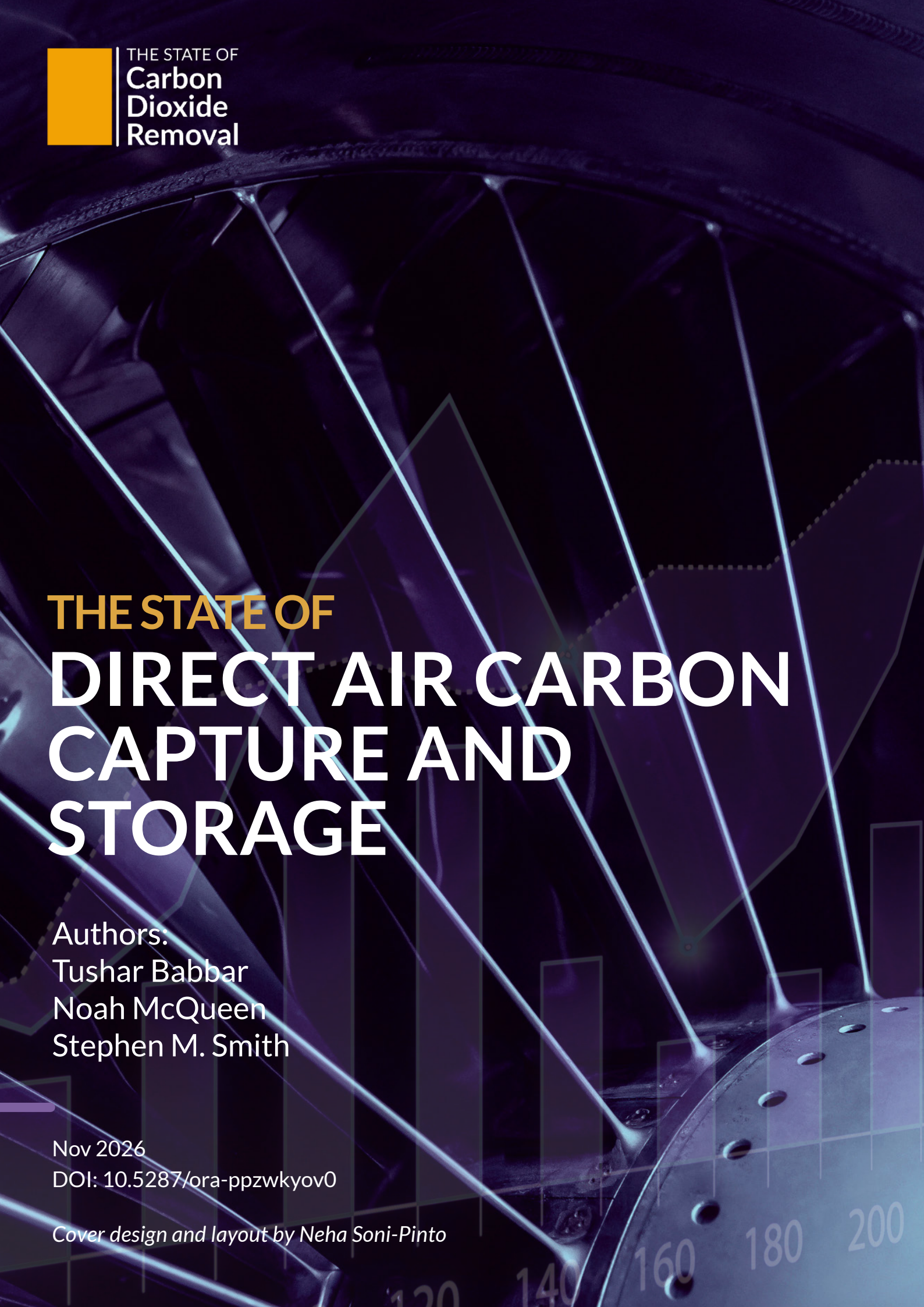


THE STATE OF DIRECT AIR CARBON CAPTURE AND STORAGE

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What is Direct Air Carbon Capture and Storage (DACCS)?

DACCS is a chemical process by which CO_2 is captured directly from the ambient air, with subsequent geological storage.

CAPTURE PROCESS	CARBON STORAGE	DURABILITY (years)
Chemical	Geological formations	10s-100s / 100s-1,000s / **>10,000**

How much is it removing, and where?

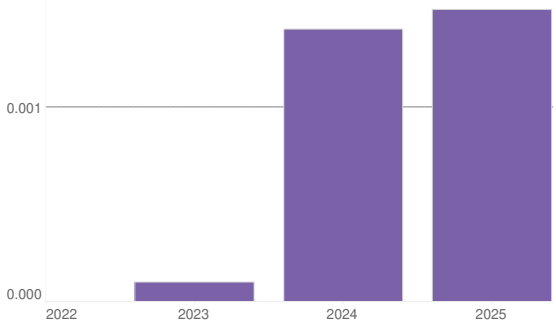
Summary

- **Snapshot** - DACCS removed around 0.0015 $MtCO_2$/yr in 2025. It is currently small relative to other CDR methods, equivalent to 0.07% of total global novel CDR.
- **Trend** - Removals through DACCS show an 18-fold increase from 2023 to 2025, reflecting rising removal rates at operating facilities.
- **Key issue** - Verified DACCS deployment up to 2025 remains highly concentrated, provided by two closely located facilities in Iceland, highlighting the method's limited geographical deployment compared with other CDR methods such as biochar.

Perspective

- **Energy determines net benefit** - The net carbon balance of DACCS is strongly dependent on the carbon intensity of its energy supply. For currently documented facilities, lifecycle emissions reduce net removals to 23-90% of gross capture, even where low-emission geothermal energy is used.
- **Infrastructure-dependent siting** - DACCS can be deployed across diverse geographical locations, but access to low-carbon energy and geological storage infrastructure will strongly influence where deployment is economically and environmentally favourable.
- **Capacity versus realized removals** - Reported DACCS removals remain substantially below installed capture capacity. Announced capacity of 0.1 $MtCO_2$/yr compares to actual removal performance of 0.0015 $MtCO_2$/yr in 2025.

Global CDR through DACCS ($MtCO_2$/yr)



Note: The bars represent gross CO_2 captured and stored.

DACCS sites delivering CDR in 2025



How much is in scenarios to meet climate goals?

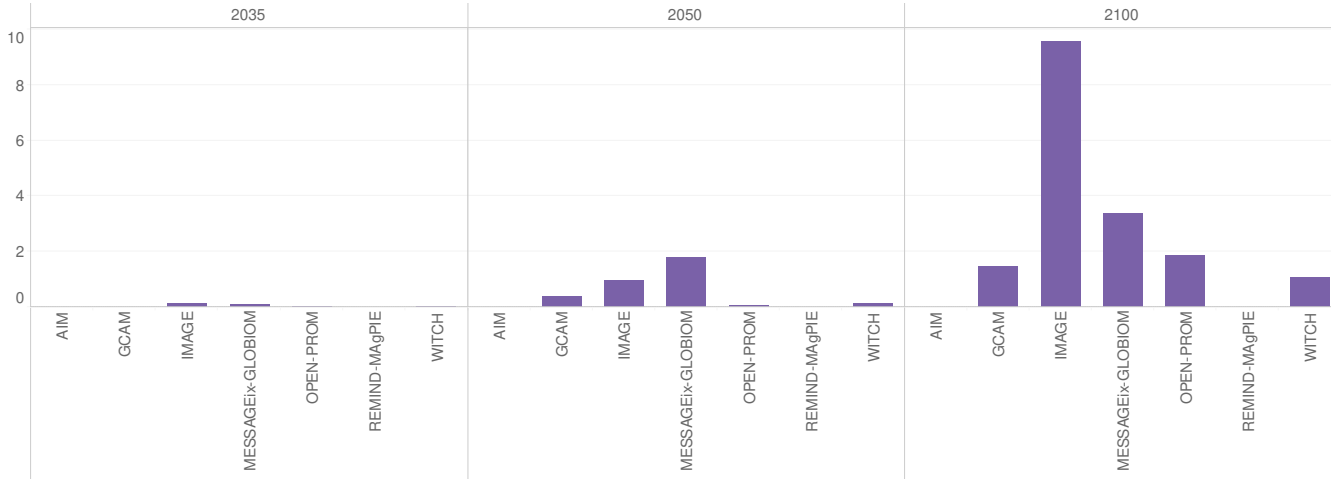
Summary

- **Snapshot** - DACCS deployment remains limited in 2035, with modelled removals close to 0 $GtCO_2$/yr across most models.
- **Trend** - In scenarios with the highest ambition for limiting warming, deployment reaches up to 1.8 $GtCO_2$/yr in 2050 (median: 0.15 $GtCO_2$/yr) and up to 9.6 $GtCO_2$/yr by 2100 (median: 1.5 $GtCO_2$/yr).
- **Key issue** - By 2100, DACCS projections range from 0 to 9.6 $GtCO_2$/yr, reflecting structural differences in the models, variations in parameters such as energy demand and technology costs, and differing constraints on resources such as geological storage.

Perspective

- **Infrastructure** - Scaling DACCS will require substantial expansion of CO_2 transport and storage infrastructure, alongside access to low-carbon energy. Separate estimates of sustainable potentials range from less than 0.5 to 5 $GtCO_2$/yr by 2050.
- **Economic feasibility** - High technology and operating costs present barriers to DACCS deployment. Future scale-up will depend partly on technology cost reductions, financing conditions and policy support.

Global CDR through DACCS in highest-ambition scenarios ($GtCO_2$/yr)



Note: All models represent the same highest ambition scenario, in which countries pursue the strongest feasible climate action immediately; differences in projected deployment reflect variations in model assumptions and constraints. Highest ambition scenarios scale total CDR to 6.5-13 $GtCO_2$/yr by 2050, while emissions reductions provide 80-91% (84% median) of mitigation to net-zero, limiting peak warming to 1.7-1.8°C before returning towards 1.5°C by 2100.

How much research is being conducted?

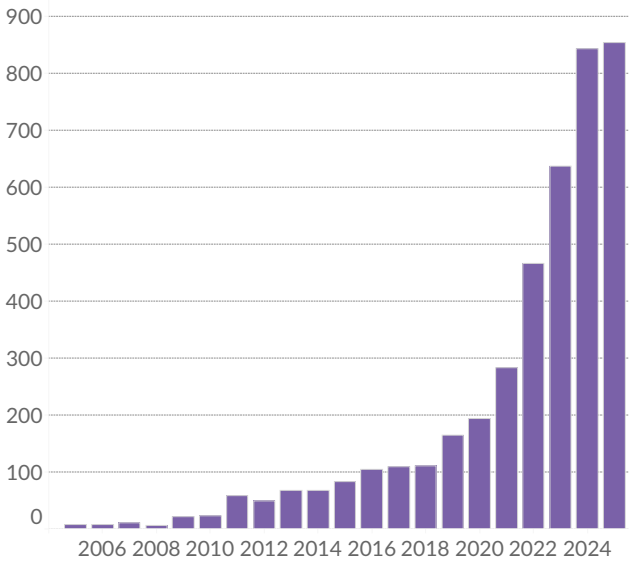
Summary

- **Snapshot** - DACCS recorded 855 scientific publications in 2025 (4.7% of total CDR publications) and US$22 million in grant funding (5.3% of total CDR funding).
- **Trend** - Publications accelerated from 190 in 2020 to 855 in 2025, while grant funding grew after 2018, peaking at US$189 million in 2023 before declining sharply. An earlier pronounced peak was also observed in 2014, highlighting the influence of large individual projects on annual funding levels.
- **Key issue** - DACCS accounted for broadly similar shares of total CDR publications (4.7%) and grant funding (5.3%) in 2025, despite substantially higher funding levels in preceding years.

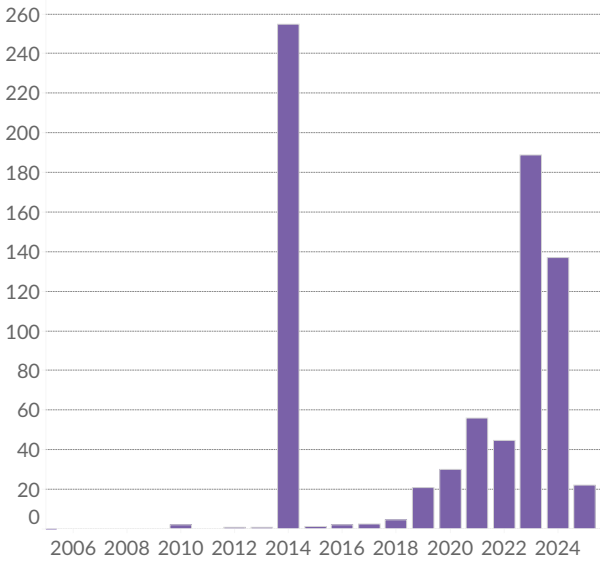
Perspective

- **Accelerating research activity** - Rapid growth in scientific publications indicates an expanding DACCS research field, although publication volume alone does not establish technical maturity.
- **Capital-intensive innovation** - High funding requirements highlight the importance of sustained public research support to advance technology development and reduce costs.
- **Translation challenge** - For DACCS to scale toward levels projected in ambitious climate scenarios, growth in research activity must be accompanied by progress towards commercial deployment.

Number of scientific publications on DACCS



DACCS R&D grant funding (US$ million)



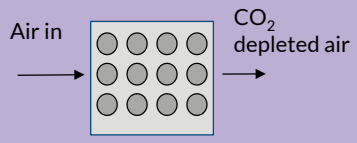
Note: 2014 funding includes a US$253 million US National Carbon Capture Center grant, which went towards other forms of carbon capture, utilisation and storage, in addition to DACCS.

Understanding the DACCS system

DACCS is not one technology. Different approaches capture CO_2 from air, recover it using different energy or chemical inputs, and store it through geologic pathways. Research and innovation span the full system, and some approaches integrate multiple stages.

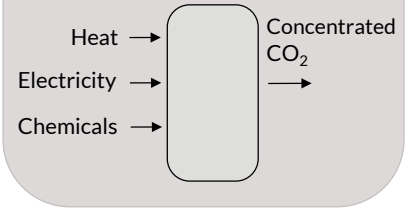
1 Capture

Separating CO_2 from ambient air using different chemical and physical processes



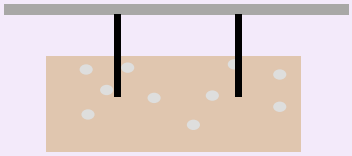
2 Regeneration & recovery

Recovering concentrated CO_2 using energy or chemical inputs



3 Transport & storage

Preparing and transporting CO_2 for storage



Example approaches

1 Capture
- Solid sorbents
- Liquid solvents
- Electrochemical approaches
- Mineral-based approaches
- Reactive capture (integrated capture and storage)

2 Regeneration & recovery
- Thermal regeneration (heat)
- Electrochemical regeneration
- Chemical regeneration (e.g., acids, bases)
- Pressure or vacuum swing

3 Transport & storage
- CO_2 conditioning and transport
- Geologic storage (e.g., saline aquifers, depleted reservoirs)
- Mineralisation (e.g., basalt)

Key research areas

1 Capture

Improving capture efficiency, durability, scalability, and cost
- Novel sorbents and solvents
- Contactor and system design
- Integrated capture-storage designs

2 Regeneration & recovery

Reducing energy and chemical inputs
- Energy efficiency and heat integration
- Low-energy regeneration
- Process intensification

3 Transport & storage

Reducing costs and improving storage and monitoring
- Infrastructure and siting
- Lower-cost conditioning and transport
- Expanded storage options

Cross-cutting innovation | Systems integration, materials innovation, life-cycle performance, and cost reduction.

What is the extent of investment and startup creation?

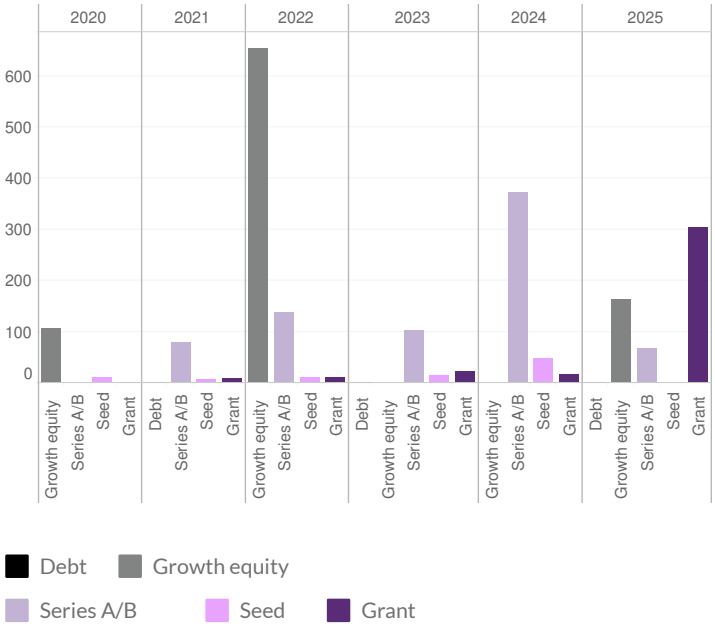
Summary

- **Snapshot** - DACCS attracted US$660 million growth equity in 2022, followed by US$370 million Series A/B in 2024 and US$305 million grant funding in 2025.
- **Trend** - Startup formation peaked at 20 firms in 2022; declining to 1 DACCS startup in 2025, representing 9% of the 11 total CDR startups founded that year.
- **Key issue** - Despite fewer new startups, DACCS has attracted substantial capital, receiving US$2 billion since 2021 — the highest total investment among all CDR methods.

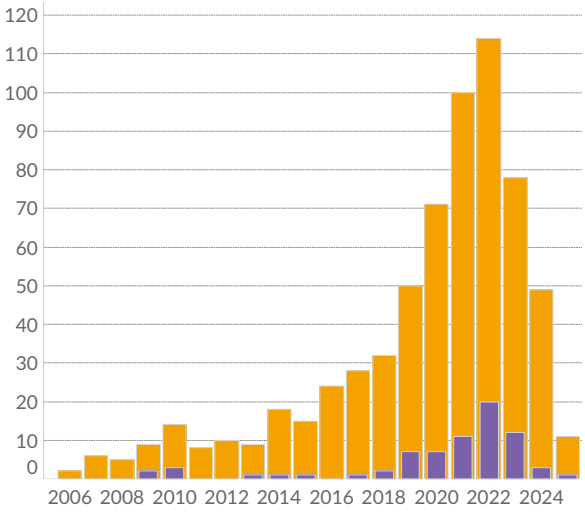
Perspective

- **Commercial maturation** - Substantial growth-equity funding alongside Series A/B investment has enabled some DACCS firms to progress beyond early-stage financing, although overall investment has declined since 2022.
- **Strong capital requirements** - Large individual funding rounds reflect the infrastructure requirements and capital intensity of DACCS projects at commercial scale.
- **Policy dependence** - Public funding plays an important role in de-risking DACCS deployment, making scale-up sensitive to changes in policy support.

Deal distribution for DACCS (US$ million)



DACCS startups founded



Debt · Growth equity · Series A/B · Seed · Grant

Total novel CDR startups · DACCS startups

Note: 2024-2025 startup counts may be understated due to data truncation, as newer and smaller firms can be difficult to identify before fundraising or public announcements.

What do the publics think?

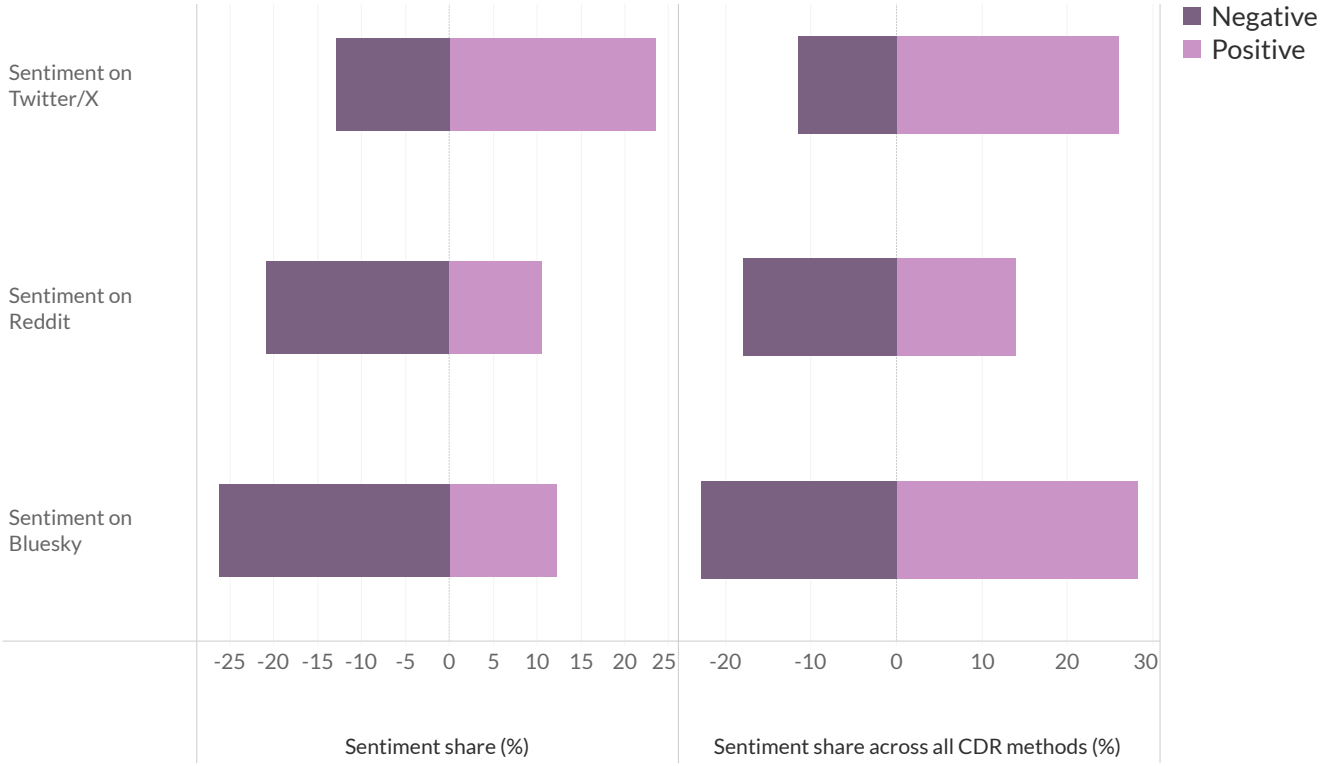
Summary

- **Snapshot** - Sentiment towards DACCS is net-positive on Twitter/X (24% positive, 13% negative), but net-negative on Reddit (11% positive, 21% negative) and Bluesky (13% positive, 27% negative).
- **Trend** - User engagement with CDR on Twitter/X increased between 2010 and 2022, but declined 16% annually between 2023 and 2025. Posts mentioning "climate change" have declined faster at 24% annually.
- **Key issue** - Sentiment for DACCS is less positive than for all CDR in general across all three platforms.

Perspective

- **Conditions for support** - Public attitudes to CDR are known to be driven strongly by costs, impacts on biodiversity, and governance.
- **Level of awareness** - DACCS is among the more extensively studied CDR methods in terms of public perceptions, with 25 papers published between 2023 and 2025. Nevertheless, public awareness of CDR remains generally low.
- **Limits of public perception data** - Social media sentiment provides a useful indicator of online discussions but is not representative of broader public opinion. Public attitudes vary across regions and populations, while complementary evidence from surveys and other sources remains geographically uneven.

Sentiment distribution across three social media platforms for DACCS (% share)





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Data contribution

Do you have additional evidence relevant to The State of Direct Air Carbon Capture and Storage? Please contact us at *socdr@smithschool.ox.ac.uk*

Unless otherwise stated, data in this report is drawn from the State of Carbon Dioxide Removal, 3rd Edition. We gratefully acknowledge its contributors. Full references and additional sources are available in the *State of Carbon Dioxide Removal, 3rd Edition*.