CARBON REMOVAL READINESS ASSESSMENT

How to realise Germany's negative emissions potential?

A Roadmap for High-Integrity, Investable Carbon Dioxide Removal in Germany (2026–2045)

February 2026

A collaboration between

carbon gap

SWECO

Disclaimer

This roadmap sets out proposed actions to accelerate the responsible deployment of carbon dioxide removal (CDR) in Germany. It draws on Carbon Gap's Carbon Removal Readiness Assessment (CRRA) for Germany and the outputs of a stakeholder workshop held in Berlin on 26 November 2025, supplemented by additional expert consultations.

The document is intended as an input for policymakers, public agencies, private-sector actors, and civil-society organisations engaged in shaping Germany's approach to CDR.

The roadmap does not represent the official views of any workshop participant or institution. Workshop inputs were synthesised, interpreted, and expanded by the authors. Any errors or omissions remain the responsibility of the authors.

Acknowledgments

This roadmap was developed by Carbon Gap using Carbon Gap's Carbon Removal Readiness Assessment (CRRA) methodology and is informed by inputs from a stakeholder workshop held in Berlin on 26 November 2025, supplemented by expert interviews and additional consultations.

We thank participants from federal and Länder administrations, public agencies, research organisations, civil-society organisations, financial institutions, and CDR project developers for sharing their perspectives on barriers, enabling conditions, and priorities for CDR deployment in Germany. Participation in these consultations does not imply endorsement of the findings or recommendations in this roadmap.

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List of abbreviations

ANK	Aktionsprogramm Natürlicher Klimaschutz (Action Program for Natural Climate Protection)
BECCS	Bioenergy with Carbon Capture and Storage
BMF	Federal Ministry of Finance
BMFTR	Federal Ministry of Research, Technology and Space
BMLEH	Federal Minister of Agriculture, Food and Regional Identity
BMUKN	Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety
BMV	Federal Ministry of Transport
BMWE	Federal Ministry for Economic Affairs and Energy
CCfD	Carbon Contract for Difference
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilisation
CDR	Carbon Dioxide Removal
CMS	Carbon Management Strategy
CO_2	Carbon Dioxide
CRCF	Carbon Removal and Carbon Farming
CRRA	Carbon Removal Readiness Assessment
DACCS	Direct Air Carbon Capture and Storage
DVNE	Deutscher Verband für negative Emissionen (German Association for Negative Emissions)
ERW	Enhanced Rock Weathering
ETS	Emissions Trading System
FOAK	First of a Kind
GHG	Greenhouse gases
IPCEI	Important Project of Common European Interest
ISO	International Organization for Standardization
KSG	Bundes-Klimaschutzgesetz (Climate Protection Act)
LNe	Langfriststrategie Negativemissionen (Long-term strategy for negative emissions)
$MtCO_2$	Million tonnes of carbon dioxide
MRV	Monitoring, Reporting, Verification
NABIS	National Biomass Strategy
OAE	Ocean Alkalinity Enhancement
R&D	Research and Development
UBA	Umweltbundesamt (German Environmental Agency)

Executive summary

Germany has committed to greenhouse gas neutrality by 2045 and net-negative emissions thereafter. Achieving these goals requires not only deep and rapid emission reductions but also the deployment of durable CDR at a multi-megaton scale within the next decades.

This roadmap translates the Carbon Removal Readiness Assessment (CRRA) analysis and a national stakeholder workshop into an action agenda for 2026–2045, focused on environmental integrity, investable market design, and enabling CO_2 transport and storage.

The CRRA analysis and national roadmap workshop confirm that:

1. **Economic and infrastructural bottlenecks are decisive.** Participants identified high capital and operating costs (especially for energy-intensive methods), competition for sustainable biomass, and uncertainty around CO_2 transport and storage infrastructure as central barriers. Limited domestic and cross-border storage options, and the pace of infrastructure build-out, were seen as particularly constraining for project development.

2. **Bankability is a key near-term constraint.** Beyond high unit costs, early CDR projects often face a combination of policy uncertainty, delivery risk, and counterparty risk, which can raise financing costs and delay final investment decisions. Stakeholders emphasised that targeted demand-side measures, such as multi-year offtake agreements with credible counterparties, appropriate guarantees or public risk backstops, and clear rules on claims, monitoring, reporting, and verification, can help reduce risk, mobilise private capital, and accelerate learning and cost reductions.

3. **Strategy and governance gaps undermine investment signals.** Stakeholders stressed the lack of a clear, long-term CDR strategy, including dedicated targets, regulatory clarity, and a coherent architecture for integrating CDR into Germany's climate policy framework.

4. **Social license and sustainability concerns must be addressed early.** Concerns about sustainable biomass use, environmental impacts, and credible and transparent MRV systems to underpin environmental integrity were prominent, alongside worries about public acceptance of a diversified CDR portfolio and perceptions of "technical CDR".

5. **Policy incentives and credible ambition are pivotal.** Stakeholders viewed the ongoing debate on Germany's climate-target architecture and EU ETS reforms as highly consequential for the emergence of viable CDR business models. A lack of "credible ambition" and an attractive national vision for Germany and society at large risks undermining meaningful investment and public support.

Building on these findings, the roadmap proposes three strategic pillars:

1. **Policy and governance** – establish national coordination and a shared evidence base for CDR, strengthen method-specific sustainability and monitoring, reporting and verification frameworks, define Germany's CDR ambition and portfolio, clarify how removals are treated across climate governance and accounting, and embed CDR into relevant national and European policy instruments and sector strategies.

2. **Pilots and scalable solutions** – support a first wave of early projects across a diverse range of methods, enable end-to-end value chain learning, and progress enabling infrastructure and standardised contracting approaches that support bankability.

3. **Large-scale deployment and international role** – prepare for system integration in the 2030s and 2040s, including cross-border CO_2 transport and storage cooperation, and alignment with evolving European and international market and integrity rules.

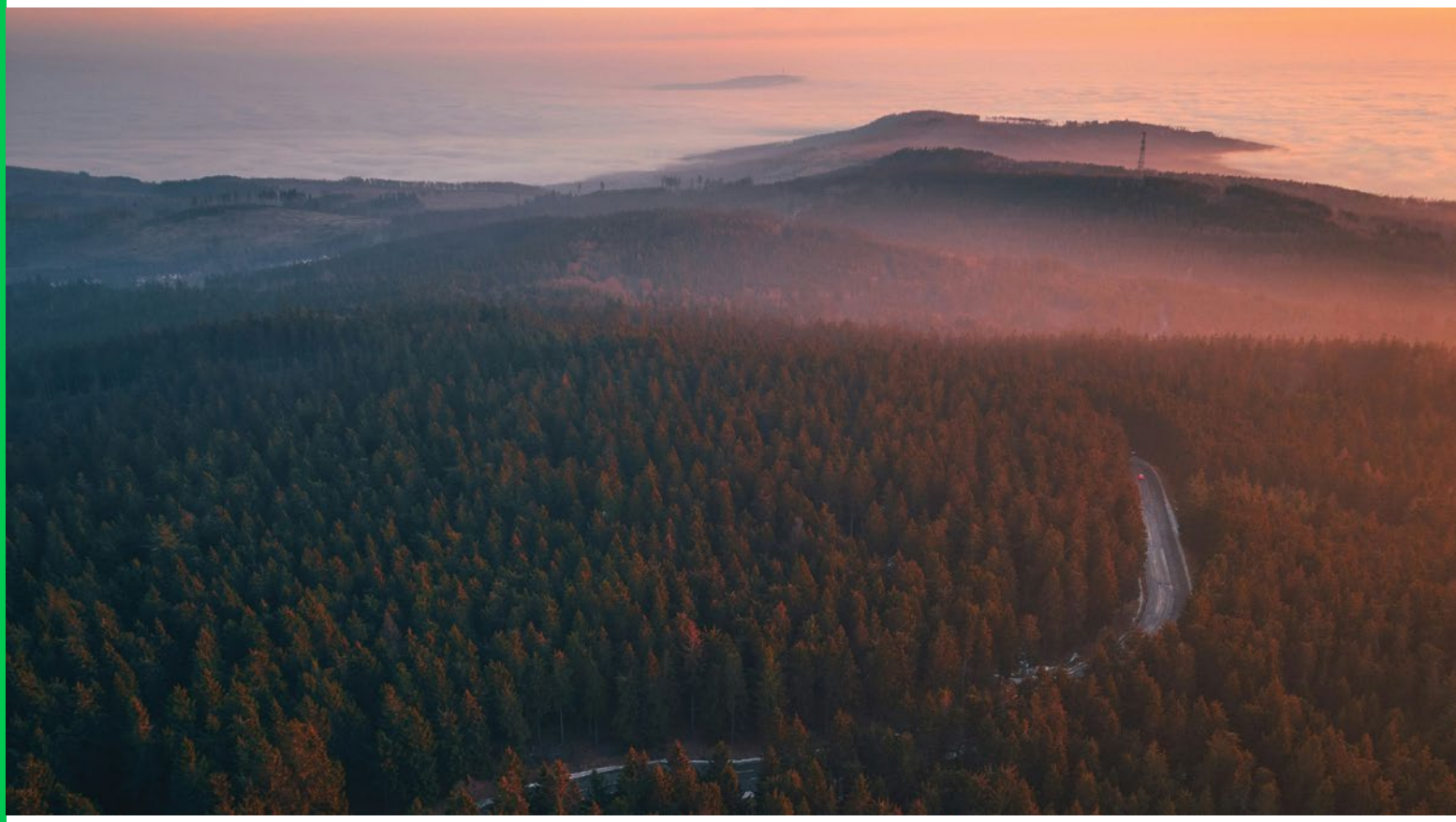
Two cross-cutting considerations apply across all pillars. First, environmental integrity and social legitimacy require robust sustainability safeguards, method-specific monitoring, reporting and verification, and transparent stakeholder engagement. Second, rapid scale-up is likely to depend on bankability: credible long-term revenue visibility and risk-sharing arrangements that reduce delivery, counterparty, and policy risks for first-of-a-kind and early-scaling projects.

Accordingly, the roadmap prioritises demand-creation and de-risking instruments in the 2026–2030 period, alongside integrity rulemaking and infrastructure execution.

An indicative timeline:

- **2026–2030: Establish core enablers** (by publishing and implementing the Long-term Strategy for Negative Emissions; launching initial purchasing rounds and de-risking tools; supporting the first wave of early projects; and advancing CO_2 infrastructure planning.
- **2030–2035: Scale successful early approaches** and standardise contracting and MRV practice; begin operationalising priority CO_2 transport and storage assets and access arrangements (including cross-border projects); embed CDR more systematically into relevant policy instruments and procurement frameworks as rules mature.
- **2035–2045: Move toward large-scale deployment** aligned with Germany's residual-emissions profile and net-negative ambitions, and with European pathways, while strengthening social legitimacy, refining standards and methodologies, and deepening cross-border cooperation where it supports cost-effective, sustainable storage access.

This roadmap compiles a series of specific actions recommended to put Germany on track to realise its CDR potential and meet its climate targets. It is intended to inform Germany's Long-Term Strategy for Negative Emissions and, beyond that, to start building a shared vision across all sectors involved.



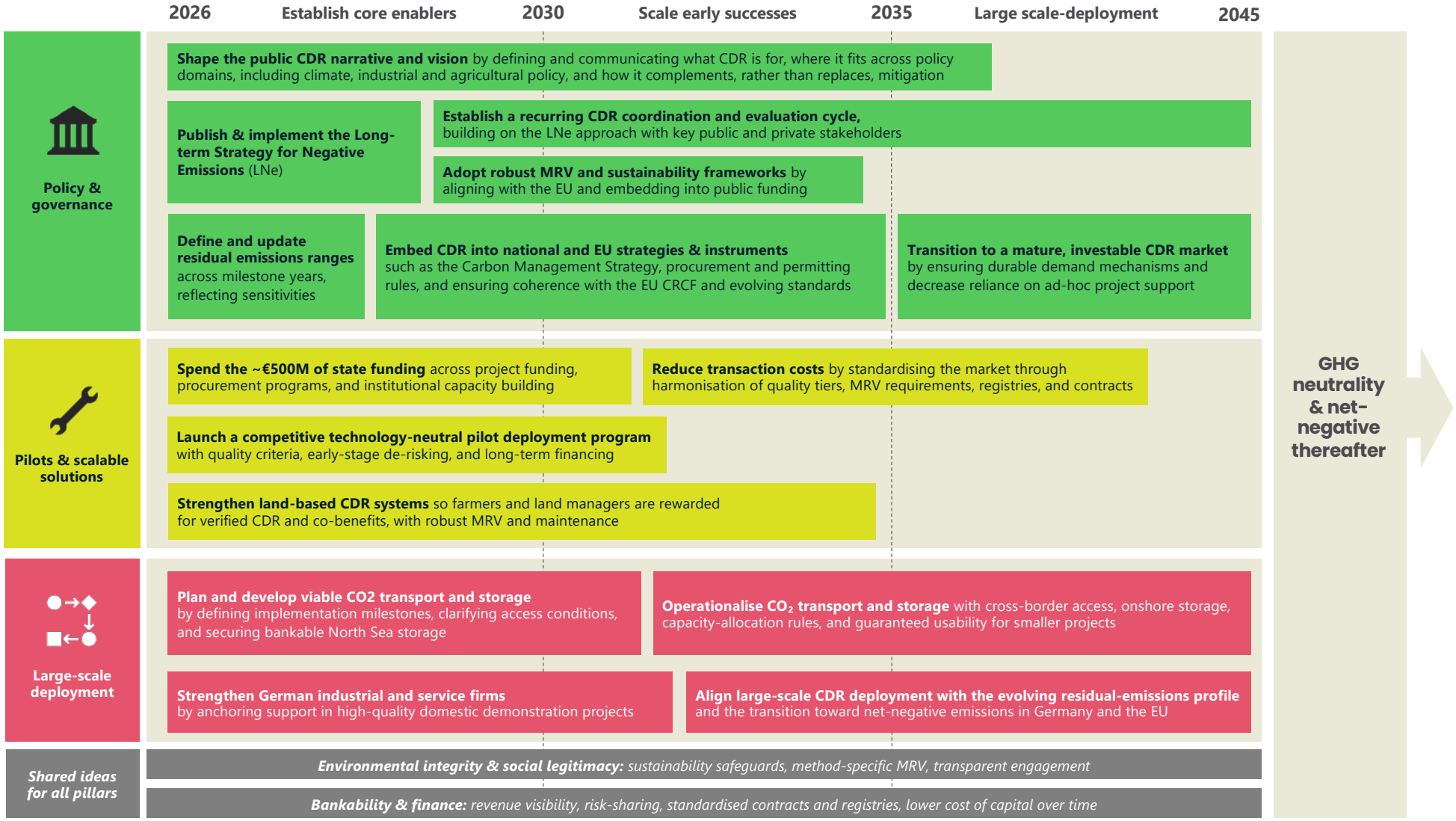


Figure 1. Overview of the measures proposed in the roadmap for the deployment of CDR in Germany. Most of the activities should be conducted in parallel and iteratively. Detailed descriptions of the activities are in Section 4.

1. Introduction

Germany's Climate Protection Act (KSG) sets a legal target for net-zero greenhouse gases by 2045 and net-negative emissions by 2050. Residual emissions are expected to remain in sectors such as the process industry, waste incineration, agriculture, and parts of transport and aviation, even under ambitious mitigation and efficiency trajectories. Often estimated between 45 and 80 $MtCO_2e$ of remaining emissions that need to be neutralised by 2045. Hence, scaling carbon dioxide removal (CDR), also known as *negative emissions*, is required as a complementary pillar alongside rapid emissions cuts and as a fundamental enabler to achieve net negative emissions.

Germany already sees political momentum around CDR, actively developing a long-term strategy for negative emissions, revising its climate policy architecture and developing carbon management frameworks, including legislation on CO_2 transport and storage, financial support for industrial point-source carbon capture and storage or utlisation (CCS/CCU), and the implementation of EU instruments such as the Carbon Removals Carbon Farming (CRCF). CDR sits at the intersection of these debates but is not yet fully integrated nor sufficiently supported.

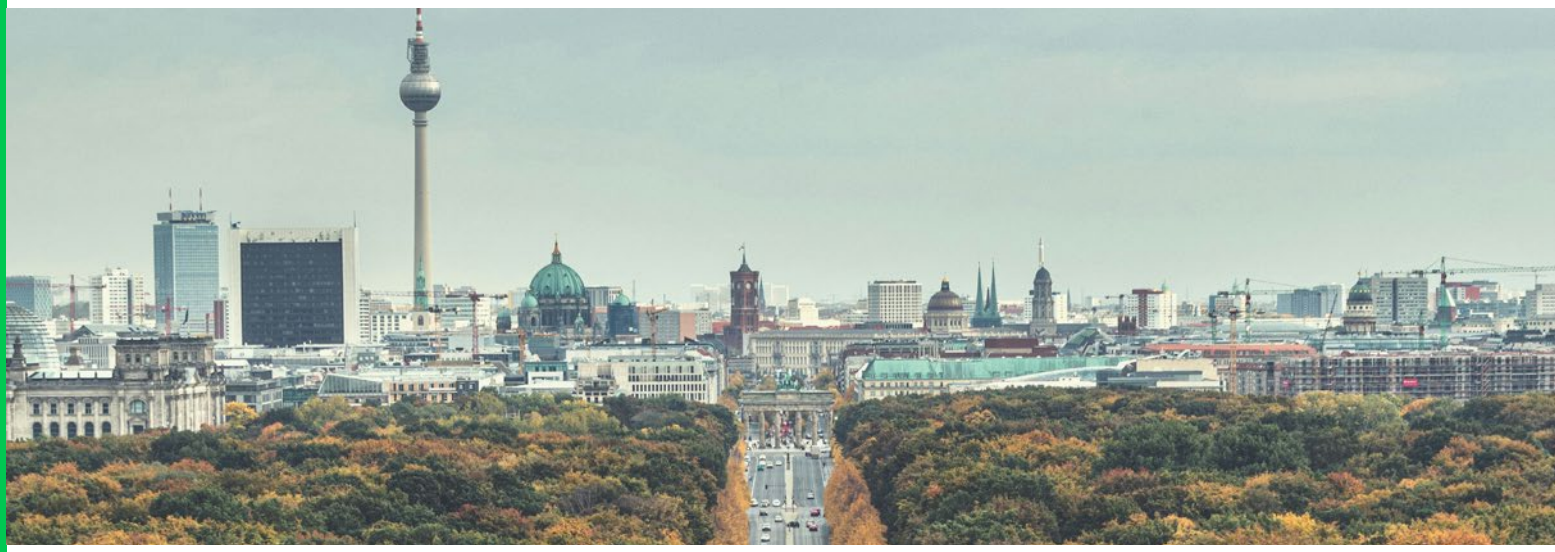
Methodology

This roadmap is part of Carbon Gap's Carbon Removal Readiness Assessment (CRRA) project, which evaluates the real-world deployability of CDR methods across multiple countries. The German roadmap was developed based on:

- **Technical and policy analysis** from the CRRA Germany background report, consisting of bottom-up modelled potentials of CDR methods and policy mapping.
- **Stakeholder consultations,** including expert interviews and survey input with policy makers, researchers, industry and civil-society actors, as well as a citizen panel.
- **A one-day interactive workshop in Berlin on 26 November 2025**, bringing together around 20 stakeholders across sectors to identify key challenges, prioritise them in terms of importance and difficulty, and co-develop potential solutions and timelines.

The workshop was structured around barrier clusters (policy, markets, research, and education), prioritisation exercises, and plenary reflections on the sequencing of actions up to 2045.

The roadmap summarises and builds on the workshop's findings, translating them into an action-oriented narrative. It is intended as a platform for joint refinement rather than a final blueprint.



2. Realistic CDR Pathways for Germany

The CRRA background report indicates that Germany has substantial CDR potential across several methods, but is constrained by CO_2 transport & storage build-out, biomass availability, land-use trade-offs, energy development, and political uncertainty. At a high level:

- **Biogenic point sources with CCS (BECCS):** Germany has significant biogenic CO_2 streams from waste incineration, pulp and paper, bioenergy plants and potentially future biomass-based industrial processes. In the CRRA scenarios, deployment is primarily constrained by CO_2 transport and storage capacity, and we identify risks related to sustainable feedstock supply and competition with other material uses.

- **Direct air capture and storage (DACCS):** Germany's strong industrial base, R&D capacity and increasingly decarbonised power system could support large-scale DACCS projects. However, high electricity costs, long investment cycles and uncertain access to storage make near-term deployment challenging. Yet, DACCS appears to be an important lever to mitigate the trade-off between preserving and restoring the natural sink and developing biomass-based removals.

- **Biochar and other biomass-based methods:** Existing pyrolysis capacities, interest in biochar use in construction and agriculture, and a large agricultural sector provide a basis for scaling biochar and related methods. Sustainability standards, consistent biomass supply and functioning value chains remain critical.

- **Enhanced weathering and mineralisation:** Industrial by-products and mining residues offer potential feedstock for mineralisation and enhanced weathering. Regulatory clarity and public trust are preconditions for scale.

- **Land-based measures:** Rewetting of peatlands, improved forest and soil management, and ecosystem restoration can provide additional removals, though they are often accounted within LULUCF and subject to significant uncertainty and permanence challenges.

The roadmap does not prescribe a single optimal mix. Instead, it assumes a diversified portfolio that combines novel, high-durability options with conventional CDR approaches, managing the risk associated with each method, and aligned with Germany's residual-emissions profile and land-use constraints.

3. Key Constraints and Bottlenecks for CDR Deployment in Germany

Workshop discussions converged on six interlinked clusters of challenges, centred around 1) costs and economics, 2) challenging markets for CDR feedstocks and credit offtake, 3) CO_2 transport and storage, 4) MRV and sustainability factors, 5) social license, and 6) policy incentives.

3.1 Costs and economics

Participants identified cost-related issues as among the most challenging barriers, driven by high capital expenditures, inhibiting energy prices, significant discrepancies in traditional avoidance-based offsets versus removal credits, and the high energy demand of some CDR methods.

Key elements:

- Project developers and lenders face unclear long-term revenue streams for negative emissions, increasing delivery risk and limiting the ability to secure offtake contracts and project finance.
- Investors and infrastructure partners highlight high capital and operating costs for BECCS, DACCS, and CO_2 transport and storage infrastructure, which increase required returns and narrow the set of financeable projects.
- Project developers and financiers highlighted long investment cycles and perceived technology and policy uncertainty, which can slow investment decisions and increase financing risk for early projects.

These risks can lead to higher financing costs for first-of-a-kind and early-scaling projects, in addition to a general lack of capital in the 10-30 MEUR scale, which is the typical demonstration stage, delaying final investment decisions even where the underlying technology appears viable.

For a project to be financially viable, lenders must be confident that it will consistently generate sufficient revenue to repay the loan, not only in an ideal year but also in the event of adverse circumstances. The key test is whether the incoming funds reliably cover the outgoing expenses.

Bankability can improve when credible long-term revenue visibility is created through a mix of instruments, including predictable policy frameworks, demand-side mechanisms such as multi-year offtake agreements anchored by a credible counterparty (including public entities where appropriate), and risk-sharing arrangements that reduce counterparty and delivery risk.

3.2 Input & output markets

The second cluster concerned markets for both inputs (including biomass, energy, and storage capacity) and outputs (negative emissions):

- Competition for sustainable biomass across sectors (energy, materials, chemicals) and concerns about locking in inefficient uses.
- Uncertain demand for durable removals, driven in part by unclear rules for high-integrity use and communication of purchases, including how voluntary claims interact with evolving EU and national frameworks, and whether and how removals may later be recognised in compliance instruments. Corporate buyers, in particular, are deterred by the lack of clarity around the claims and regulations governing CDR credits.
- Lack of long-term offtake agreements, leading to a significant "valley of death" between early pilots and bankable projects.

3.3 Infrastructure and storage

Infrastructure and storage were repeatedly highlighted as top-priority and high-difficulty barriers:

- Uncertainty over the availability and timing of domestic CO_2 transport and storage capacity, including the build-out of pipelines, shipping terminals, hubs, and guaranteed CO_2 delivery, that developers can plan against.
- Limited clarity on cross-border transport and storage options (e.g. to North Sea hubs), despite emerging European initiatives.
- Permitting complexity – and lack thereof for novel CDR method classifications - and social license issues for new infrastructure.
- Limited visibility on access rules, potential tariffs and capacity allocation for shared infrastructure, particularly for smaller or first-of-a-kind projects, such as DAC pilots.

This cluster was seen as defining the business case for many CDR projects. As a result, stakeholders often viewed credible timelines, access conditions and cost expectations for transport and storage as prerequisites for committing to large, long-lived CDR assets, such as waste-to-energy and other biogenic point-source capture with storage, and direct air capture with storage projects.

3.4 Sustainability and MRV

A separate cluster dealt with the sustainability of biomass and land use, environmental impacts and robust MRV systems:

- Ensuring that biomass use for CDR does not undermine biodiversity, food security or other ecosystem services.
- Addressing concerns regarding carbon debt, where biomass harvest or land-use change causes an up-front CO_2 increase that is only offset later, if at all, including indirect land-use change and long-term permanence risks.
- Developing credible MRV frameworks tailored to different CDR methods, aligned with the EU CRCF and emerging international standards.
- For some CDR pathways – particularly those with dispersed feedstocks or complex supply chains – end-to-end monitoring and verification can remain resource-intensive, with limited standardised tooling and verifier capacity compared to more established measurement contexts.

3.5 Social license and narrative

Participants emphasised that public trust will shape what is politically and socially feasible:

- Need for a positive vision that connects a wide spectrum of conventional and novel CDR methods to broader social and industrial benefits, not just costs and risks.
- Citizens tend to prefer "natural" solutions; purely technical approaches are often viewed with suspicion. Rephrasing into other categories, such as novel and conventional methods, may foster more neutral, nuanced public debates.
- Concerns about greenwashing, especially if CDR is seen as a licence for delayed mitigation ("mitigation deterrence").

3.6 Policy incentives and governance

Finally, policy incentives and overall industrial- and climate-policy architecture were identified as a decisive cross-cutting factor:

- Lack of a clear national CDR strategy, including quantitative targets for removals and residual emissions, as well as a concrete vision for the net-negative period post-2045.
- Unclear pathways to integrate CDR into the EU ETS or other carbon-pricing mechanisms.
- Limited availability of demand-side instruments that are well-matched to early project stages, including carbon contracts for difference and competitive auctions.

Stakeholders are awaiting regulatory clarity, without which plannability remains challenging. CDR is anchored in a set of national and European processes, including the EU CRCF, the European Climate Law (including its 2040 climate-target framework), the EU Industrial Carbon Management Strategy, the Net Zero Industry Act, the Clean Industrial Deal, and the review of the EU ETS Directive, with a view to the potential inclusion of removals.

At the national level, the *long-term strategy for negative emissions* (LNe) is currently being developed by the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN) in coordination with other ministries, Länder and stakeholders. The LNe aims to quantify residual emissions, determine the national need and potential for CDR and set target volumes for technical sinks in 2035, 2040, and 2045, along with a long-term net-negative target for 2060, with the LULUCF target already enshrined in the KSG.

Furthermore, CDR is closely linked to the pending *Carbon Management Strategy* (CMS), the *National Biomass Strategy* (NABIS), the *Aktionsprogramm Natürlicher Klimaschutz* (ANK), BMFTR research missions, including *CDRterra* and *CDRmare*, and sector-specific initiatives such as the *Nationale Moorschutzstrategie* and the *Holzbauinitiative*.

4. Actions Required to Accelerate Deployment of CDR in Germany

The barrier clusters identified above translate into three strategic pillars of action. Each pillar lays out rationales, key activities, and indicative responsible stakeholders. The "readiness" assessment indicates how quickly an action could plausibly be initiated in practice, acknowledging that political decisions, institutional mandates, and capacity constraints may affect delivery.

Across all pillars, two elements are key considerations. First, environmental integrity and social legitimacy depend on robust and transparent sustainability safeguards, method-specific MRV, and early stakeholder engagement. Second, near-term progress is likely to depend on improving bankability, including clearer revenue certainty and risk-sharing arrangements that reduce delivery, counterparty and policy risk for first-of-a-kind and early scaling projects.

The timeframes below are intended as focus periods rather than rigid end-dates. They recognise that several foundational elements are already underway, and therefore emphasise actions to initiate, institutionalise, or scale from 2026 onwards. And while sequencing matters for some measures, many activities will need to proceed in parallel and iteratively, given long lead times for infrastructure, permitting, and investment decisions.

4.1 Policy and governance (2026–2030)

4.1.1 Establish a German CDR knowledge and coordination hub

Rationale: Germany already has several relevant coordination formats and forums, including the LNe process and sectoral networks in industry, research, government and civil society. However, stakeholders indicated that these efforts are not yet institutionalised as a recurring, cross-sector integration function with a stable mandate to i) consolidate an agreed evidence base, ii) track implementation progress across policy, infrastructure and MRV, and iii) provide continuity between strategy and policy cycles (like the LNe). The value of a "CDR hub", therefore, lies less in creating a new platform and more in institutionalising a periodic coordination and evaluation cycle that connects existing sectoral hubs and produces concrete, reusable outputs.

Key activities

- Institutionalise a recurring CDR coordination and evaluation cycle: Establish a light-touch process, for example, every three years, building on the LNe approach (led by BMUKN) and facilitated by an existing convening body (such as dena or a mandated consortium).
- Define a clear, non-duplicative mandate: Focus on cross-cutting integration tasks that are not consistently covered by existing sectoral hubs, including shared assumptions, method and sector interfaces, and MRV and sustainability requirements.
- Core outputs and deliverables (first cycle, 2026–2028): Deliver a shared, reusable evidence base and implementation support, including i) a baseline synthesis with harmonised assumptions on potentials, constraints, costs and sustainability considerations; ii) an MRV and sustainability standards and methodologies map, including priority gaps and a workplan; iii) an annual implementation tracker covering pilots, infrastructure and policy milestones; and iv) a 2028 evaluation report with recommendations for the next cycle.
- Establish structured linkages to relevant networks (for example, research consortia, industry alliances, and civil-society platforms), and use the cycle to align priorities, surface trade-offs, and disseminate lessons learned from pilots.
- Create a lessons-learned repository from early projects: Collect and share non-confidential lessons learned on permitting, community engagement, monitoring approaches, and operational performance to reduce repetition and shorten development timelines.

Indicative stakeholders

- *Mandating ministries:* BMUKN (lead), BMWE, BMFTR, BMF; and as relevant, BMLEH, BMV.
- *Delivery and facilitation body:* public agencies like dena or a competitively selected consortium, such as a mix of research institutes and implementation partners.
- *Implementing and technical agencies:* UBA (MRV, environmental safeguards), and, where relevant, federal and Länder authorities responsible for permitting and oversight.
- *Research and scientific coordination:* CDRsyntra and relevant research institutes and universities contributing synthesis and methods expertise.
- *Industry and infrastructure networks:* DVNE and the Carbon Management Allianz for interfaces with CO_2 transport and storage, industrial clusters, and project pipelines.
- *Civil society and independent scrutiny:* environmental NGOs, consumer organisations, and citizen-panel representation, to support legitimacy and transparency.
- *Market actors* (as contributors, not governors): project developers, financiers, standard setters and verifiers, among others, to ensure outputs are usable and bankable.

Readiness: Medium. Medium. Many coordination elements already exist; the main requirement is a clear mandate, stable resourcing, and a governance model that complements rather than duplicates existing sectoral hubs.

4.1.2 Clarify the role of CDR in Germany's climate-policy architecture

Rationale: Investment and infrastructure planning require early clarity on the expected scale and function of removals in Germany's pathway to climate neutrality and net-negative emissions. At the same time, key parameters (residual-emissions estimates, accounting rules, and the treatment of different CDR methodologies) will evolve as the LNe and broader climate-policy architecture are finalised. A pragmatic near-term objective is therefore to define credible corridors and dependable timelines that can guide planning while preserving policy flexibility.

Key activities

- Define residual-emissions and CDR corridors: Develop indicative ranges for residual emissions and corresponding CDR needs for 2030, 2035, 2045, 2050, and 2060, including sensitivities, consistent with Germany's climate targets and EU-wide pathways.
- Clarify how CDR is counted and where it sits: Set out, at least at a framework level, how different CDR types interact with the KSG architecture, including the distinction between LULUCF-based removals and durable technical removals.
- Specify the role of compliance use cases, minimum quality criteria, carbon pricing, and procurement instruments, including BMUKN's 11.5 MEUR purchasing scheme for 2026.
- Align with EU rules and emerging international standards: Ensure coherence with EU-level developments – notably CRCF, Article 6, and potential future compliance uses – while retaining the ability to adopt higher domestic integrity requirements where needed.

Indicative stakeholders

- BMUKN (lead) in coordination with BMWE, BMF, BMFTR; expert bodies and advisory councils; UBA; Länder; Bundestag committees as relevant.

Readiness: Medium. Foundational analytical work can begin immediately; key design choices will likely depend on outcomes of the LNe process, broader KSG architecture decisions, and evolving EU-level rules.

4.1.3 Adopt robust MRV and sustainability frameworks

Rationale: Credible monitoring, reporting and verification (MRV) and robust sustainability safeguards are central to public trust and to the acceptance of CDR in policy and finance. While key MRV components already exist for some parts of the value chain (for example, metering at capture points and monitoring of geological storage under CCS regulation), gaps persist for several CDR methods and for demonstrating traceability from feedstock sourcing to long-term storage or durable use. Early implementation should therefore combine standardisation of mature MRV elements with targeted pilots that generate Germany-specific learnings on baselines, uncertainty, and safeguards, while remaining compatible with EU-level methodologies.

Key activities

- To avoid duplication and accelerate deployment across CDR projects and policies (such as a public procurement scheme), Germany should adopt, align and strengthen EU-level CDR criteria, including biomass sourcing, land-use safeguards, and environmental impact assessment, such as the CRCF.
- In line with EU efforts, apply a differentiated MRV approach: implement and standardise MRV for technical elements that are mature (e.g., capture measurement and geological storage monitoring), while piloting and localising MRV for site-specific and higher-uncertainty approaches (e.g., land-based measures and enhanced weathering), including baselines, sampling strategies, uncertainty quantification, and durability considerations.
- Strengthen capacity within authorities and independent verifiers, including guidance, training, and accreditation practices to enable consistent assessments across methods.
- Embed MRV and sustainability requirements into public funding instruments and procurement design from the outset, including monitoring plans, data reporting expectations, and remedies for under-delivery where appropriate.
- For less-established methods, permitting pathways and legal classifications remain unclear; Germany could help reduce duplication and uncertainty by promoting shared EU-level permitting guidance and transferable criteria based on early movers' experience.

Indicative stakeholders

- UBA; BMUKN; BMFTR; relevant standards bodies; accreditation and verification bodies; research institutes; project developers; Länder authorities (as relevant to permitting and land-based measures); civil society organisations.

Readiness: Medium. International templates are emerging; given the urgency to deliver, Germany should adapt rather than reinvent, and help reduce uncertainty by advancing transferable EU-level permitting guidance for less-established methods.

4.1.4 Shape the public narrative and build a "CDR vision"

Rationale: Public trust and perceived fairness are likely to shape which CDR options are politically feasible and at what pace. Without clear, credible communication, CDR risks being viewed as a substitute for mitigation or as primarily benefiting specific sectors, which could weaken social support and slow permitting and investment. Stakeholders emphasised the importance of a positive narrative and an accessible political vision to counter polarisation and climate fatigue.

Key activities

- Define and communicate the purpose: articulate, in plain and consistent terms, why Germany needs CDR (residual emissions, historical emissions, addressing a likely temperature overshoot) and what it is not intended to do (delay mitigation), including clear guardrails and sequencing principles.
- Make the benefits legible: connect CDR to tangible public outcomes, such as strengthening industrial capabilities, supporting innovation and engineering services, creating regional opportunities around industrial clusters, and improving ecosystem resilience when pursuing nature-based measures. Integrate CDR into broader narratives about German and European leadership across technology, social, and environmental spheres.
- Explain the portfolio logic: communicate why multiple approaches are pursued in parallel, including how sustainability safeguards, durability, and risk management differ across methods; avoid a simplistic "natural versus technical" framing, instead consider categorisation such as "conventional and novel" CDR methods.
- Embed fairness and accountability: set expectations for transparency, anticipated trade-offs, project risks, community engagement, and grievance mechanisms for publicly supported projects; clarify how environmental impacts are assessed and managed.
- Establish structured dialogue formats with civil society, local communities, and stakeholders in potential project regions, including early engagement for CO_2 infrastructure and biomass supply chains where relevant. Use these citizen and stakeholder deliberation formats to test framing, identify concerns early, and improve policy design and project practice.
- Encourage trusted intermediaries (for instance, environmental NGOs, consumer organisations, or citizen panels) to engage with and critique CDR options, rather than leaving the field to niche actors.

Indicative stakeholders

- *Federal ministries:* BMUKN, BMWE, BMBF (and, where relevant, BMLEH and BMV).
- *Agencies and intermediaries:* UBA, dena, Federal Agency for Civic Education (bpb), Länder ministries and regional development agencies.
- *Civil society and trusted messengers:* consumer organisations, NGOs, trade unions, journalism and media organisations, municipal associations, and local civic organisations.
- *Science and dialogue formats:* research institutes, science communication initiatives, citizen panels and deliberative dialogue providers.
- *Practice partners:* industrial clusters, project developers, chambers of commerce, and local authorities in potential project regions.

Readiness: Medium. Public awareness and understanding of CDR appears mixed and method-dependent: the umbrella term is not widely salient, but related concepts and specific approaches already attract attention in some contexts.

4.2 Pilots and Scalable Solutions (2026–2035)

Moving from strategic intent to delivery, Germany will need a focused "implementation push" across public policy and market actors. This means creating an early pipeline of credible projects; translating CO_2 transport and storage planning into visible, financeable projects for developers; and reducing the commercial and contractual friction as projects move from pilots to scaling.

This section, therefore, prioritises competitive early deployment; pragmatic investments that accelerate shared CO_2 infrastructure and storage access; targeted instruments that improve bankability and address the valley of death for CDR companies; and scalable land-based programmes that incentivise durable removal under robust MRV and long-term stewardship.

4.2.1 Establish a competitive pilot deployment programme

Germany should establish competitive programmes that fund a diversified portfolio of CDR projects, to reduce first-mover risk, address a looming "valley of death" for CDR companies, and enable large-scale deployment.

Key activities

- Launch a competitive, technology-neutral procurement for high-quality removals, with clear eligibility and quality criteria (MRV, durability, sustainability safeguards) using the 11.5 MEUR funding from the 2026 state budget. This can allow the state to act as an anchor buyer and improve revenue certainty for early projects. Given limited funds, funding should focus on high-integrity, lower-risk CDR projects. This will increase the chances of procurement success and foster trust across policymakers, market actors, and the public.

- Complement procurement with targeted de-risking for first-of-a-kind projects, for example, through CAPEX cash grants and OPEX support, guarantees, or milestone-based funding (if not too bureaucratic; early policy versions should be as simple as possible). Assess whether existing and well-established contract-for-difference approaches could be adapted for removals, where appropriate, to bridge the gap between market prices and the cost of high-durability CDR during early deployment. Using the 2026 state budget lines, funding should come from the 98 MEUR pool allocated to CDR project support, as well as the 44.5 MEUR to strengthen and incentivise soil carbon sinks.

- Using and iterating on CDR support schemes, Germany should draw on the additional €320 million in forward-looking authorisations through 2033 announced in the 2026 state budget, and continue to allocate increasing amounts to CDR public financing, in particular the 100 BEUR Special Fund for Infrastructure and Climate Neutrality (KTF).

- Differentiate support by method maturity and lead times by prioritising immediate, scale-oriented instruments for infrastructure-dependent pathways with long development cycles (often 5+ years from concept to commissioning, such as with many BECCS projects), so that projects can reach large-scale delivery in the early-2030s, while other approaches continue through structured piloting, MRV maturation, and standardisation.

Indicative stakeholders

- *Federal ministries*: BMUKN (lead), in coordination with BMWE, BMF, BMFTR; where relevant, BMLEH and BMV.

- *Technical and oversight bodies:* UBA; accredited verification bodies; relevant standards bodies and registries.

- *Market actors:* CDR project developers and relevant financiers.

- *Civil-society stakeholders*: environmental NGOs and consumer organisations.

Readiness: High. Implementation is supported by Germany's mature track record in competitive bidding and the CO_2 contracts for difference framework and confirmed state budget funding for CDR support in 2026. By utilizing these proven policy instruments, the government could draw on established institutional pathways to reduce regulatory uncertainty and accelerate the transition from pilot phase to commercial scale.

4.2.2 Develop viable CO_2 transport and storage networks

Many durable CDR projects are not financeable without credible access to CO_2 transport and durable, often geological storage.

Key activities

- Set clear implementation plans for CO_2 transport and storage (milestones, owners, priority corridors and hubs).
- Clarify access conditions early (third-party access principles, indicative tariffs/cost expectations, capacity allocation) to make shared infrastructure usable for first-of-a-kind and smaller projects.
- Secure transitional storage access via pragmatic cooperation with North Sea storage hubs while domestic options and infrastructure mature.

Indicative stakeholders

- *Federal ministries*: BMWE (lead), in coordination with BMUKN, BMV and BMF.
- *Authorities and regulators:* relevant federal and Länder permitting authorities.
- *Infrastructure and storage actors:* CO_2 transport infrastructure developers and operators; storage operators; port and shipping operators; cross-border partners (North Sea hubs).
- *Project actors:* industrial clusters and anchor projects (such as BECCS & DACCS developers).
- *Local stakeholders:* municipalities and civil-society organisations.

Readiness: Low. Delivery depends on multi-year legal and permitting decisions, as well as infrastructure build-out for networks and storage. Near-term storage access also relies on cross-border agreements and third-party capacity allocation, which adds further timing and coordination risks.

4.2.3 Strengthen land-based CDR programmes

Land-based measures can deliver near-term removals and co-benefits, but scaling depends on credible MRV, long-term stewardship, and incentives that reward durable outcomes. Programmes should prioritise integrity, durability risk management, and practical uptake by land managers.

Key activities

- Align and strengthen incentives across land-use policy (agriculture, forestry, peatlands, biodiversity) so land managers are rewarded for verified CDR and potential co-benefits, with clear safeguards and long-term maintenance requirements.

- Upgrade MRV and permanence management for priority measures (e.g., peatland rewetting, soils, forests), including baselines, leakage and reversal management, and transparent reporting compatible with evolving EU approaches.

Indicative stakeholders

- *Federal and Länder ministries*: BMLEH, in coordination with BMUKN and the Länder.
- *Practice partners*: farmers, foresters, peatland managers, and relevant landholders.
- *Civil-society stakeholders:* nature conservation organisations and environmental NGOs

Readiness: High. Core programs exist, including 44.5 MEUR of confirmed funding in the 2026 state budget, though scaling at high integrity depends on sophisticated MRV, durable incentive design, and broad coordination across institutions and funding streams.

4.3 Large-scale Deployment and International Role (2035–2045+)

As CDR moves beyond pilots in the 2030s, Germany will need to shift from ad-hoc support to durable market and infrastructure arrangements that can deliver removals at scale while maintaining high environmental integrity. This requires predictable, long-term demand signals, mature MRV and sustainability governance, reliable access to CO_2 transport and storage, coordinated with European partners, alongside public and private investment at scale.

This pillar focuses on i) transition from pilots to a mature, investable CDR market with stronger standardisation and declining reliance on grants; ii) integration into European CO_2 networks and evolving EU integrity and accounting rules; and iii) positioning Germany to contribute technology, services, and governance approaches that support scaling in Europe and internationally.

4.3.1 Transitioning to a mature CDR market

Large-scale deployment will require moving from one-off support to durable market structures that provide long-term revenue visibility, protect integrity, and lower financing costs.

Key activities

- Establish durable demand mechanisms that provide multi-decade revenue visibility for high-quality CDR (e.g., regular procurement rounds, CCfDs, and compliance markets).
- Standardise the market: harmonise quality tiers, MRV requirements, registry practices, and model contracts to reduce transaction costs and enable portfolio financing.
- Shift from predominantly grants to market-based support: reduce reliance on ad-hoc CAPEX grants as delivery reliability increases, while maintaining targeted risk-sharing for remaining early scaling segments.

Indicative stakeholders

- *Federal ministries:* BMUKN, BMWE and BMF.
- *Market-building institutions:* designated procurement function and implementing entities.
- *Technical and oversight bodies:* standards bodies; registries; accredited verification bodies.
- *Finance sector*: lenders, institutional investors, insurance and guarantee providers.
- Market actors: CDR developers and operators.

Readiness: Medium. Key building blocks can be developed in the late 2020s, but full implementation depends on market maturity, EU rule evolution, and the availability of CO_2 transport and storage at scale.

4.3.2 Integrating with European CO_2 networks and positioning Germany internationally

By the 2030s, German CDR scaling will increasingly depend on European interoperability, both for physical access to CO_2 transport and storage and for how removals are certified, transferred, and recognised across international jurisdictions. Clear, aligned rules can reduce legal and counterparty uncertainty, expand the set of feasible projects, and lower the cost of capital, while enabling Germany to capture value through technology, services, and standard setting.

Key activities

- Ensure German industrial clusters and CDR projects are connected to European transport and storage systems as they mature, via coordinated access and capacity arrangements.
- Align German approaches with evolving EU rules (including the CRCF, procurement programmes, and claims guidance) while advocating for a robust, high-integrity baseline.
- Support German firms across equipment, engineering, construction, and services by combining domestic reference projects (similar to Norway's Longship project).

Indicative stakeholders

- *Federal ministries:* BMWE, BMUKN and BMV; where relevant, BMF and BMFTR.
- *European institutions and processes:* relevant EU bodies and implementing partners.
- *Cross-border infrastructure actors:* corridor, hub, shipping and storage operators; partner governments and competent authorities in North Sea storage jurisdictions.
- I*ndustry and service providers:* industrial clusters, EPC, and MRV service providers.
- *Integrity and accountability stakeholders:* standards bodies, registries, accredited verifiers, and civil-society organisations.

Readiness: Low. Key building blocks can be developed in the late 2020s, but full implementation depends on market maturity, EU rule evolution, the availability of CO_2 transport and storage at scale, and significant public funding and private investment in the billions of EUR.

5. Mobilising Finance for the CDR Transition

Many CDR methods face high up-front capital requirements and elevated technology, delivery, and policy risks, while revenue is often uncertain and fragmented. A pragmatic finance strategy should therefore combine durable demand signals (to create revenue certainty), targeted public de-risking (to lower the cost of capital), and integrity-aligned market infrastructure (MRV, contracting, registries) so that, over time, scaling can be increasingly financed by private capital.

5.1 Design demand-side finance mechanisms

In the near term, demand-side support is likely to be most effective when it prioritises bankability and learning-by-doing. As delivery capability by CDR project developers and methodological standardisation increase, CDR support schemes, such as public-private procurement, can place greater weight on competitive allocation mechanisms that promote cost-effectiveness.

To address the combined funding gap and demand constraints, alongside revenue-stabilisation, policymakers – building on the measures referenced in Chapter 4, – should consider to:

- Establish a credible "buyer of record" function that can aggregate demand and sign multi-year offtake agreements for high-quality removals, potentially implemented through an existing public institution with contracting capacity and financial expertise (for example a development bank or a designated procurement entity).
    - This function could also enable public procurement by federal, Länder and municipal entities through standardised guidance and contracting templates.
    - It could interface with voluntary buyer coalitions by offering due diligence support, portfolio aggregation and contracting assistance, rather than replacing private demand initiatives.
- Use offtake-based procurement as the default near-term tool for pilots and early scale-up, potentially complemented by pragmatic milestone-based payment structures and targeted risk-sharing to reduce counterparty and delivery risk.
- Provide clear guidance to participating buyers on acceptable use and claims during the pre-compliance period, aligned with evolving EU rules and high-integrity practices, to reduce reputational and policy uncertainty.
- Clarify accounting and reporting for CDR pathways, particularly biomass-based CDR, spanning land-use, energy and industrial systems, and the treatment of temporary sinks.

5.2 Address risk across the project lifecycle

Different financing tools are needed throughout the CDR project lifecycle, with instruments matched to the dominant risks at each stage (technology, delivery, policy, and demand risks). Relevant support mechanisms include the following non-exhaustive set of instruments, selected for their relevance to the risk profile at each stage:

- Early R&D and pilots: grants; technical assistance; challenge prizes and accelerators (to reduce technical uncertainty and build capability).
- First-of-a-kind and early scaling projects: long-term offtake (like via advance market commitments); CCfDs or similar revenue-stabilisation tools; concessional loans and loan guarantees; time-limited per-tonne support (such as outcome-based "reverse tax credits" or feed-in-tariff style support) where appropriate.
- Scaling and market maturation: public CDR investment vehicles (including public or blended funds); targeted public support for building enabling infrastructure where market coordination is weak; transition over time toward higher reliance on competitive allocation and long-term market rules.

6. Conclusion

Germany has the technical capabilities and industrial base to play a leading role in the responsible deployment of durable carbon dioxide removal in Europe. However, without progress on national strategic clarity, CO_2 transport and storage access, investable demand signals, and a broad social licence, CDR risks remaining peripheral to Germany's core climate and industrial policy delivery.

This roadmap sets out a strategic approach built around three pillars: 1) establishing a coherent policy architecture (ambition, accounting treatment, and integration across relevant strategies and instruments); 2) introducing support schemes for pilots and early scaling (with costs, bankability, demand, and infrastructure as central constraints); and 3) preparing for large-scale deployment and an international role (aligned with evolving EU integrity rules and cross-border CO_2 networks).

To translate this agenda into delivery, near-term priorities should include:

Confirm a credible CDR role consistent with Germany's climate targets, including decision points on accounting treatment and use cases.

Institutionalise coordination and i**mplementation ownership across federal ministries and Länder**, with a clear mandate to track progress and resolve cross-cutting bottlenecks.

Operationalise high-integrity MRV and **environmental safeguards** in a method-specific way, and **embed** these requirements **into public support instruments** from the outset.

Create revenue certainty for early projects through demand-side instruments and risk-sharing that enhance bankability for first-of-a-kind and early-scaling projects.

Move CO_2 transport and storage from planning to investable access pathways, including pragmatic cross-border solutions, while domestic options mature.

Strengthen social legitimacy and **public confidence** via local engagement, clear guardrails against mitigation deterrence, and credible communication of portfolio trade-offs.

Ultimately, success is likely to depend on sustained political commitment, coordinated execution across levels of government, credible resourcing, and constructive public–private collaboration. If Germany delivers on these conditions, it can credibly close its residual-emissions gap by 2045 and move toward net-negative emissions by 2050, while contributing technology, standards, and implementation lessons that support responsible CDR scaling in Europe and internationally

ABOUT

Carbon Gap

Carbon Gap was established as Europe's first philanthropically funded environmental advocacy organisation focused exclusively on carbon dioxide removal (CDR). The mission is to ensure that Europe becomes a leader in developing and deploying CDR solutions at scale in a safe and equitable manner to preserve a stable climate. Find out more on ***www.carbongap.org***

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Design: www.lunatrix.co.uk
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