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CCS in Germany:
Between Climate Goals and Reality

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CCS in Germany: Between Climate Goals and Reality

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1 Introduction

Limiting global warming requires a drastic reduction in emissions toward net-zero and, in the long term, even negative emissions.[1] There is broad international consensus that Carbon Capture and Storage (CCS) must play a central role in achieving these goals. In CCS, CO_2 is captured, for example, at industrial point sources, compressed to high pressure, and then transported by rail, truck, pipeline, or ship to a storage site. There, the CO_2 is permanently injected into and stored in deep geological formations.[2,3] In the context of CCS, Carbon Capture and Utilization (CCU) is also frequently discussed, in which the captured CO_2 is used as a raw material. However, since this type of use does not constitute permanent storage in the vast majority of cases and it is therefore difficult to achieve net-zero emissions, let alone negative emissions, CCU is not considered in this paper. CCS, on the other hand, is currently being considered particularly for sectors with hard-to-abate process emissions, as alternative decarbonization strategies are limited or, in some cases, impossible in industries such as cement, lime, and parts of the chemical industry.

Consistent pursuit of climate goals thus requires the expansion of CO_2 infrastructure, particularly pipeline networks and storage facilities.[4,5] The European Commission anticipates that CCS-based capture capacities must grow to over 100 Mt per year by 2050 (+2,800%),[5] in order to store hard-to-avoid emissions and even achieve negative emissions on a net basis. Therefore, as part of the Net-Zero Industry Act, the EU has set a binding target to create an annual injection capacity of at least 50 Mt CO_2 by 2030.[2] In comparison: Current storage capacities in Europe amount to approximately 7 Mt CO_2/year, and the projected capacity for 2030 is expected to be 42.70 Mt CO_2/year, slightly below the target of 50 Mt.[6] Furthermore, storage capacity of 73 Mt CO_2/year is already estimated to be required for German emitters alone by 2045 in order to meet Germany's climate targets.[7]

While international pioneers such as Norway and the Netherlands are initiating the first large-scale commercial CCS storage projects in collaboration with gas and oil companies, Germany has so far remained passive despite its emission-intensive industry. CCS projects in Germany are predominantly in early planning or development phases, while only one demonstration project (LEILAC-2) for CO_2 capture at a cement plant is under construction. No CO_2 storage projects are currently planned in Germany, though there are initiatives in the areas of transport and capture.[8] The energy company Exxon Mobil is evaluating a potential

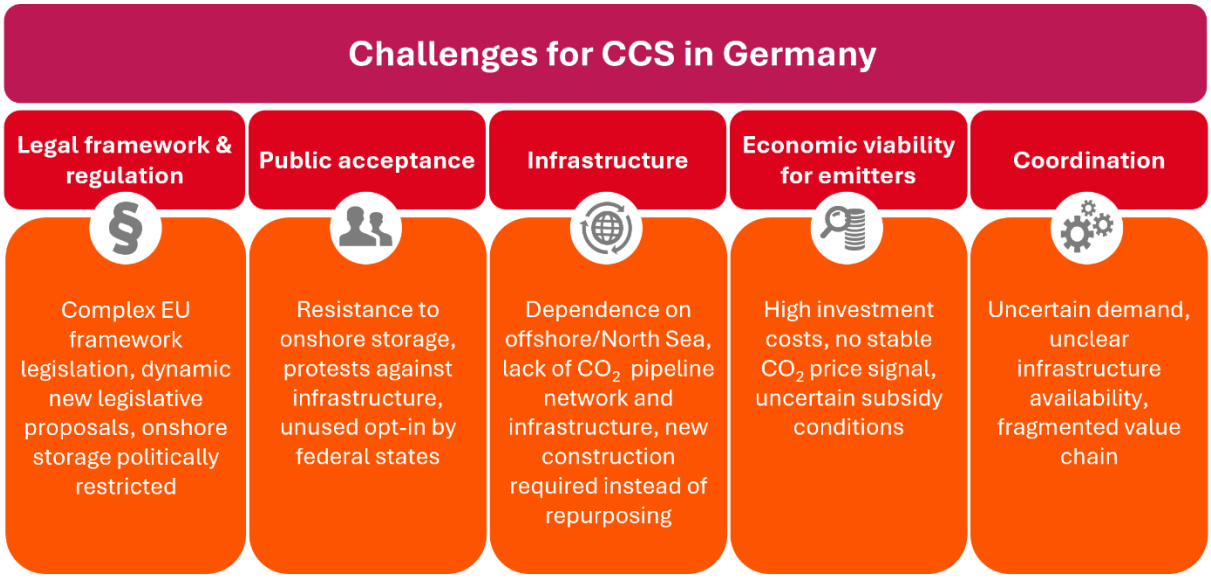

Figure1: Overview of the obstacles to the ramp-up of CCS in Germany.

CO_2 storage project in the German North Sea through its subsidiary BEB and has submitted an application for a geological survey of an area within the exclusive economic zone. The goal is to assess the suitability

of the subsurface for permanent CO_2 storage over the next five years, although the project is still in an early exploratory phase. This limited progress in planning and implementation stands in contrast to the ambitious goals and high storage demand.

Against this backdrop, this paper outlines the key obstacles currently hindering the ramp-up of CCS in Germany (see**Fehler! Verweisquelle konnte nicht gefunden werden.** Figure 1): To this end, the paper first examines the current legal framework and regulations for CCS in Germany and then briefly addresses the obstacles related to public acceptance. The paper then addresses the status and problem areas regarding infrastructure, emitters, and the coordination of these, before offering an outlook on the next steps for CCS in Germany.

2 Barriers to CCS in Germany

2.1 Legal Framework for CCS in Germany

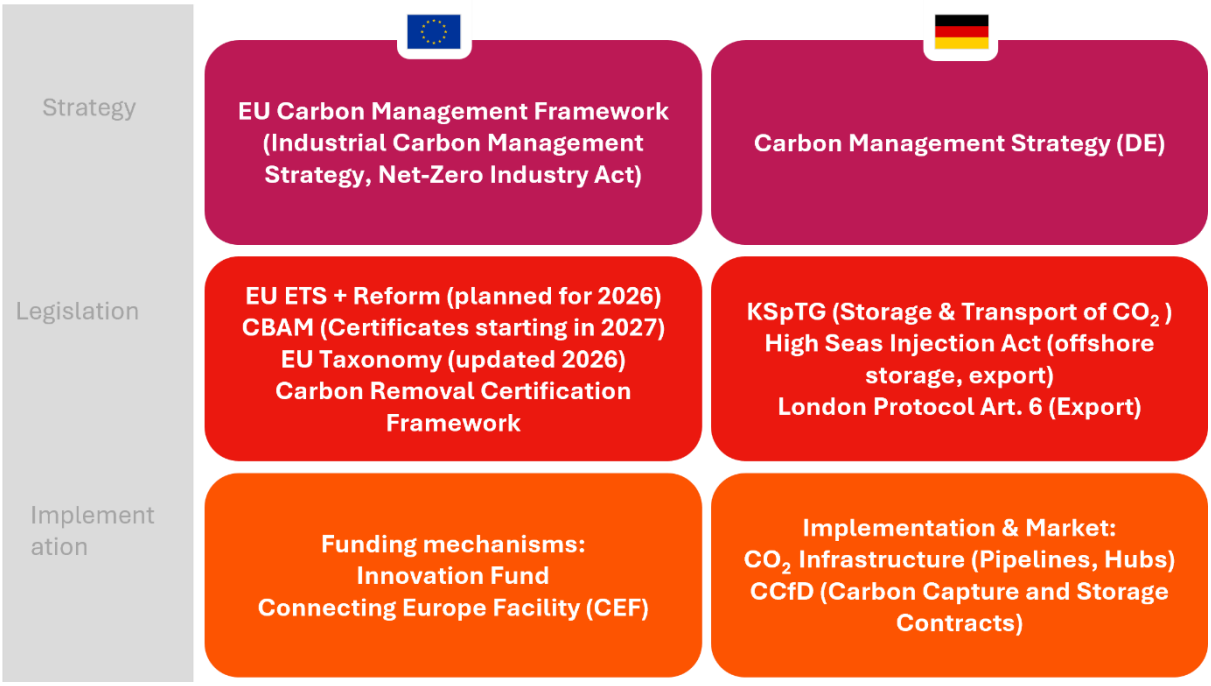

Figure2: Regulatory framework for CCS in the EU and Germany.

2.1.1 European Union

The drivers for promoting and regulating Carbon Capture, Utilization, and Storage (CCUS) in Germany in 2026 will continue to be the complex regulations under European law, the EU Industrial Carbon Management Strategy as a **strategic framework for CCS**, **legislation** governing CO_2 certificates, market, and trading (EU Taxonomy Regulation, EU Emissions Trading System, CBAM), the various **EU funding mechanisms** (in particular the Innovation Funds and the Connecting Europe Facility as the main sources of funding for the development of cross-border carbon dioxide networks), and the Net-Zero Industry Act as a funding mechanism for European key technologies. [9]

The status of the legislation is as follows:

- As expected, the regulatory phase of the EU CO_2 Carbon Border Adjustment Mechanism (CBAM) began in January 2026. CBAM certificates must be purchased starting in 2027.
- With the Delegated Regulation of February 3, 2026, to Regulation (EU) 2024/3012, the European Commission further developed the European certification framework for CO_2 removals and, for the first time, established specific certification methods for permanent CO_2 removals.
- The EU taxonomy was revised as part of the so-called omnibus procedure at the beginning of the year and simplified in many respects.
- A legislative proposal from the European Commission on the reform of emissions trading is expected in mid-2026, which is intended to fundamentally reform the system. A key focus is on the integration of permanent negative emissions.
- Three months later, in the third quarter of 2026, a legislative proposal is expected for the development of CO_2 infrastructure and markets, specifically including regulations on grid access and tariff structuring, standards for cross-border services, the harmonization of permitting procedures, multimodal transport, and, where applicable, financing incentives.

2.1.2 National Implementation in Germany

At the national level, the CDU/SPD federal government has essentially continued the previous government's carbon **management strategy** in 2025 and 2026.

There have also been significant developments in **legislation** in recent months:

- In particular, the relevant laws governing the transport, storage, and export of CO_2 have entered into force. The Carbon Dioxide Storage and Transport Act (KSpTG) – whose name has now been sensibly amended – will enable the permanent storage of carbon dioxide in underground rock formations for commercial purposes in the future. [10] At the same time, the law establishes a uniform legal framework for the transport of carbon dioxide via pipelines for the first time.
- In January 2026, the Bundestag supplemented this by amending the High Seas Disposal Act to establish the legal framework for CO_2 export by sea and the storage of CO_2 beneath the seabed. [11] It remains to be seen to what extent the European legislative proposals outlined above will necessitate adjustments in the near future.
- The Bundestag has passed the Act ratifying an amendment to Article 6 of the Protocol of November 7, 1996, to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Protocol) to enable the export and storage of CO_2 in the seabed. [11] The relevant amendment has not yet entered into force under international law, as it has not yet been ratified by the required two-thirds of the contracting states. However, the London Protocol provides for the possibility of provisional application, provided that the states concerned – for example, the exporting country and the importing country in whose territory the storage site is located – conclude separate, more detailed agreements. This option is to be utilized, and to the authors' knowledge, corresponding international agreements are currently being negotiated.

Progress is also being made on **implementation**: In December 2025, the preparatory process for the second round of the bidding procedure for CO_2 differential contracts (climate protection contracts) was launched. Unlike in the first round, CCUS projects are now also eligible for funding.

Interim Conclusion

The legal framework for CCS in Germany has become significantly more concrete: At the EU level, certification, market integration, and infrastructure regulation are being further developed, while Germany has established key legal prerequisites with the KSpTG and the regulations on CO_2 exports. As a result, CCS is increasingly moving from strategic discussion toward the possibility of practical implementation.

2.2 Social Acceptance

Public acceptance of CCUS is likely to vary depending on the specific project.

While CCU projects are likely to benefit from the generally positive attitude toward the circular economy, pipeline projects, the necessary storage sites, and final disposal sites on land and on the high seas – insofar as they are within German territorial waters – are expected to be viewed more critically. In Northern Germany, protests already arose when the amendment to the High Seas Disposal Act was passed. However, protest groups have also formed against onshore storage sites over the past decade.

Interim Conclusion

Social acceptance of CCUS is likely to vary greatly depending on the application. While CCU tends to be viewed positively, CO_2 infrastructure and storage sites are expected to face greater reservations.

2.3 Infrastructure: Transport and Storage Bottlenecks

Despite the opening of the legal framework in Germany, the unresolved outlook for storage and transport remains a key obstacle to the ramp-up of CCS: For onshore storage, the states would have to give their consent under the opt-in solution. However, the states are largely cautious in their responses: Schleswig-Holstein has rejected onshore storage, citing risks to groundwater and drinking water. Saxony has at least signaled interest but likely lacks suitable geological formations. In contrast, Baden-Württemberg has stipulated in its coalition agreement that it intends to use the opt-in solution. Bavaria is also exploring such possibilities.[12] Even if storage sites become available in the South, priority will in practice be given primarily to offshore storage in the exclusive economic zone, which will, of course, also compete with other forms of use, such as wind energy. All in all, the prospects for domestic storage thus remain limited both politically and geographically.

Given the limited domestic storage options, efficient transport options for German CO_2 are becoming increasingly important. However, even on a pan-European scale, only a few operational CCS chains exist so far, such as Sleipner and Snøhvit in Norway and the OCAP network in the Netherlands. Compounding the issue is the fact that existing CH_4 infrastructure cannot be easily repurposed for CO_2, meaning that new construction projects are particularly necessary.[13] Unlike with the gas or electricity grid, there are currently no remuneration models – and thus no viable business cases – for CO_2 network investments, at least in Germany.

Since storage and hub projects are primarily being developed outside of Germany, the ramp-up of German CCS depends on integration into a European system: The Northern Lights project off the Norwegian coast, with a capacity of over 100 million tons of CO_2 is operational and began in 2025. Porthos near Rotterdam,

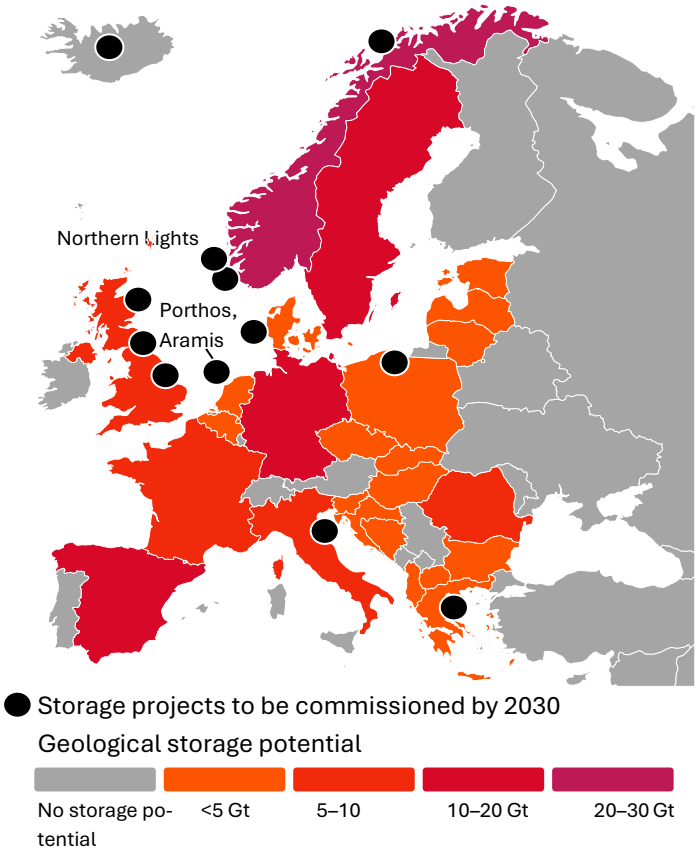

Figure3: Geological storage potential and storage projects in Europe [17]

with a capacity of 37 million tons of CO_2 is under construction and is scheduled to go into operation in 2026. The Delta Rhine Corridor is intended to transport CO_2 from Germany and the Netherlands to offshore storage sites in the Dutch North Sea, particularly Porthos and ARAMIS (starting in 2030), beginning in 2033.[14]

These storage projects in the North Sea were made possible primarily through structural funding. Investments in storage and transport infrastructure with a very long lifespan and high capital costs require a high degree of certainty: both that the infrastructure will develop in an economically viable manner and that it will be booked, utilized, and thus not become a stranded asset. Consequently, infrastructure operators think in even longer cycles than is the case with investment decisions on the part of industrial emitters.

Interim conclusion

The rollout of CCS in Germany is currently being slowed by the lack of – or at least the limited availability of – storage and transport options. Since domestic storage facilities are currently neither politically nor practically available on a significant scale, the development of viable cross-border CO_2 infrastructure and robust business models has become a key prerequisite for implementation.

2.4 Economic challenges and lack of incentives on the part of emitters

Investment decisions for or against CCS rest largely with the emitters, as CO_2 capture must be financed at the industrial or waste site. For individual facilities – such as cement, lime, chemical, or waste-to-energy plants – this creates a fragmented value chain: A company is expected to invest in CO_2 capture but relies on external infrastructure for transport and storage, which may in some cases be located abroad.

Currently, however, CCS is not economically attractive enough for many emitters. The costs of capture, conditioning, and grid connection are not expected to be reliably covered by savings on ETS costs or other revenues in the foreseeable future. There is thus a lack of a credible private-sector price signal, while abstract macroeconomic climate targets or climate impact costs do not yet create short-term pressure for action within industrial companies. Furthermore, political decisions are often conceived in terms of legislative cycles, whereas industrial investment decisions are made for decades. Companies must therefore expect that subsidy schemes, regulations, and CO_2 price assumptions will remain uncertain over the lifetime of a facility.

This is one of the reasons why it remains unclear to many companies what role CCS will play in the transition compared to other decarbonization pathways such as electrification, hydrogen, or process conversions. Above all, it remains to be seen which approaches will prove viable from a business and regulatory perspective. This makes a clear definition of hard-to-abate emissions – that is, emissions that cannot be avoided technically or can only be avoided at very high costs – all the more important. This distinction must be clearly defined in legislation so that emissions that are actually avoidable do not continue to be permitted by citing future CCS possibilities. The expected capture demand (see Table1) nevertheless shows that CCS will remain relevant for certain sectors. By 2045, approximately 14 million tons of CO_2 per year are estimated for cement and lime processes, around 15 million tons of CO_2 per year for waste incineration, and 27 to 33 million tons of CO_2 per year for the chemical industry. Overall, the total required CO_2 capture is estimated at approximately 73 million t CO_2 per year.[15,16,7]

Table1: CO_2 capture requirements through 2045 in various sectors.[15,16,7]

Category		Sector/Element	CO_2 capture requirements by 2045*
Hard-to-abate sectors		Cement & Lime (Process Emissions)	~14 million t CO_2/year
		Waste incineration	~15 million t CO_2/year
		Chemicals	27–33 million t CO_2/year (also used for CCU instead of storage)
Total CCS demand		Total required capture	<73 million t CO_2/year

* The exact storage requirement depends on the ratio between CCU and CCS

Interim conclusion

For industrial emitters, CCS remains an uncertain investment path: high upfront costs are compounded by a lack of infrastructure, volatile regulatory and price signals, and unclear prospects for funding. At the same time, projected capture requirements indicate that CCS is likely to remain a key solution for certain hard-to-abate sectors. What companies lack are long-term, reliable policy frameworks featuring either economic incentives (“carrot”) or a credible threat of penalties (“stick”).

2.5 Coordination Problem: Infrastructure and Demand

The uncertainties described above converge into a coordination problem. Because neither price, funding, nor infrastructure prospects are sufficiently robust, many emitters are postponing their investment decisions. At the same time, without reliable demand, no viable business models for transport and storage can emerge. Without available transport and storage infrastructure, in turn, emitters will not invest in capture

facilities. The CCS ramp-up thus suffers from a classic chicken-and-egg problem: capture, transport, and storage must develop in parallel, but are planned, financed, and regulated by different actors. The consequences of the lack of opportunities to utilize CCS, in turn, will only become apparent after a delay—for example, in the form of excessively rising CO_2 prices, failure to meet climate protection targets, and ultimately high climate-related costs.

The weak demand for CCS is therefore not solely a result of high costs. It reflects a lack of economic and regulatory reliability. As long as companies cannot assume that infrastructure, subsidies, and regulatory approval will be available in a timely and sustainable manner, investing in CO_2 capture remains risky. Conversely, infrastructure operators will not finance large-scale transport and storage projects without robust demand. The ramp-up of CCS thus risks failing not because of a single component, but rather due to the lack of synchronization across the entire value chain.

Interim Conclusion

To date, the ramp-up of CCS has failed primarily due to a coordination problem along the entire value chain. Without reliable demand, transport and storage infrastructure will not be built—and without this infrastructure, investments in CO_2 capture remain mere ideas for emitters. Additional governance is therefore needed to achieve the socio-political goal of decarbonization.

3 Summary and Outlook

In Germany, CCS is increasingly viewed as a necessary tool for reducing industrial emissions that are difficult to avoid. Despite a significantly more developed legal framework, however, the ramp-up remains stalled. The reasons for this do not lie in a single obstacle, but in a combination of factors: a lack of public acceptance, limited storage prospects, a lack of transport infrastructure, insufficient economic incentives, a lack of confidence in the reliability of political decisions, and unresolved coordination issues. Currently, there is neither a sufficiently robust economic incentive for emitters to capture CO_2 nor a secure business model for infrastructure providers to build transport and storage infrastructure.

Crucial to further development will therefore be whether the EU and the German government create a stable economic and regulatory framework with the announced Carbon Management Action Plan. Since the CO_2 price alone is currently hardly sufficient as an investment incentive, additional funding instruments and a clear prioritization of eligible sectors are likely to be central. Only if regulation, infrastructure planning, and funding are better coordinated can investment decisions for CCS in Germany be significantly accelerated. Otherwise, while CCS remains necessary from a climate policy perspective, it will continue to be, in practice, a tool caught between policy objectives and implementation gaps.

01 Appendix

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