



Summary of the UPTAKE CDR: 2nd Stakeholder Workshop

Athens, October 9th 2025

The second UPTAKE CDR Stakeholder Workshop took place on 9 October 2025 in Athens, bringing together representatives from **research, policy, civil society, and business** to exchange views on the latest findings and ongoing work within the project.

The event began with a brief opening presentation that outlined the policy, governance, and equity dimensions of scaling Carbon Dioxide Removal (CDR), followed by **four thematic panel discussions** focusing on science and technology, social perspectives, business and investment models, and policy and governance challenges.

Below you can find a summary of the sessions and key takeaways, along with links to selected presentations.

Agenda: [UPTAKE 2nd Stakeholder Workshop](#)

Opening presentation: [Policy, Governance, and Equity in CDR Scaling](#)

Panel Discussion 1 - Knowledge and Science

During the first panel, ***Exploring the Latest Developments in DACCS and CO₂ Transport***, Vittoria Bologaro from ETH Zurich focused on the contributions from Work Package 2 of the [UPTAKE project](#). The panel was moderated by Mohamed Abdalla from the University of Aberdeen. Genevieve Hodgins from Supercritical and Ondrej Masek from the University of Edinburgh joined the discussion as panelists.

Key takeaways:

- Dioxide Removal Reviews - Part 1: Direct Air CO₂ Capture and Storage," Energy & Environmental Science, 2025, DOI: 10.1039/D5EE01732G - provides a comprehensive analysis of the existing literature on Direct Air Carbon Capture and Storage (DACCS). The study examines the different types of DACCS technologies, their technological readiness levels, and the status of commercial deployment. In addition, it explores key aspects such as system design, energy requirements, and economic performance across various DACCS approaches. The review also assesses CO₂ removal efficiency, potential burden-shifting, and the challenges associated with monitoring, reporting, and verification (MRV), among other relevant topics.
- Although DACCS technologies included in the review differ, they face similar challenges related to high energy demand, material durability and lifetime, and environmental and system integration.
- The energy source used for the DACCS plant determines the carbon removal efficiency. Clean energy sources are more efficient.
- Other factors influencing removal efficiency and potential include ambient air conditions, energy availability, local social and economic factors, environmental factors (e.g., land and water availability), and presence of CO₂ storage and transport infrastructure.



- There is a lack of Life Cycle Assessment (i.e. cradle-to-grave analysis for one tonne of CO₂ stored) for the high-TRL calcium-looping DACCS systems that are already commercial. This gap is being closed as part of work package 2.
- Decarbonized energy levels playing field across high-TRL DACCS technologies in terms of removal efficiency.
- Cement production integrated with calcium-looping DACCS offers a pathway to deep decarbonization and net-negative cement production.
- Air contactors and bigger indirect and electric calciners offer straightforward upgrades for new and existing cement plants, enabling low-carbon or even net-negative cement production.
- There is a lack of comprehensive global geospatial techno-economic optimization for higher TRL DACCS technologies. This gap is being closed as part of work package 2.
- The techno-economic optimization tool with regional/temporal inputs developed as part of Work Package 2 has revealed that sorbent-based DACCS cost varies massively based on region.
- Regional WACC and location-specific energy demand as well as location-specific available CO₂ transport routes and impact costs and removal efficiency (hence net costs).
- The future work in Work Package 2 will focus on finalizing the techno-economic optimization model and results, and time permitting, expanding the tool to include other sorbents for sorbent-based DACCS or other DACCS technologies such as solvent-based and calcium-looping DACCS.

Discussion:

- DACCS technologies cannot be scaled without public funding.
- The current price of DACCS technologies and credits is much higher than internal carbon prices. Therefore, cost reduction through using the right materials and processes is key.
- Given that the number of operating plants is currently very low, there are few opportunities for cost reduction.
- Not all of the energy resources used for DACCS are fully decarbonized.
- Tackling moisture and oxygen is critical for the safety and efficiency of DACCS plants.
- Pipelines used for CO₂ transport should align with land use and land rights to enable at-scale delivery, ensuring that local communities are not alienated.
- Having materials that are sustainably sourced and do not cause environmental risks when disposed of is critical.
- Studies examining DACCS materials, processes, and systems in an integrated manner have begun to emerge; however, further research is needed in this area
- Policy and regulatory alignment is key for obtaining the necessary investment for DACCS plants that have high capital expenditure.
- Since DACCS requires massive investments, having a stable and long-term climate policy is crucial.
- Public acceptance is key for operationalizing DACCS plants.
- The mitigation deterrence argument detrimentally impacts the public acceptance of DACCS.
- Electrification can significantly enhance the efficiency of DACCS.
- Besides electrification, low-grade heating can improve efficiency.
- Geological CO₂ storage is much more complicated and much less available than previously assumed.



Panel discussion 2 - Society and Communities

During the second panel, ***Perceptions of Fairness and Justice in CDR***, Livia Fritz from Aarhus University presented the latest interview and survey work as part of the UPTAKE project. The session was moderated by Benjamin Sovacool from Aarhus University. Mark Preston Aragonès from Bellona Europa and Ulriikka Aarnio from Climate Action Europe joined the discussion as panelists.

Slides: [Perceptions of Fairness and Justice in CDR](#)

Key takeaways:

- Large-scale CDR deployment raises profound questions about distributive justice (fair allocation of costs, benefits, and side-effects across societies and time) and procedural justice (inclusive decision-making, community engagement, and ownership).
- The recent UPTAKE survey among members of the public in six countries shows that governance and project design shape public support for local implementation of CDR: opening-up decision-making to the public and experts, as well as equitable profit-sharing or non-for-profit set-ups, increase support. Also, the capacity to remove high amounts of CO₂ with the project matters, but it cannot compensate for a lack of due process. Public familiarity with CDR methods is very low in all countries.
- Asking the public about how to distribute costs for carbon removal globally suggests that fairness is maximized by applying the “polluter pays” and “historical responsibility” principles that go beyond Eurocentric appeals to employment. Uncoordinated and unnegotiated approaches are perceived as highly unfair.
- Stakeholder interviews in the same six countries reveal a broad consensus that justice must be central to CDR governance, but practical implementation pathways are unclear, pointing to a need for wider societal deliberation.
- Key tensions exist between: (a) accelerating deployment vs. equitable outcomes, (b) Global North responsibilities vs. Global South opportunities, and (c) market-based mechanisms vs. the common good principle
- The panellists acknowledge that just transition can have varying meanings in different settings. In Europe it might primarily refer to employment, while at the global level it refers to historical responsibility.
- The panellists emphasize that from a justice perspective it is important to explore avenues in which CDR can be generated as a co-benefit and prioritizing those approaches which do more than just remove carbon and have the potential to create jobs and support workers.
- Many nature-based CDR methods that offer temporary removal should not be viewed primarily from a carbon angle but primarily taking into account their benefits for biodiversity, ecosystem, resilience and adaptation.
- Panellists concur that overreliance and poorly planned rollout of CDR is a risk to climate justice. CDR must not replace or deter ambitious emissions reductions, which should remain the primary focus. CDR should be used to address legacy emissions, not as a license for continued pollution. For removals to contribute to just transitions funding models based on the logics of offsetting are insufficient.



- Robust policy frameworks must precede large-scale deployment, including separate, distinct targets for emissions reduction, temporary land sinks, and permanent removals to ensure accountability. They must not be used as a license to pollute or for offsetting. Recent policy developments in e.g. Germany, Sweden, UK are good examples.
- The precautionary principle should guide CDR deployment, especially for methods that may not generate net removals or that offer only temporary storage (which should be valued for ecosystem benefits, not just carbon).
- The panel also critically discussed the role of the fossil fuel industry from the perspective of just removals. While the transition requires engaging oil and gas companies and other incumbents in some capacity, their privileged access to decision makers is a concern. Emitters should not be allowed to decide what gets offset and mandates like the EU's for CO₂ storage capacity are significant steps to ensure responsibility (e.g., Net Zero Industry Act).



Panel Discussion 3: Business and Investment

During the third panel, discussions focused on **the economic and business viability of Carbon Dioxide Removal (CDR) technologies**, drawing from the recently finalized deliverable prepared by the Reform Institute under the UPTAKE project. Paweł Wiejski presented the analytical work on existing and emerging CDR business models, while Yörükcan Erbay (ERM) and Christina Larkin (InPlanet) shared their perspectives from consultancy and implementation viewpoints. The panel was moderated by Soheil Shayegh from CMCC. The conversation highlighted how business structures, policy support, and market dynamics jointly determine whether CDR technologies can become scalable and investable.

Slides: [Adding Profit by Removing Carbon? Business Models for CDR](#)

Key takeaways:

- CDR technologies remain at an early stage of commercialization, and business model development varies widely between novel approaches (BECCS, DAC, biochar, enhanced rock weathering) and conventional land-based removals (such as afforestation, reforestation and forest management). Data availability and comparability between technologies remain limited.
- Public policy and regulatory stability are decisive for business viability. Recent cutbacks in U.S. CDR support programs show how public funding withdrawal directly affects deployment plans and investments.
- Novel CDR methods such as BECCS and DACCS attract significant attention but face high capital and operational costs. Their long-term viability depends on public support. Especially BECCS projects are often publicly funded or are undertaken by publicly owned companies. DACCS projects, while at an early stage of development, attract significant investor attention.
- Biochar presents a distinct model: revenues come mainly from product sales rather than carbon credits, linking climate impact to waste management and agricultural value chains. This diversification of income streams increases resilience compared to purely credit-based models.
- Enhanced rock weathering and ocean alkalinity enhancement are still in pilot phases, with early-stage venture capital and philanthropic support. Their success depends on robust MRV (Monitoring, Reporting and Verification) frameworks to build investor confidence.
- Voluntary carbon markets currently underpin a large part of novel CDR business models but face significant challenges for long-term viability. Integration into compliance mechanisms on the is expected to create a stronger market signal.
- According to ERM's insights, lack of demand is the central bottleneck. Most CDR firms must pre-sell at least 50% of their credits before securing financing, but corporate demand remains concentrated among a few large buyers (e.g., Microsoft).
- Co-products and diversified value chains can improve business resilience. Biochar and BECCS benefit from selling carbon-negative materials, energy, or waste-management services, while DAC lacks tangible co-products, making it vulnerable to market fluctuations.
- Emerging CDR business models include 'carbon-negative products' (e.g., carbon-negative concrete, farming inputs) that embed removal value directly into supply chains instead of separate carbon credit transactions.
- MRV systems are critical for credibility and risk management. Developers often design proprietary MRV systems to prove performance and attract investors, while



public standards such as the EU CRCF are expected to become common benchmarks.

- Fossil fuel and hard-to-abate sectors (aviation, mining, energy) were discussed as necessary but controversial actors. While collaboration is essential for scaling transport and storage infrastructure, engagement must avoid greenwashing risks.
- Panelists agreed that scaling CDR requires policy stability, long-term funding instruments, clear MRV standards, and new demand-side mechanisms (e.g., ETS integration or other compliance markets).



Panel Discussion 4: Policy and Governance

During the fourth panel, the discussion focused on **the political and governance dimensions of Carbon Dioxide Removal (CDR) deployment in a fragmented policy environment**. The session was moderated by Till Reinholz (IKEM) and opened with a presentation by Pietro Andreoni (CMCC), who introduced the policy questions arising from international outsourcing of removals. Theofania Troupi (Climate Strategies) and Christiana Foglia (Zero Emissions Platform) contributed insights from civil society and industry networks, highlighting both the risks and opportunities associated with cross-border governance of CDR.

The panel explored whether outsourcing CDR implementation across jurisdictions might lead to resource inequalities and governance gaps or, conversely, foster innovation and policy learning through experimentation.

Slides: [Outsourcing CDR in a Policy-Fragmented World: Resource Grabbing or Fostering Innovation?](#)

Key takeaways:

- Global governance frameworks for CDR remain fragmented. Divergent national regulations and certification systems hinder international investment and mutual recognition of carbon removals.
- Speakers emphasized that policy fragmentation risks creating unequal access to CDR opportunities, potentially leading to 'carbon colonialism' or resource competition, particularly where land and mineral resources are needed for removals; this raises more questions about the global framework and potential divisions between global North and South
- Outsourcing carbon removals to developing countries can raise fairness concerns if benefits do not accrue locally. Transparent governance, participatory decision-making, and fair compensation mechanisms are essential to avoid resource grabbing.
- At the same time, policy diversity can stimulate innovation by allowing for experimentation with multiple CDR approaches, regulatory instruments, and financing schemes.
- Speakers discussed how existing EU legislation—such as the Net Zero Industry Act, CBAM and the upcoming Carbon Removal Certification Framework—can serve as reference models for integrating removals into compliance systems.
- Governance must balance flexibility with integrity. Allowing a variety of approaches (public-private partnerships, offset markets, subsidies) should not undermine environmental integrity or lead to double counting.
- Public trust and legitimacy depend on transparency, inclusiveness, and clear communication about the limits of CDR. Policymakers must address concerns about 'mitigation deterrence'—the risk that removals distract from emission reduction efforts.
- Cross-sectoral coordination is key. Energy, industry, and land-use policies should be aligned with CDR frameworks to avoid contradictory incentives and ensure permanence and verifiability of removals.
- Panelists highlighted that CDR policy design should reflect principles of distributive and procedural justice, ensuring that communities affected by deployment participate in decision-making and share in the benefits.
- Long-term governance must include monitoring of environmental and social impacts, public registries of CDR activities, and mechanisms to revise standards as technology and evidence evolve.