operationalizing CDR through a combination of approaches:

- Land-based approaches (e.g. urban afforestation[57–59] in Freetown,[60] Melbourne[61] and Navi Mumbai[62]) and peatland and coastal wetland restoration in Yokohama;[63]

- Integration of carbon-storing materials into the built environment[64,65] (e.g. biochar in soils, asphalt and concrete, as in Basel[66] and Helsingborg[67]); and

- Ownership or coordination of facilities for biochar (e.g. in Minneapolis[68]) and BECCS (e.g. in Oslo,[69] Lahti[70] and Stockholm[71]).

Crucially, many of these efforts rely on partnerships and co-finance with other municipal or regional governments, research institutions, expert organizations and higher-level public agencies to provide governance capacity, research and innovation support, robust MRV and access to finance, enabling cities to translate CDR potential into durable and scalable implementation.

3.2 Growth in the CDR start-up ecosystem

Startups are important actors within the innovation ecosystem because they can quickly bring new products and services to market. However, they face many well-known challenges when trying to move a new technology from the demonstration stage to initial commercialization and market growth.[72] Various financing mechanisms in the public and private sectors can address these challenges.[73] Startup funding occurs in consecutive rounds, typically increasing in dollar amount. The first grant or seed funding is used to fund precommercial, high-risk technologies. Grants are most often provided by public entities, and seed funding commonly comes from specialized investors such as venture capital or "angel" investors. Next are series A and B equity rounds, which typically occur when commercial development has started but deployment is limited. After early-stage financing, startups may seek growth equity funding, which tends to provide the higher dollar amounts needed to expand operations.[74] Because growth equity funding comes once technologies are more developed and risks are lower, these rounds have higher rates of participation by corporations and non-specialized financial sector actors. To support large-scale diffusion, companies then take on debt[75,76] and, finally, may exit through mergers, acquisitions or buyouts to transfer ownership to another company – or through initial public offerings to become publicly owned.

CDR startups and investment

This section examines the formation of CDR startups and investments in CDR companies through the end of 2025, as reported in the Net Zero Insights (NZI) database.[77] NZI integrates automated data collection, direct company submissions and manual validation to track investment flows across climate technologies (i.e. climate-tech). NZI categorizes companies in a taxonomy of climate-tech solutions, including GHG removal. We collect data on companies within this GHG removal category as well as the carbon offsetting and carbon market categories. We use a combination of automated and manual categorization techniques to determine whether each company meets our definition of CDR (see Chapter 1) and, if so, which method it uses (see the Methods Annex). Our cleaned dataset contains 766 CDR companies, 396 of which have at least one recorded investment since 2005. For these companies, 1,260 investors have contributed US$8.4 billion since 2005. Ninety-nine percent of these companies were founded after 2005; six, however, have been operating for at least 20 years but have recently received additional targeted funding to develop new CDR technologies.

The number of CDR companies founded annually peaked in 2022 at 114 and then started to decline in 2023 (see Figure 3.2). However, the steep decline observed in 2024 and 2025 may be due to a data truncation in recent years, since newer and smaller firms are inherently harder to track prior to fundraising or public announcements (see the Methods Annex). At the same time, investor interest in CDR companies appears to be growing. While funding for all climate-tech peaked in 2022 and has continued to decline, funding for CDR rebounded after a dip in 2023 and 2024 to US$1.6 billion in 2025, close to the

US$1.7 billion observed in 2022. Overall, CDR rose from 1.9% of all-climate tech funding in 2022 to 2.6% in 2025.

The diverging trends in CDR startup founding and investment trends may be due to a combination of drivers. First, parts of the CDR innovation ecosystem may be maturing,[78] with private investors shifting to later-stage funding for CDR companies[79] that have less risky business models or active demonstration projects. Second, current market conditions may mean that more CDR innovators prefer to spend resources on technology development (e.g. during the research stage preceding a startup's launch) rather than company organization,[80] resulting in fewer companies founded and more funding for the R&D stage (see Chapter 2). These explanations align with the broader observations in global venture capital markets, including increasing concentration and higher capital costs after 2022 affecting early-stage climate-tech startup formation.[81]

Startup and investor activity across CDR methods also continues to evolve. From 2005 to 2020, 60% of CDR startups founded were afforestation and reforestation or biochar. During this time, all companies developing afforestation and reforestation or biochar methods received a cumulative US$0.35 billion in funding, with 82% of this funding for afforestation and reforestation. Since 2021, DACCS startups have grown rapidly, comprising 13% of new startups. DACCS companies have received US$2.0 billion in funding since 2021, the largest amount across all CDR methods, while afforestation and reforestation companies received US$1.4 billion. Soil carbon sequestration and BECCS form smaller but meaningful shares, receiving US$0.8 billion and US$0.9 billion, respectively, since 2021. Other methods, such as biochar, represent a relatively large percentage of startup formation (34%) but only a small percentage of funding (US$0.5 billion, or 7% of the total US$6.7 billion since 2021).

The distribution of funding rounds for CDR companies points to an industry with robust early-stage activity and growing maturity. Overall, a majority of funding is still at an early stage, with 66% of investments from 2024 to 2025 from series A, series B or seed funding, or from grants. Afforestation and reforestation (20%) and DACCS (40%) received the largest shares of this early-stage funding. DACCS and soil carbon sequestration companies received the most growth equity funding since 2024 (34% and 56% of funding, respectively), while in 2025, Stockholm Exergi, an established energy company, financed a new BECCS project with US$0.5 billion of debt. While NZI reports only 18 exits by CDR companies, 13 of these have occurred since 2023. Across all exits, 13 are acquisitions, and 10 of the companies were acquired by corporations. The time between founding to exit ranges from 2 to 15 years but has decreased over time (see Figure 3.2c). These trends point to more CDR activity by established, diversified companies. Overall, funding is highly concentrated, with 72% of investment dollars in 2025 going to four companies.

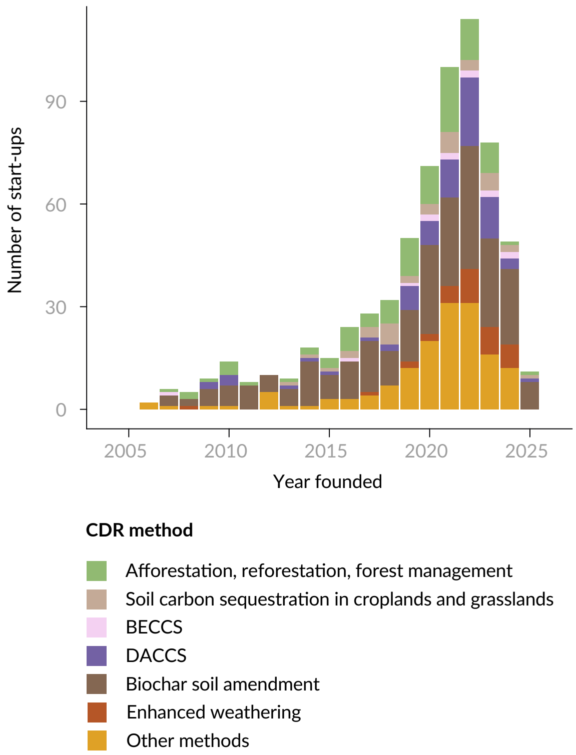
Funding for CDR comes from a variety of sources (see Figure 3.2d). Venture capital investors participate in 48% of all funding rounds and represent 17% of total investment.

While they participate in few rounds, financial sector investors are the largest source of funding, cumulatively investing US$1.9 billion in CDR companies since 2021 (60% as growth equity). Financial sector investors and public/quasi-public investors together drove a US$730 million (205%) increase in CDR funding from 2024 to 2025; this offset a US$300 million (66%) funding decrease from venture capital and corporate investors during the same period. European and Canadian governments – along with some state-level governments in the United States – drove a surge in public/quasi-public investment in 2025. Federal agencies in the United States, which have previously supported funding efforts, have pulled back. While most investor types diversify across CDR methods, corporate investors appear to have favoured soil carbon sequestration companies before 2021, which received 88% of all corporate investments, and DACCS companies since 2021 (40% of corporate investments).

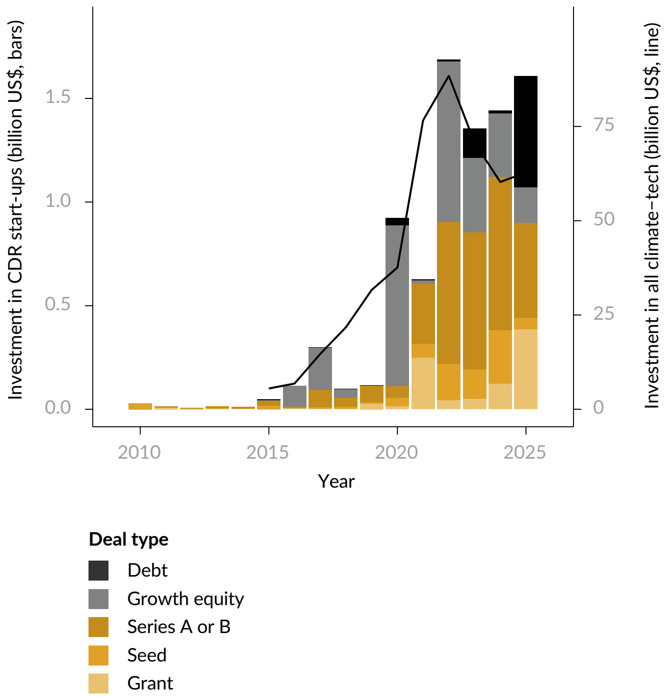
Our analysis focuses on companies that follow the three principles of CDR as described in Chapter 1, based on an analysis of their descriptions in the NZI database. We account for ambiguity, including companies where storage can be inferred from the capture method (such as afforestation and reforestation) or where no explicit description of point-source capture or utilization is given. In addition to these companies, many companies develop CDR-adjacent technologies; these companies are not purely focused on CDR but develop products that may be useful components of future CDR processes. One example is companies that capture CO_2 but incorporate it into products where it is re-released over the lifetime of the product, such as synthetic transportation fuel. Another is companies that capture CO_2 from point-source combustion of fossil fuels, not the atmosphere. These types of CDR-adjacent companies have together received US$16 billion since 2023. Finally, many companies engage in CDR-enabling activities, specifically financing platforms that connect individual purchases to CDR projects or MRV systems. We track these companies as additional indicators of an evolving CDR ecosystem.

Indicators of upscaling activity and investment trends by CDR startups

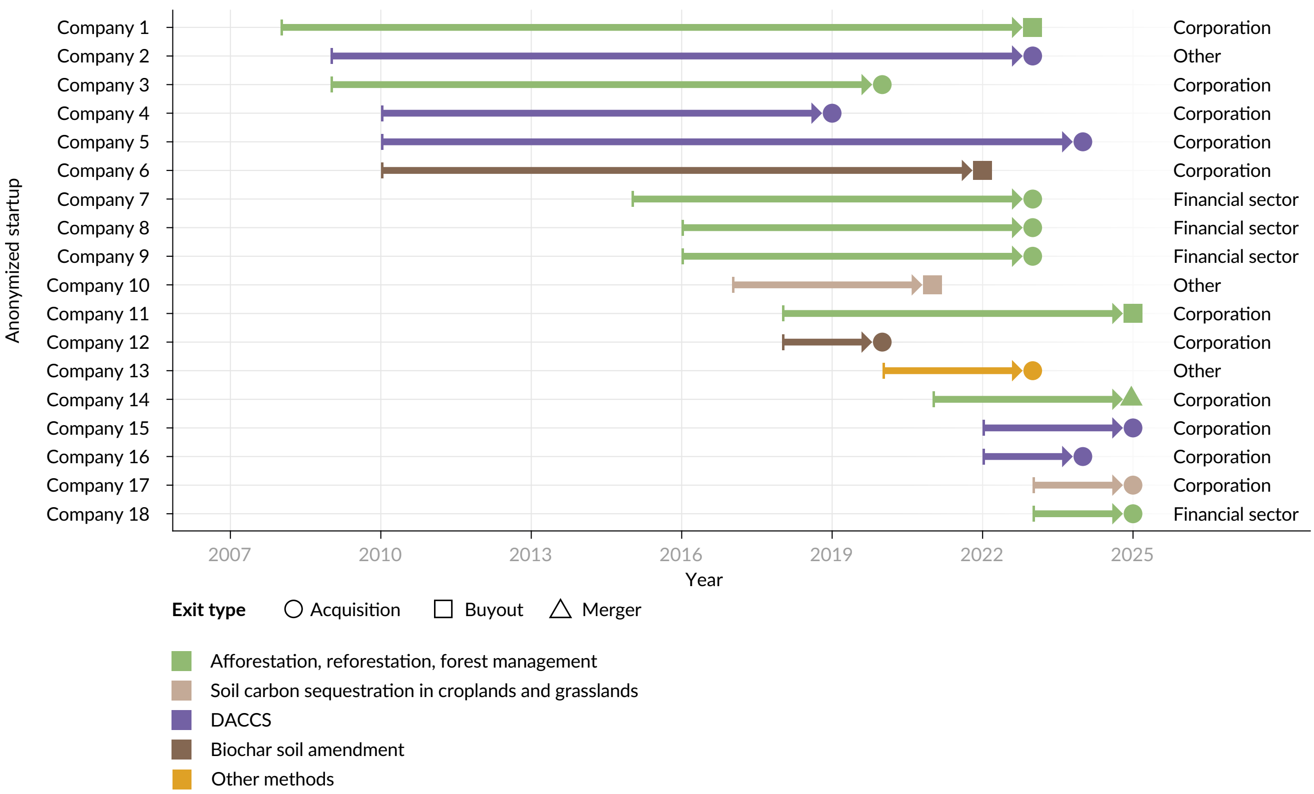
a) Number of CDR startups founded per year



b) Amount invested across all CDR methods by deal type



c) Number of years from founding to exit



d) Cumulative investment flows from investor type to CDR method

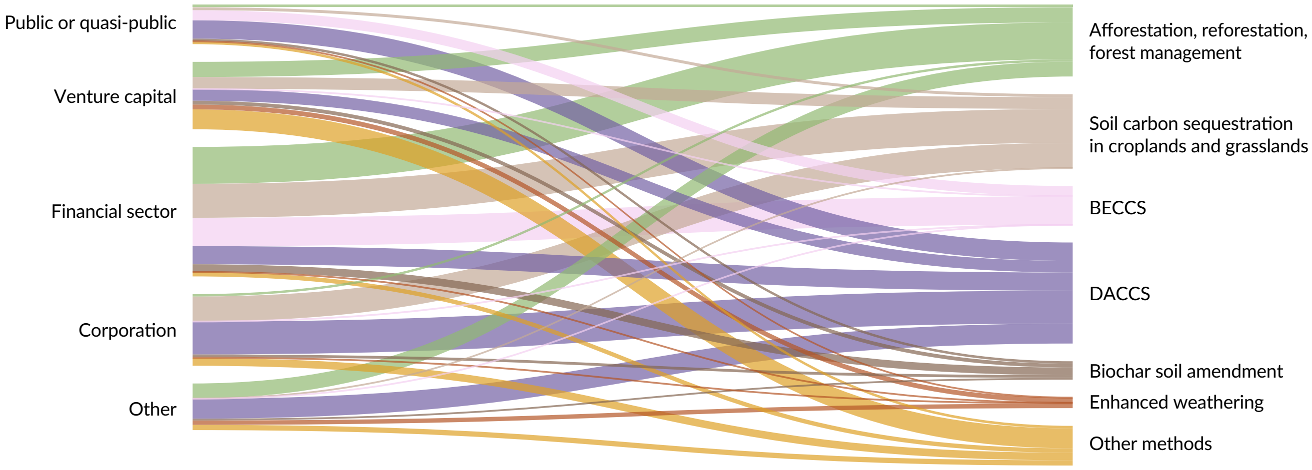


Figure 3.2 *(a) Number of CDR startups founded each year, (b) amount invested across all CDR methods by deal type, (c) number of years from founding to exit for 18 companies, and (d) cumulative investment flows from investor type to CDR method. Data for startups founded in 2024 and 2025 may be heavily truncated (see the Methods Annex). "Other methods" refers to agroforestry, peatland and coastal wetland restoration, mineral products, durable wood products, bio-oil storage, biomass burial, ocean fertilization, biomass sinking, alkalinity enhancement of water bodies and DOCCS.*

Box 3.3 The diverse business models of European CDR startups

Converting leads into actual sales has been identified as a key bottleneck facing CDR startups (see *The State of CDR 2nd Edition*). Challenges including high prices and uncertainties in the voluntary carbon market (VCM), and related to MRV, are driving a fundamental restructuring of how CDR startups operate. Generating and selling credits in the VCM may no longer be the only go-to business model for CDR startups.

A survey conducted by the Sustainability in Business Lab (sus.lab) at ETH Zurich and the CDR accelerator remove explored this shift among 69 European startups.[82] The survey revealed a move towards more diversified business models. Follow-up interviews with 18 startups identified two key factors driving diversification: limited market demand and complex sales processes for CDR credits, and a desire for basic business efficiency. Companies thrive when they concentrate on their core competencies rather than wrestling with the difficulties of VCM sales. Many startups now supplement or replace direct VCM credit sales with alternative business models, especially insetting, and product and asset models. The insetting model monetizes CDR within customers' value chains. For instance, Cotierra collaborates with large coffee retailers to explore insetting within their supply chain by providing biochar solutions to smallholder coffee farmers. The product model involves selling CDR-derived products or services without issuing credits, an approach taken by Reaforma, which produces calcined clay in biomass-powdered kilns. And finally, the asset model consists of selling or licensing technology for use by other organizations, as demonstrated by Captur Tower, which sells DAC installations and provides operation and maintenance services to industries requiring CO_2 as a feedstock.

This shift indicates how the CDR industry is maturing. The trend toward more distinct business-to-business strategies pushes startups to more clearly define customer segments and value propositions, improving operational efficiency and scalability. Adopting multiple, often hybrid, business models appears to be a natural progression for startups seeking to establish themselves in a rapidly evolving market. Successfully navigating these currents requires strategic flexibility and the ability to capitalize on new commercial opportunities while preserving credibility. Startups must balance short-term pragmatic adaptation with long-term positioning to capture value as the market matures. Those who manage this transition effectively are likely to emerge as key players in the evolving CDR ecosystem.

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Box 3.4 Skills and CDR workforce development for deployment and scaling

Building a workforce spanning engineering, operations, project management and other services is essential for scaling CDR from pilots to large-scale deployment. Early signs point to talent availability as a key bottleneck (see *The State of CDR 2nd Edition*). Although global estimates remain scarce, one independent US analysis[83] suggests that scaling durable removals to around 0.1 $GtCO_2$ per year could support 95,000–130,000 jobs annually, illustrating the magnitude of workforce demand even at modest deployment levels. Using data from CDRjobs,[84] we provide a quantitative overview of CDR job postings, categorized by CDR method and skills. CDRjobs is a global database and analytics platform that tracks open positions across CDR companies using company websites and public job boards. The data capture job title, company, CDR method, contract type, location, discipline, experience and education requirements and salary range. We analysed approximately 4,500 full-time listings from over 350 novel CDR and CDR-enabling companies worldwide between April 2024 and December 2025, offering a snapshot of the emerging CDR labour market (see Figure 3.3).

Engineering and technical operations account for the largest share of job postings, highlighting the infrastructure-intensive nature of early CDR scale-up. Novel removal methods like DACCS account for nearly 30% of all postings, with engineering and technical operations accounting for the largest share of DACCS vacancies (45%). Across all openings, a 24% share for CDR ecosystem or enabling services captures the expanding importance of supporting activities, such as MRV providers, certification platforms and project developers for the functioning and credibility of CDR removal. Their prominence underscores how supporting capabilities are becoming as strategically important as removal technologies. Biochar, mineral products and BECCS show more diverse workforce needs, with openings more evenly distributed between the engineering, operations and sales categories. Other methods encompassing emerging pathways – such as ocean-based CDR, biomass sinking, bio-oil storage and durable wood products – account for 24% of all postings.

Although the postings analysed span multiple regions, hiring activity skews towards companies and startups from North America and Europe. This concentration reflects both the high density of early-stage CDR firms in these markets and the greater visibility of recruitment channels in these regions. Consequently, regional hiring in Africa, Latin America and parts of Asia is likely underrepresented, as these regions often rely heavily on localized or offline recruitment practices. Furthermore, the data show a relative underrepresentation of job postings for conventional CDR methods such as afforestation and reforestation and soil carbon sequestration. This likely reflects differences in recruitment practices, as these methods have traditionally relied more on offline and informal hiring channels than online job boards. A more comprehensive outlook would require combining job board analytics with targeted surveys to provide a globally representative picture of the CDR workforce.

Distribution of full-time CDR job postings by skill category

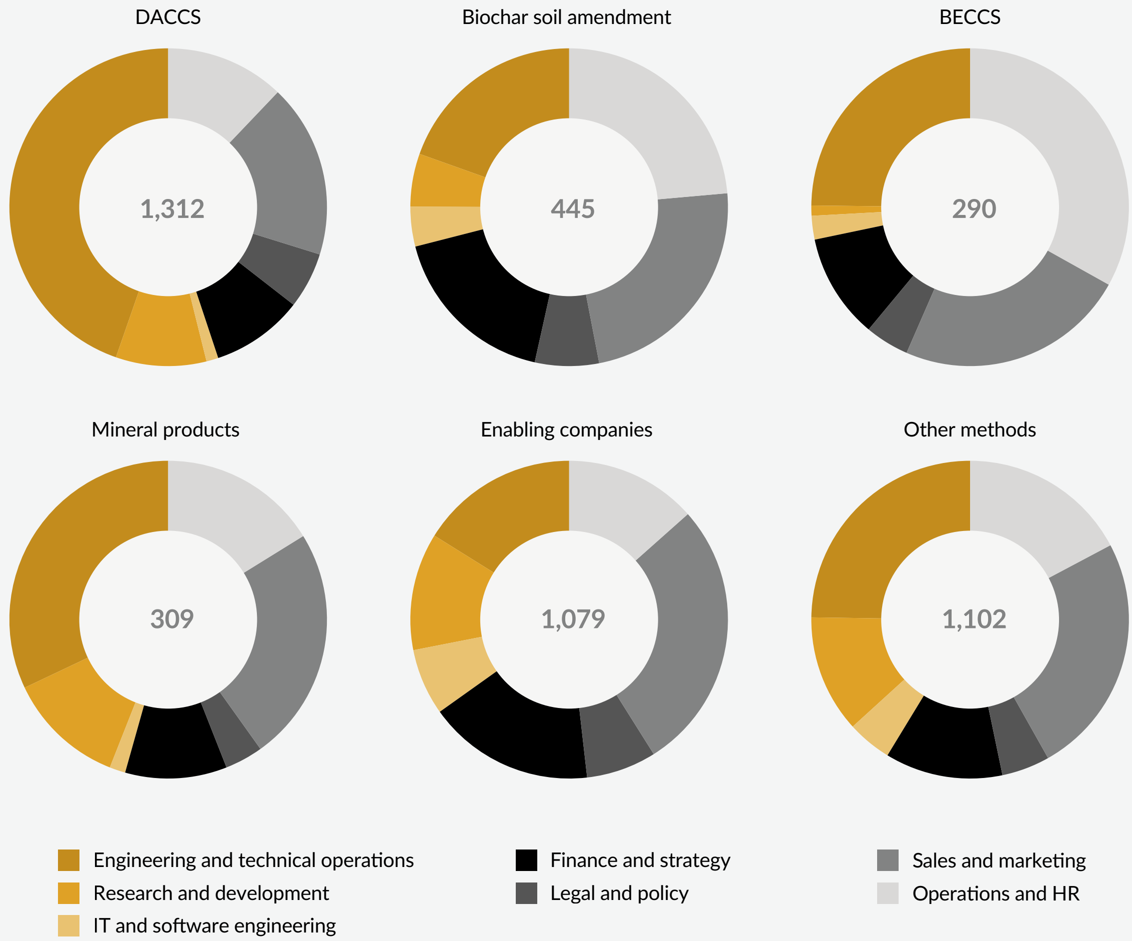

Figure 3.3 *Job postings for CDR and enabling companies from April 2024 to December 2025. Each donut represents a different method, with segments showing the breakdown of job postings across seven workforce categories. Numbers in donut centre indicate total postings per method. Data reflects publicly advertised full-time positions captured in the CDRjobs dataset. Other methods include afforestation, reforestation and forest management, enhanced weathering, DOCCS, ocean fertilization, alkalinity enhancement of water bodies, soil carbon sequestration, bio-oil storage, biomass burial, biomass sinking and durable wood products.*

3.3 Company ambition for novel CDR

Companies have announced their ambitions for novel CDR over the coming decades (from 2030 to 2050). In the near-term, they have also made plans to upscale CDR (see Chapter 7). The credibility of the long-term public announcements in terms of both timelines and scale is uncertain. While Chapter 7 presents projects that are "in the pipeline" between 2025 and 2030 if they are under construction, the removal capacities included in this analysis must only reach the threshold of being announced and are not necessarily tied to specific projects. These announcements do not necessarily indicate whether funding has been acquired for specific projects, whether projects are under construction, or even whether engineering studies have begun. We include them in our analysis if a company has made a public announcement about an ambition that includes both a year and capacity. Company announcement data was gathered through three mechanisms listed below (more details on data gathering can be found in the Methods annex).

1. New for *The State of CDR 3rd Edition*, we developed an industry survey of CDR companies.

2. For all companies that had included a long-term ambition in *The State of CDR 2nd Edition*, we updated their announcement data.

3. We gathered data from companies that received late-round funding or that included a removal goal in their pitch line (see Section 3.2) but were not otherwise included in our dataset.

The total number of individual announcements through these three mechanisms that included adequate details was 52. These add up to the removal of 5.29 $GtCO_2$ per year by 2050 – comprising of 71% from DACCS, 19% from soil carbon sequestration in croplands and grasslands, 10% from biochar and less than 1% from other methods. Since *The State of CDR 2nd Edition*, ten companies that previously reported a long-term ambition no longer report it. Some removed the announcement from their website, some include a capacity without a year, some cancelled projects, and others only made the announcement in a report and have neither repeated nor updated it since. In addition, five companies have either pushed their ambition further into the future or have lowered their capacity goal from a previous announcement. Despite these changes, the cumulative novel CO_2 removal that companies have announced between 2030 and 2050 exceeds the median amount of novel CO_2 removal in the scenarios considered in Chapter 8. Whether companies will reach these ambitions is uncertain.

Company ambitions of novel CDR capacity, 2030–2050

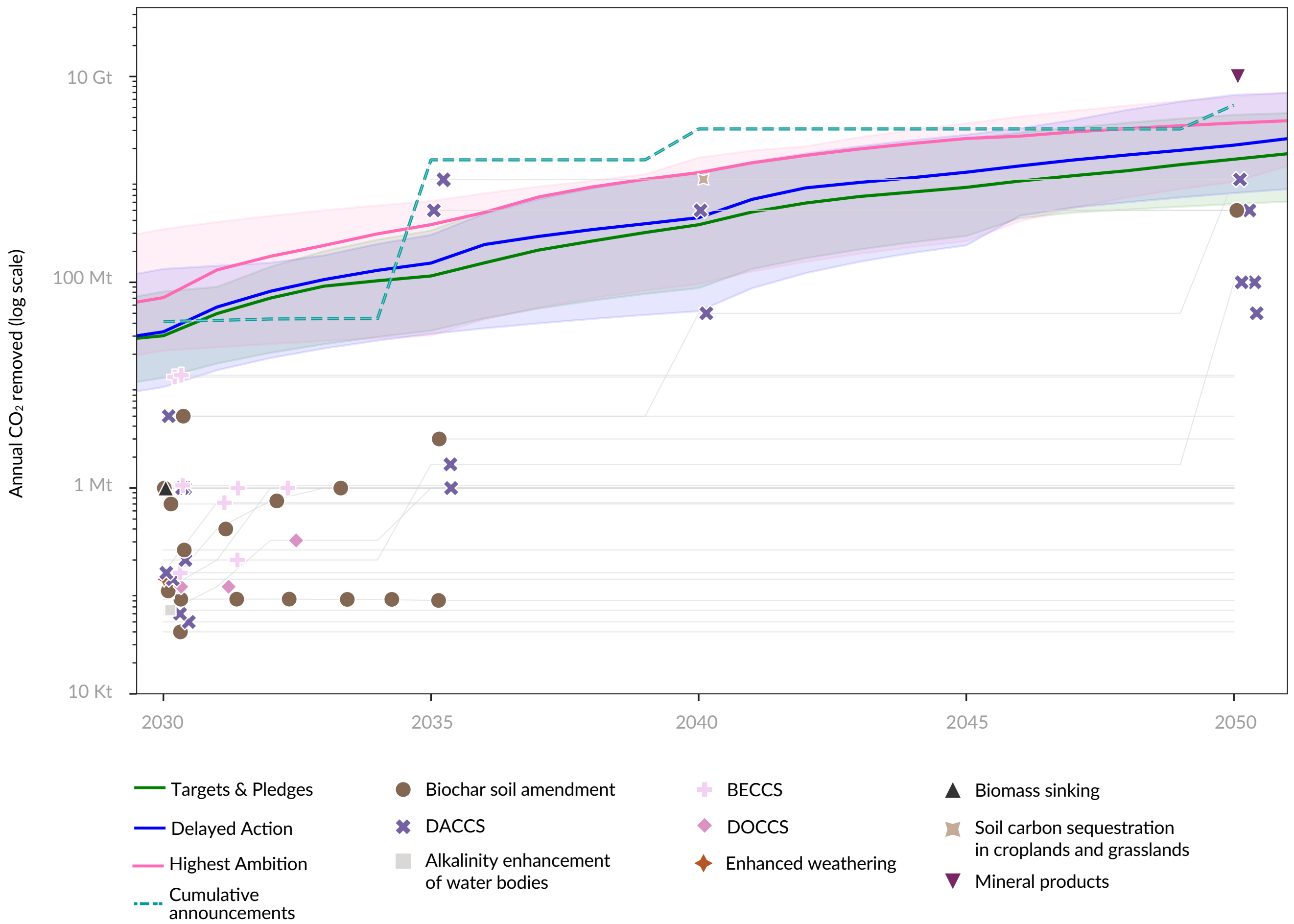

Figure 3.4 *Novel CDR capacity ambitions reported by companies. The dashed line shows the cumulative capacity of company ambition; points are individual announcements of company ambitions; each faint grey line is a time series for one company; solid lines show the median amount of novel CDR in three scenario pathways (Targets & Pledges, Delayed Action and Highest Ambition; see Chapter 8). The shaded areas around the solid lines show the minimum and maximum values. Company ambitions are not filtered by their project status or completion, so whether these announcements will be reached is highly uncertain. One company target point, the 2050 mineral products point, is not included in the total because the company ambition may be an industry-wide ambition – although it is unclear.*

As of the end of 2025, 2.0 million tonnes of CO_2 have been delivered from novel CDR methods (see Chapter 7). Twenty-two companies have a capacity announcement for 2030, totalling 42 million tonnes. Using current deployment figures as a base, reaching the 2030 announcements would require a compound annual growth rate of 84%. Expanding from the 2.0 million tonnes of deployed capacity in 2025 to the 2050 announced capacity of 5.29 billion tonnes would require a compound annual growth rate of 37%. For context, the global cumulative capacity of solar photovoltaics grew at a compound annual growth rate of 36% per year between 1975 and 2018, and the number of electric vehicles in use globally grew at a compound annual growth rate of 80% per year between 2005 and 2019. Reaching the amount of novel CDR implied by long-term company ambitions will require similarly fast growth. The characteristics of both a particular technology and the country in which it is adopted can impact the speed of technological growth; a stable policy landscape, for instance, can support such growth. Moreover, novel CDR approaches differ from solar photovoltaics and electric vehicles in many ways that may impact growth. Nevertheless, these historical examples provide interesting studies in rapid technological growth (see Box 3.5 for additional comparisons).

Generally, we see less ambitious longer-term company announcements in this edition than in *The State of CDR 2nd Edition*. In the 2nd Edition, long-term company announcements totalled 11 $GtCO_2$ removed per year, including one announced ambition of 8 $GtCO_2$ per year by 2050. That announcement is no longer included in the 3rd Edition dataset, as it has been removed from the company's website. In the 3rd Edition, total company ambition is 6 $GtCO_2$ removed per year less than in the previous edition. However, if we exclude the most ambitious company in the previous dataset, the total ambition in this edition is 2 $GtCO_2$ removed per year greater.

Company ambitions are highly variable over time; some companies make new, ambitious announcements, while other companies that previously announced large ambitions later remove them from public view. Because company ambitions are not necessarily tied to specific projects, it is difficult to interpret why ambitions change at an industry scale. Companies that have lowered or removed their long-term ambitions may be moving to a more mature phase of development, responding to more realistic long-term plans, or a shifting in focus from setting ambitions to building CDR capacity. On the other hand, a rise in more ambitious announcements may indicate confidence in the CDR market.

Box 3.5: Historical technologies show the urgency of upscaling CDR

Technology innovation takes time, and so does widespread adoption. Figure 3.5a shows 111 examples of technology scale-up. The scale-up curves show the values from fitting a logistic function onto technology adoption time series data, scaled to the first year of commercialization for each technology (x-axis) and scaled to the asymptote value derived from the logistic function fit (y-axis). The speed and scale reached in the first 25 years of the time series varies considerably across technologies. Three examples are highlighted in the figure to demonstrate a slower- (hydroelectricity), medium- (cell phones), and faster-paced (vehicle disk brakes) diffusion pathway. These diverse pathways demonstrate that there are many possibilities for the future of novel CDR scale-up.

Historical speed and scale of technology diffusion

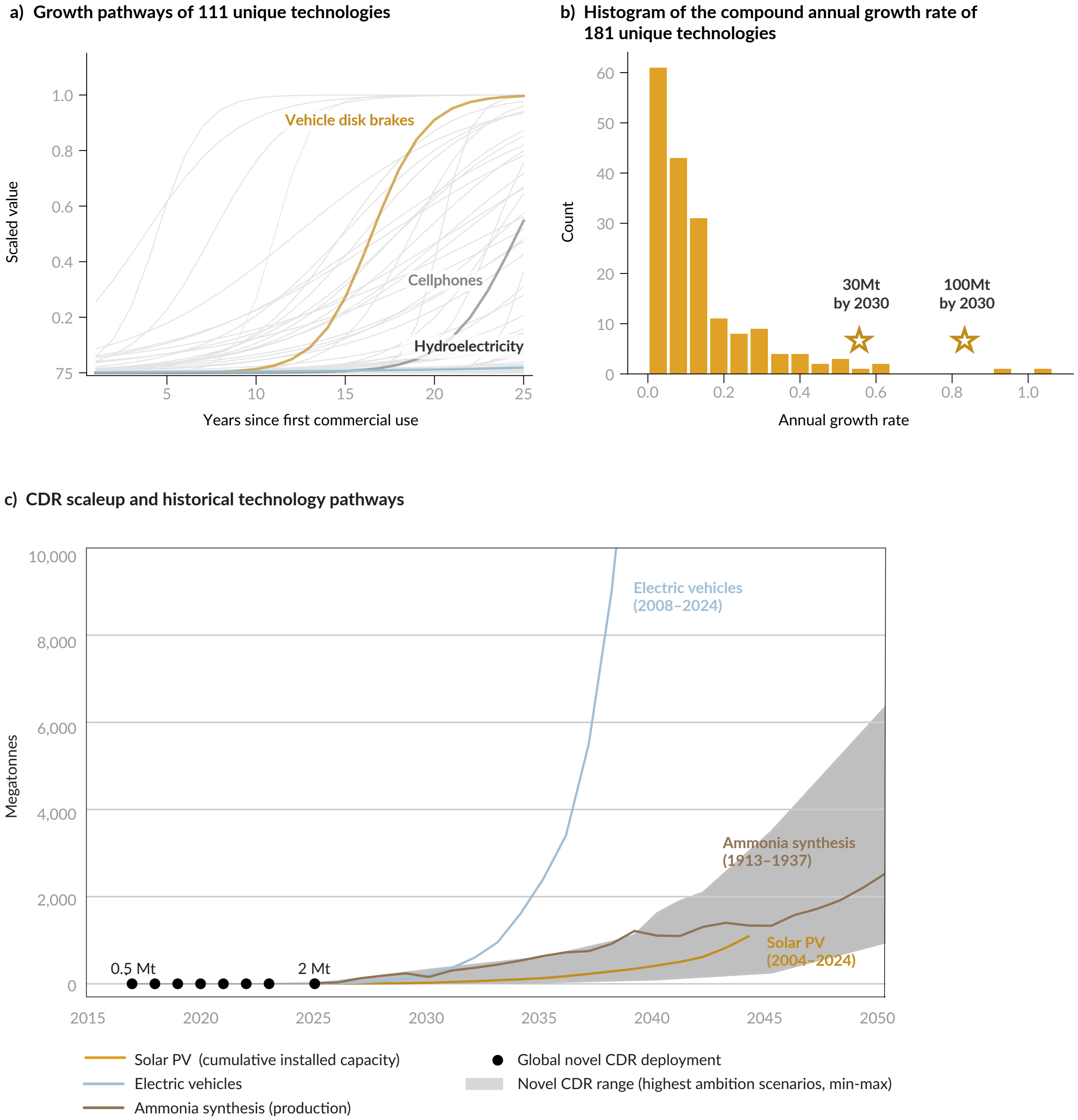

Figure 3.5 *(a) The growth pathways of 111 unique technologies, with three technologies highlighted to show examples of a fast, medium and slow diffusion pathway in the 25 years after first commercialization, (b) a histogram of the compound annual growth rate of 181 unique technologies compared to goals for novel CDR scale-up, and (c) pathways of novel CDR if it follows the growth trajectories of three example technologies compared to the highest ambition scenarios (see Chapter 8).*

Two 2030 goals for the scale-up of novel CDR have been proposed recently, both of which focus on international collaboration to catalyse growth. An independent review of GHG removals commissioned by the UK Department for Energy Security and Net Zero[85] proposes a global "30 by 30" campaign as part of its recommendation to pursue international collaboration efforts. The proposed campaign would focus on building 30 million tonnes of operational CDR capacity globally by 2030. Meanwhile, at COP 30 in 2025, CDR2030[86] – a new initiative under the UN Climate High-Level Champions architecture – launched the CDR Mutirão, a collaboration to accelerate progress towards reaching 100 $MtCO_2$ of novel removal capacity and 3 $GtCO_2$ of conventional carbon removal capacity by 2030. The Mission Innovation CDR Mission[87] has a similar goal for novel CDR scale-up.

Both of the 2030 targets represent potential scale-up pathways for novel CDR that may benefit from comparison to historical technology scale-up. Reaching 30 $MtCO_2$ of novel CDR by 2030 from 1.3 $MtCO_2$ of novel CDR in 2023 implies a compound annual growth rate of 57%. When compared to 181 historical examples of global technology growth, this rate is on the fast end of the spectrum (see Figure 3.5.b). There is some precedence for this growth speed in other technologies: magnetic data storage, cell phones, lithium-ion battery storage and internet traffic have all grown faster than the implied compound annual growth rate for novel CDR. By comparison, reaching 100 $MtCO_2$ of novel CDR by 2030 is more ambitious and implies a compound annual growth rate of 86%. Lithium-ion battery storage and internet traffic both scaled faster than 86%. Since novel CDR refers to a portfolio of diverse methods, a one-to-one comparison with the individual technologies assessed in Figure 3.5 is not straightforward. However, this analysis illustrates that although both the novel CDR goals are ambitious, the speed of upscaling is not unprecedented when compared to other transformative technologies.

Box 3.6 Limitations and knowledge gaps

- Demonstration projects reported in Section 3.1 have either been announced, are under construction or are in operation. Some of these demonstration projects may have been cancelled, but that information is not always available. Companies tend only to announce celebratory milestones and do not typically offer project status updates, so some projects included in Section 3.1 may in reality have been delayed or mothballed. IEA and Mission Innovation are improving their methods for monitoring project status and providing updates, which would improve the accessibility and robustness of their databases going forward.

- The analysed demonstration programmes and projects are concentrated in geographic areas where data has been made available, for instance through the Clean Energy Ministerial and Mission Innovation. Not all countries are parties to these groups, so any CDR demonstration projects or public programmes to support CDR demonstration projects in these countries may not be included, despite our efforts to collect comprehensive data. In the future, wider research may provide a more complete picture of demonstration projects globally.

- NZI uses a combination of public data scraping and individual submissions to record investments and categorize companies under its hierarchy of climate solutions. This approach may not record all investments or categorize all climate-tech startups accurately, especially for startups reporting activities in languages other than English and located outside of the United States and Europe. Additionally, while compiling funding data for startups is a useful metric for tracking innovation, it does not capture privately supported innovation within corporations or private research institutions. Future work could compare funding reported by NZI to other indicators of innovation such as patents (see Chapter 2).

- CDRjobs tracks publicly advertised vacancies and individual submissions, an approach which may underrepresent hiring through networks, accelerators and academic partnerships common in early-stage startups. The dataset could, therefore, be biased towards mature companies and firms in the United States and Europe. In addition, the data include few postings for conventional CDR such as afforestation, reforestation and forest management or soil carbon sequestration in croplands and grasslands; this may reflect differences in recruitment practices across the CDR methods, with conventional pathways often relying more on offline hiring than online job boards. Moreover, regional hiring in Africa, Latin America and parts of Asia, where offline recruitment is common, may be underrepresented. Future updates could track the evolution of the CDR workforce over time and expand data coverage in underrepresented regions (for example by incorporating employer surveys).

3.4 Outlook

Across this analysis, we find evidence of an increasingly mature CDR ecosystem. More countries are using diverse policy mechanisms to fund CDR demonstration projects. More CDR startups are receiving late-stage investment, while fewer startups are being founded. Long-term company ambition, assessed through company announcements, is less ambitious than in the previous edition – but with changes in the set of companies that have adopted long-term ambitions. This may signal that some companies have strategically refocused away from announcing long-term ambition and towards focusing on building capacity. Workforce development is also expanding beyond engineering and technical roles to encompass more enabling services, reflecting the growing needs of the CDR ecosystem to support scale-up. These findings may suggest that more CDR innovators are focusing on meeting reasonable growth benchmarks with tested CDR methods, refining novel methods in the research and development stages before soliciting support for late-stage growth.

At the same time, significant challenges threaten the pace and stability of CDR upscaling. Funding for demonstration projects currently depends heavily on institutional continuity, which remains fragile. While more countries are funding CDR demonstration projects, policy reversals, particularly in major markets like the United States, underscore that funding uncertainty remains a key barrier to demonstration projects and continued growth of the CDR ecosystem. Furthermore, many companies continue to struggle with the persistent bottleneck of converting leads into actual sales due to the uncertainty in the VCM (see Chapter 4), as evidenced by the shift among European startups towards alternative business models.

Increasing support for demonstration projects – and investment in CDR companies across the value chain – will be essential to bridge the gap between current levels and future ambition. Ultimately, delivering on announcements from CDR innovators for removals in 2030 and beyond – whether at the company scale or through coordinated efforts such as CDR2030 – will require rapid growth that, while not unprecedented, necessitates sustained effort and public and private support.

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