

2024 BRIEF

CCS IN GERMANY'S DECARBONISATION PATHWAY: STATE OF PLAY AND WAY FORWARD

MARCH 2024



GLOBAL CCS
INSTITUTE

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Acronyms

BDI	Federation of German Industries	EU	European Union
BECCS	Bioenergy with carbon capture and storage	Ffe	Research Center for Energy Economics
CCfD	Carbon contract for difference	GHG	Greenhouse gases
CCS	Carbon capture and storage	NABU	Nature and Biodiversity Conservation Union
CCUS	Carbon capture, utilisation and storage	NECP	National energy and climate plan
CO₂	Carbon dioxide	OGE	Open Grid Europe
DAC	Direct air capture	PCI	Project of Common Interest
DGB	German Trade Union Confederation	PMI	Project of Mutual Interest
ETS	Emissions trading system	WWF	World Wildlife Fund

Acknowledgements

This report was prepared by the Global CCS Institute. Mathilde Blanchard, Daniela Peta, and Ellina Levina were the main authors. Ellina Levina provided overall guidance and oversight of this publication. The authors are grateful to Bruno Gerrits, Client Engagement Manager Europe for support and input. Valuable comments and feedback were provided by Iris Rieth-Menze (State Agency for Energy and Climate Protection in North Rhine-Westphalia), Katja Witte (Wuppertal Institute), Martin Albicker (German Energy Agency Dena), Dr. Martin Volmer (Lhoist), Jana Psarska (Drax). The report was edited by Wendy Wells and designed by Creative Instinct.

1.0 KEY TAKEAWAYS

- In February 2024, a gradual shift in Germany's take on carbon capture and storage (CCS) that has been observed since late 2022 culminated in a complete turnaround towards embracing CCS as an indispensable climate mitigation option. On 26 February, the German Federal Ministry for Economic Affairs and Climate Action announced the key points that will be included and further clarified in the upcoming country's Carbon Management Strategy, highlighting the important role CCS and CCU technologies are expected to play in meeting the country's ambition to reach carbon neutrality.
- In 2023, Germany, the largest economy and CO₂ emitter of the European Union (EU), repositioned CCS as part of its climate and industrial agenda after many years of reluctance. Nonetheless, the regulatory landscape surrounding CCS, notably outlined in the Carbon Dioxide Storage Act, did not allow its development. The situation is changing: alongside the key points of the carbon management strategy, the Federal Government presented a draft bill to amend the Carbon Dioxide Storage Act to pave the way for progress in this area.
- The country's target of achieving climate neutrality by 2045 has been a critical factor in this shift in approach. CCS is set to play a vital role in the decarbonisation of select industries – e.g., cement, lime, waste incineration – in tandem with renewable electricity, green hydrogen and energy efficiency measures.
- The government's recent announcement builds on the results of the evaluation report on the Carbon Dioxide Storage Act, which was published by the German Federal Ministry of Economics and Climate Protection at the end of 2022, as well as a broad stakeholder dialogue undertaken by the Federal Government from March to August 2023.
- In 2023, Germany repositioned CCS as part of its climate and industrial agenda after many years of reluctance. The focus is on CO₂ capture and transport that would enable Germany to export its CO₂ to countries with storage resources. At the cross-border level, the ratification of the amendment to Article 6 of the 2009 London Protocol would be needed to allow Germany to export its CO₂ by sea. As shown by the key points of the German Carbon Management Strategy, the Federal Government is also considering exploring and allowing offshore CO₂ storage sites in the German Exclusive Economic Zone (EEZ) or continental shelf.
- The German Federal Government has been collaborating with European counterparts to advance multilateral and bilateral collaboration in the field of CCS. Further international agreements would be needed for the cross-border transport of CO₂.
- Additional work is also needed to facilitate the development of CO₂ infrastructure, implement support mechanisms for CCS projects, and improve stakeholder's and public perception of and confidence in CCS as a climate mitigation measure.

2.0 INTRODUCTION

As the world grapples with the escalating challenges posed by climate change, 2023 and early 2024 have been pivotal for carbon capture and storage in the EU. The European Commission spearheaded last year a series of policy proposals recognising the role of CCS as a strategic net-zero technology, notably through the Green Deal Industrial Plan¹ and the Net-Zero Industry Act², and made further progress in funding such projects thanks to the Innovation Fund or Connecting Europe Facility – Energy. In early 2024, the Commission also released its EU Industrial Carbon Management Strategy, proposing a comprehensive approach to address all aspects of the CO₂ value chain.

Germany, the EU's largest economy and CO₂ emitter, has also embraced this momentum by strategically repositioning CCS in its climate and industrial agenda. The federal target of achieving climate neutrality by 2045 has been a critical factor in reigniting the debate around this technology after many years of reluctance. The first wave of CCS projects is now taking shape. Support starts emerging from federal and regional governments and through international collaboration with other European counterparts.

This high-level insight stems from a meeting organised by the Global CCS Institute and its select members in Düsseldorf on 31 January 2024. The report reflects the Federal Government's announcement of 26 February that unveiled key points of the upcoming and long-awaited carbon management strategy, making a crucial step on the country's decarbonisation pathway.

THE FIRST WAVE OF CCS PROJECTS IS NOW TAKING SHAPE.



¹ Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. A Green Deal Industrial Plan for the Net-Zero Age, COM/2023/62 final

² Proposal for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act), COM/2023/161 final

3.0 ROLE ENVISIONED FOR CCS IN GERMANY

In 2021, Germany enshrined in law a target to achieve climate neutrality by 2045.³ To fulfil this objective, the country must reduce greenhouse gas (GHG) emissions by at least 65% by 2030 and 88% by 2040 compared to the 1990s level. As of 2022, GHG emissions totalled 746 million tonnes of CO₂ equivalent, reflecting a reduction of around 40% [Figure 1].

The primary source of emissions (around 34%) is the energy sector, largely attributed to the combustion of fossil fuels in coal and gas power plants.⁴ Although CCS can play a critical role in curbing emissions from power generation, the country is firmly committed to a strategy prioritising the consumption of renewable electricity and green hydrogen.⁵

Another significant lever is the industrial sector, which accounted for roughly 22% of Germany's emissions in 2022. The role of CCS in this field is a subject of ongoing discussion among national stakeholders⁶, with indications that it may be prioritised for application in hard-to-abate industries facing challenges in decarbonisation due to the lack of alternative technological pathways.

National champions like HeidelbergMaterials and BASF are contemplating its application in the cement and chemical sectors as a substitute for surrendering emission allowances in the context of high EU emissions trading system (ETS) prices. The German Environment Agency also recommends the application of CCS in waste management, which contributes around 4% of the total German emissions.⁷

Germany needs to clarify these considerations in the updated National Energy and Climate Plan (NECP) that the Federal State submitted in November 2023⁸ and will finalise by 30 June 2024. The current draft underscores research and development in the realm of carbon capture, storage and utilisation (CCUS), cooperation with other North Sea countries on CO₂ storage and utilisation in the context of the North Sea Basin Task Force, as well as funding support for CCUS through the Innovation Fund. However, a clear and comprehensive roadmap needs to be formulated for carbon management.

The European Commission, in its assessment of the draft NECP⁹, has thus recommended that Germany provide information on the annual volumes of CO₂ to be captured by 2030 categorised by sources, planned CO₂ transport infrastructure, and potential for domestic CO₂ storage capacity along with injection volumes that could be available by 2030.

³ Federal Climate Change Act of 12 December 2019, Federal Law Gazette I, p. 2513, as last amended by Article 1 of the Act of 18 August 2021, Federal Law Gazette I, p. 3905.

⁴ The energy sector represented 256 Mt of CO₂ in Germany in 2022 [Figure 1].

⁵ Green hydrogen refers to hydrogen produced through electrolysis of water using renewable electricity.

⁶ The German Federal Government is expected to provide more clarifications on the role of CCS in the industry with the publication of its national carbon management strategy. Please see Part IV.A. for more information.

⁷ German Environment Agency (2023) Carbon Capture and Storage: Contribution to the discussion on its integration into national climate action strategies, position paper, September 2023. Available at: https://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/uba_pos_ccs_engl.pdf

⁸ German Federal Government (2023) Draft update of the integrated national energy and climate plan. Available at: <https://commission.europa.eu/system/files/2023-11/GERMANY-%20DRAFT%20UPDATED%20NECP%202021-2030%20EN.pdf>

⁹ Commission Recommendation of 18/12/2023 on the draft updated integrated national energy and climate plan of Germany covering the period 2021-2030 and on the consistency of Germany's measures with the Union's climate-neutrality objective. Available at https://commission.europa.eu/document/download/f4607ccb-1a19-4428-8b2b-3eb02a35e747_en?filename=Recommendation_draft_updated_NECP_Germany_2023.pdf

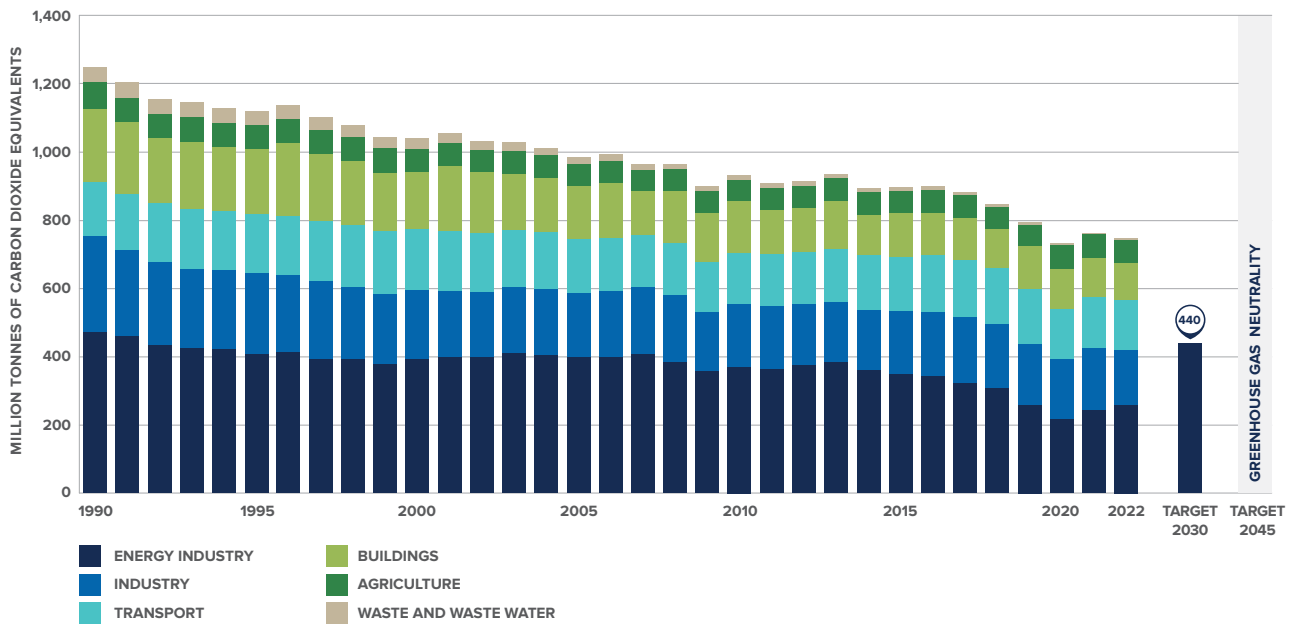


Figure 1 – Emission of greenhouse gases covered by the UN Framework Convention on Climate in Germany¹⁰



GERMANY IS FIRMLY COMMITTED TO A STRATEGY PRIORITISING THE CONSUMPTION OF RENEWABLE ELECTRICITY AND GREEN HYDROGEN.

¹⁰ Adapted from German Environment Agency (2023) Emissions of greenhouse gases covered by the UN Framework Convention on Climate. Available at: <https://www.umweltbundesamt.de/en/data/environmental-indicators/indicator-greenhouse-gas-emissions#at-a-glance>

4.0 CCS POLICY DEVELOPMENTS IN GERMANY

Germany's commitment to achieving climate neutrality by 2045 has fueled a sense of urgency. Since then, this led to the reevaluation and reinforcement of policies governing CCS both at the federal and Länder levels¹¹ in 2023. A recent announcement made on 26 February 2024 by the German Federal Government on the key points of its national Carbon Management Strategy sent a strong signal that CCS and CCU technologies will play an important role in the country's transition towards carbon neutrality.¹²

4.1 At the federal level

The German Federal Government has been taking substantial steps to foster the development of CCS projects, setting the scene for the upcoming national Carbon Management strategy. Originally slated for release in June 2023, the publication was rescheduled to 2024 partly to coincide with the EU Industrial Carbon Management strategy, thus allowing for a harmonised approach towards addressing GHG emissions on both the European and national fronts.

Following the release of the EU strategy on Industrial Carbon Management on 6 February 2024¹³, the German Federal Minister for Economic Affairs and Climate Action, Robert Habeck unveiled on 26 February 2024 the key points of its national Carbon Management

strategy.¹⁴ The Federal Government also proposed a draft bill to amend the Carbon Dioxide Storage Act¹⁵, a legislation adopted in 2012 to transpose the EU CCS Directive into German national law and regulate CCS exploration and demonstration projects.

The first step leading to this new milestone took place in December 2022, when the German Federal Ministry of Economics and Climate Protection released an evaluation report of the Carbon Dioxide Storage Act, 10 years after the legislation was introduced. While the document outlined CCS as a mature and tested technology, it also identified several hurdles within the German legal framework that could hinder the adoption of this technology, such as the restricted application deadline for storage permit requests that was set for the end of 2016.¹⁶ No storage applications were submitted by this date, and the new ones may no longer be accepted as the deadline has expired. Moreover, a provision enabled Länder to ban onshore CCS within their jurisdiction, a clause exercised by several regional states, including Lower Saxony, Mecklenburg Vorpommern and Schleswig Holstein. The recent announcement on the national Carbon Management strategy's key elements and the draft bill amending the Carbon Dioxide Storage Act marks a critical step in setting the scene to enable CO₂ capture, transport, utilisation and offshore storage in the country.

¹¹ Germany is a federal state which relies on various layers of governance. Among them, the Federal Government and the 16 Länder (i.e., regional states) have their own areas of responsibility.

¹² BMVK (2024) Habeck will den Einsatz von CCS ermöglichen: „Ohne CCS können wir unmöglich die Klimaziele erreichen.“ BMWK legt Eckpunkte einer Carbon Management Strategie und den Entwurf zur Änderung des Kohlendioxid-speicherungsgesetzes vor. Available at <https://www.bmwk.de/Redaktion/DE/Pressemitteilung/en/2024/02/20240226-habeck-will-den-einsatz-von-ccs-ermoeglichen.html>

¹³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the committee of the regions, Towards an ambitious Industrial Carbon Management for the EU, COM(2024) 62 final. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2024%3A62%3AFIN&qid=1707312980822>

¹⁴ BMVK (2024) Eckpunkte der Bundesregierung für eine Carbon Management-Strategie. Available at https://www.bmwk.de/Redaktion/DE/Downloads/E/240226-eckpunkte-cms.pdf?__blob=publicationFile&v=8

¹⁵ BMVK (2024) Entwurf eines Ersten Gesetzes zur Änderung des Kohlendioxid-Speicherungsgesetzes. Available at https://www.bmwk.de/Redaktion/DE/Downloads/Gesetz/20240226-referentenentwurf-cms.pdf?__blob=publicationFile&v=10

¹⁶ BMVK (2022) Bundeskabinett beschließt Evaluierungsbericht zum Kohlendioxid-Speicherungsgesetz (KSpG). Available at <https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2022/12/20221221-bundeskabinett-beschliesst-evaluierungsbericht-zum-kohlendioxid-speicherungsgesetz-kspg.html>



Under the key elements laying the foundation of the strategy and the proposed legal changes still to be adopted by the Cabinet, the German Federal Government showed its intention to remove barriers to the application of CCS/CCU in sectors responsible for generating unavoidable emissions, including those where the switch to electrification or hydrogen cannot be yet conducted in a cost-effective way.

The Federal Government also aims to set the necessary conditions to allow the transport of CO₂, as well as enable its cross-border movement for the purpose of offshore storage. While permanent onshore CO₂ storage in Germany remains unauthorised, there is an intention to explore and allow offshore storage sites in the German Exclusive Economic Zone (EEZ) or continental shelf, considering safety standards and ecological criteria. The Federal Government is also willing to create a legal basis in the CO₂ Storage Act that would allow individual Länder to have an opt-in option to allow permanent onshore CO₂ storage within their region.

In order to complement the efforts undertaken to revisit and strengthen the CCS policy framework during 2023, the Federal Government launched a €50 billion programme dedicated to decarbonising its prized heavy industry.¹⁷ Following a preparatory phase that commenced in June 2023, the country plans to introduce a Carbon Contract for Difference (CCfD) scheme that compensates heavy industries for the extra cost of climate-friendly production. This public support will be crucial in deploying CCS technologies at this early stage.

Concurrently, Germany has also made revisions to its national hydrogen strategy, introducing provisions to support applications relying on blue hydrogen produced from fossil fuels with CCS during the ramp-up phase of the hydrogen market.

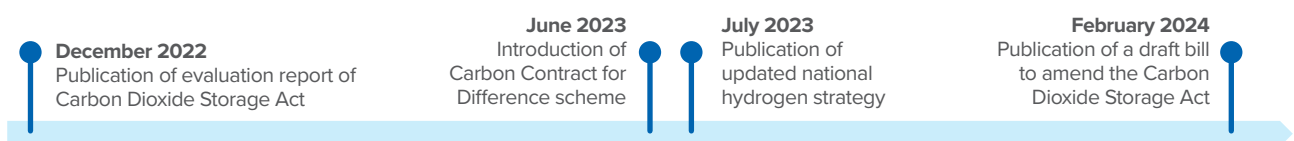


Figure 2 – Recent CCS-related federal policy developments in Germany

¹⁷ Euractiv (2023) 'Berlin launches €50 billion 'climate contracts' for industry', 5 June 2023. Available at: <https://www.euractiv.com/section/energy-environment/news/berlin-launches-e50-billion-climate-contracts-for-industry/>

4.2 At the Länder level

Recognising the need for local strategies to complement federal efforts, several Länder have been considering CCS in their regional policies lately, including some that imposed a ban during the transposition of the CCS Directive at the national level:

- In North Rhine-Westphalia, a region traditionally associated with heavy industries, the Ministry of Economic Affairs, Innovation, Digitalisation and Energy of the State embraced its own Carbon Management strategy¹⁸ in October 2021. This included provisions such as advancing the CO₂ infrastructure planning in North Rhine-Westphalia, campaigning at the federal level to adapt the legal framework, especially the Carbon Dioxide Storage Act, as well as strengthening national and international cooperation.
- In Bavaria, which committed to reaching climate neutrality by 2040, the significance of a regional CO₂ infrastructure has been recently underscored by the State Minister of Economic Affairs, Regional Development, and Energy, Hubert Aiwanger.¹⁹ This acknowledgement aligns with the findings of a study released by the Research Center for Energy Economics (Ffe) in October 2023 which highlights the pivotal role of CCS in this Länder in addressing unavoidable emissions from the cement, lime, and waste incineration sectors.²⁰
- In Schleswig-Holstein, the Prime Minister Daniel Günther and the Minister for Energy Transition, Climate Protection, Environment and Nature Tobias Goldschmidt have reconsidered their early position and now voiced support for CCS in Germany.^{21, 22}

4.3 Other developments

Beyond developments at the federal and Länder levels, CCS is also gaining traction in internal politics. As an illustration, in its manifesto for the 2024 EU elections, the German Green Party embraces this technology as a solution for addressing hard-to-abate GHG emissions, particularly in specific industrial processes like cement production.²³

More recently, in January 2024, two environmental organisations – the Nature And Biodiversity Conservation Union (NABU) and the World Wildlife Fund (WWF) –, the German Trade Union Confederation (DGB) and the Federation of German Industries (BDI) issued a joint appeal for a comprehensive carbon management strategy in Germany.²⁴ The endorsement of the document by DGB can also serve as an indication of the support of the social democrats.²⁵

¹⁸ Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North-Rhine Westphalia (2021) Carbon management for climate protection. The Carbon Management strategy of North Rhine-Westphalia. Available at: https://www.wirtschaft.nrw/sites/default/files/documents/mwide_br_carbon_management_strategie_summary_eng_bf.pdf

¹⁹ CO₂PELINE (2023) Our contribution to the circular carbon economy. Available at: <https://www.CO2peline.com/en/>

²⁰ VBW (2023) Analyse CO₂-Infrastrukturbedarf in Bayern, October 2023. Available at: https://www.ffe.de/wp-content/uploads/2023/10/vbw-Studie_Analyse_CO2-Infrastrukturbedarf_in_Bayern.pdf

²¹ NDR (2023) 'Klima: Günther bringt CO₂-Verpressung in SH wieder auf den Tisch', 20 January 2023. Available at: <https://www.ndr.de/nachrichten/schleswig-holstein/Klima-Guenther-bringt-CO2-Verpressung-in-SH-wieder-auf-den-Tisch,klima564.html>

²² Bündnis 90 Die Grünen (2024) Positionspapier zum Einsatz von Carbon Capture and Storage (CCS). Available at: <https://sh-gruene-fraktion.de/wp-content/uploads/sites/4/2024/01/CCS-Positionspapier-2024-01-18.pdf>

²³ German Greens call for European framework on CCS for hard-to-abate emissions. Available at <https://www.cleanenergywire.org/news/german-greens-call-european-framework-ccs-hard-abate-emissions>

²⁴ Industrietransformation aus einem Guss, 2 January 2024. Available at: <https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Klima/Thesenpapier-Industrietransformation-aus-einem-Guss.pdf>

²⁵ German industry joins forces with green groups on CO₂ capture, article by Euractiv, 10 January 2024. Available at: <https://www.euractiv.com/section/energy-environment/news/german-industry-joins-forces-with-green-groups-on-CO2-capture/>

5.0 CCS INVESTMENTS AND PROJECT DEVELOPMENT IN GERMANY

There are currently 23 CCUS projects at different stages of development in Germany [Table 1]. Since it is currently not permitted to develop underground CO₂ sites under the Carbon Dioxide Storage Act, projects focus on CO₂ capture and transport.

CCS can also support the production of low-carbon hydrogen with noteworthy projects already developing in this field such as BlueHyNow, located in the energy hub of Wilhelmshaven, and H2GE Rostock in Eastern Germany.

5.1 CO₂ capture

To meet its climate neutrality target by 2045, Germany must capture between 34 and 73 million tonnes of CO₂ annually, as suggested by various studies.²⁶ Projects currently under development primarily focus on industrial applications, most notably in the cement and lime sectors, and blue hydrogen generation.

Cement production ranks among the largest industrial emitters in Germany, with 53 plants collectively releasing 18.8 million tonnes of CO₂ in 2022.²⁷ CCS stands out as one of the few technologies available to effectively reduce the process emissions of this sector. Notable progress is underway with various CO₂ capture projects scheduled for short- to mid-term development at German cement plants, including LEILAC 2 in Hanover, CO₂LLECT in Rüdersdorf, GeZero Cement in Geseke, Everest in Wülfrath, and Carbon2Business in Lägerdorf, showing the ambition of these key industrial players in decarbonising their industries.

5.2 CO₂ transport

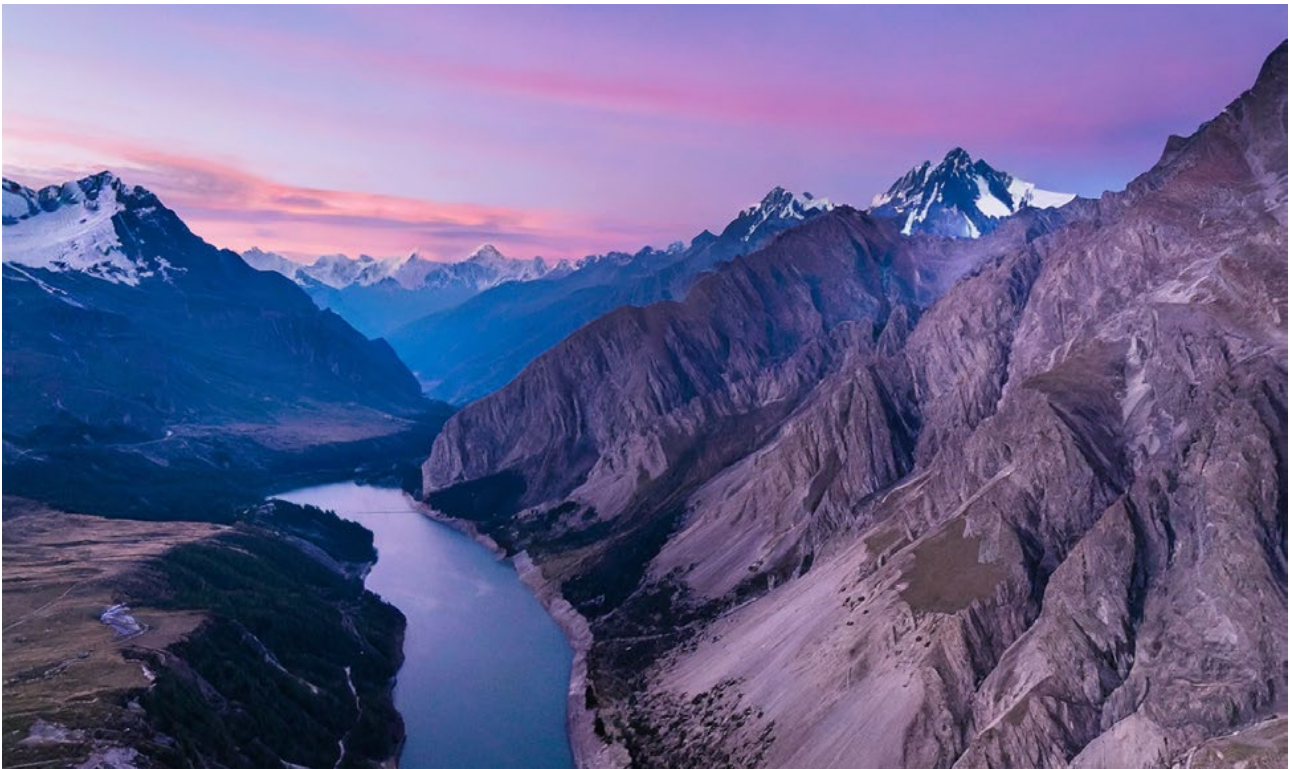
In Germany, various transport modes are being considered to transport the captured CO₂ domestically for permanent storage under the North Sea or to customers for utilisation:

- Export terminals and ships,
- Cross-border and regional pipeline networks,
- Decentralised means of transportation such as trains, trucks and barges.

Wilhelmshaven hosts a crucial energy hub which has a key role to play in the energy transition of Germany. In December 2022, the first LNG terminal in Germany was launched in Wilhelmshaven and several companies are planning projects in this strategic location, due also

²⁶ BMWK (2022) Evaluierungsbericht der Bundesregierung zum Kohlendioxid-Speicherungsgesetz (KSpG). Available at: https://www.zim.de/Redaktion/DE/Downloads/Energiedaten/evaluierungsbericht-bundesregierung-kspg.pdf?__blob=publicationFile&v=1

²⁷ Cemnet (2023) Germany's net-zero ambitions. Available at: <https://www.cemnet.com/Articles/story/175682/germany-s-net-zero-ambitions.html>



to the presence of a deep-water port. The objective of the BlueHyNow project at the Wilhelmshaven energy hub, for example, is to produce low-carbon hydrogen from natural gas and ship the CO₂ generated from the hydrogen production by sea for geological storage in underground reservoirs located offshore Norway and Denmark.

The capture and collection of the CO₂ generated by BlueHyNow will likely take place in the framework of the CO₂nectNow project, a CO₂ hub at the Wilhelmshaven Tank Terminal which also aims to use Wilhelmshaven as a collection point for the unavoidable CO₂ emissions captured from industrial sites across Germany. The CO₂ will then be transported by ship or pipeline to storage sites in the North Sea.

Furthermore, there are multiple cross-border and regional CO₂ pipeline projects currently under development in Germany:

- Gasunie, Shell, BASF and Open Grid Europe (OGE) are in the feasibility stage of a network between Rotterdam and the Ruhr area in Germany.
- Equinor and Wintershall Dea are collaborating on infrastructure for the transportation, injection and storage of CO₂ from Germany to Norway.

- The CO₂pipeline project led by bayernets GmbH and Rohrdorfer considers linking sources of unavoidable CO₂ emissions in Bavaria and Upper Austria with industrial hubs in South East Bavaria. In the second phase, the project is poised to integrate the regional network with additional European CO₂ transmission pipelines, fostering a more comprehensive carbon management ecosystem.
- A new 1,000 km onshore pipeline project by OGE will connect German industries to the port of Wilhelmshaven.

Beyond these project developments led by the industry, the issue of CO₂ infrastructure is actively discussed by the German government at the international level, exemplified by the joint statement between Germany and Norway. In January 2023, both countries agreed to initiate a joint feasibility study analysing the large-scale hydrogen supply through pipelines from Norway to Germany and the transport of CO₂ from Germany to Norway.²⁸ Subsequently, in September 2023, a German-Norwegian Task Force was established to overcome and implement the outcome of this common initiative.²⁹

²⁸ Joint Statement, Germany-Norway Hydrogen, 5 January 2023. Available at: <https://www.regjeringen.no/no/aktuelt/dep/smk/pressemeldinger/2023/tettere-samarbeid-mellom-norge-og-tyskland-for-a-utvikle-gronn-industri/joint-statement-germany-norway-hydrogen/id2958105/>

²⁹ Norway and Germany take next step in hydrogen cooperation, 8 September 2023. Available at: <https://www.regjeringen.no/en/aktuelt/norway-and-germany-take-next-step-in-hydrogen-cooperation/id2993340/>

According to the recent announcement by the German Federal Minister for Economic Affairs and Climate Action, Robert Habeck, there is an intention to update the Carbon Dioxide Storage Act to remove legal uncertainties and establish a streamlined state regulatory framework conducive to the construction of privately owned CO₂ pipelines.

The government also intends to enable the cross-border transport of CO₂ for the purpose of offshore storage by ratifying the amendment to the London Protocol. Finally, individual Länder could have an opt-in option to allow permanent onshore CO₂ storage within their region, should they be interested in exploring this possibility.

OFFSHORE STORAGE SITES WILL BE EXPLORED... CONSIDERING SAFETY STANDARDS AND ECOLOGICAL CRITERIA.



PROJECT NAME	LOCATION	OPERATIONAL DATE	FACILITY INDUSTRY	FACILITY CATEGORY	PUBLIC SUPPORT (IF ANY)	REFERENCE
K4		2021-2025	Cement / lime	Pilot and demonstration facility	KlimPro-Industrie	Here
Northern Lights	Involve multiple countries, including Germany	2024	CO ₂ transport and storage	Commercial facility	Connecting Europe Facility - Energy	Here
LEILAC 2	Hanover	2025	Cement / lime	Pilot and demonstration facility	Horizon Europe	Here
CI4C	Mergelstetten	2025	Cement / lime	Pilot and demonstration facility		Here
CAP2U	Lengfurt	2025	Cement / lime	Utilisation facility	BMWK funding	Here
BlueHyNow	Wilhelmshaven	2028	Hydrogen / Ammonia / Fertiliser	Commercial facility		Here
Delta Rhine Corridor	From Ludwigshafen to Cologne, from Cologne to Rotterdam and from Gelsenkirchen to Rotterdam	2028	CO ₂ transport and storage	Commercial facility	PCI status	Here
CO ₂ nnectNow	Wilhelmshaven	2028	CO ₂ transport and storage	Commercial facility		Here
GeZero	Geseke	2029	Cement / lime	Commercial facility	Innovation Fund	Here
Everest	Wülfrath	2029	Cement / lime	Commercial facility	Innovation Fund	Here
EU2NSEA	Involve multiple countries, including Germany	2029	CO ₂ transport and storage	Commercial facility	PCI status	Here
Elbe estuary cluster	From Lägerdorf to Brunsbüttel to Hemmingstedt	End of 2020s	CO ₂ transport	Commercial facility		Here
CapTransCO ₂	Halle-Leipzig conurbation	2030	Storage			Here
CO ₂ LLECT	Rüdersdorf	2030	Cement / lime	Commercial facility		
NOR-GE		2032	CO ₂ transport and storage	Commercial facility		Here
Rhenish coalfield cluster	Regions of Aachen, Cologne and Rhenish mining area		CO ₂ transport	Commercial facility		Here
C Zero	Duisburg		CO ₂ transport	Commercial facility	PMI Status (as part of Nautilus)	
WHVCO ₂ logne	From Cologne region to Wilhelmshaven		CO ₂ transport	Commercial facility		Here
H2GE Rostock	Rostock	Under Evaluation	Hydrogen / Ammonia / Fertiliser	Commercial facility		Here
Bremen Carbon Dioxide Transshipment Hub	Bremen	Under Evaluation	CO ₂ transport and storage	Commercial facility		Here
Carbon2Business	Lägerdorf		Cement		Innovation Fund	Here
Aramis	Involve multiple countries, including Germany				PCI status	
CO ₂ peline	From Rohrdorf, Germany, to Burghausen, Germany, to Linz, Austria		CO ₂ transport	Commercial facility		Here

Table 1 - List of CCS projects in Germany³⁰

³⁰ Global CCS Institute (2024) based on its own research.

6.0 MULTILATERAL AND BILATERAL COLLABORATION INVOLVING GERMANY

In 2023, Germany's Federal Government collaborated with several European partners to advance multilateral and bilateral collaboration in the field of CCS. These efforts resulted in joint declarations signed with Norway in January,³¹ Belgium in February,³² and Denmark in April.³³ In November, another significant milestone was reached as Germany, alongside Denmark, France, the Netherlands, and Sweden, signed the Aalborg Declaration³⁴ to promote CCUS as a technology indispensable to support the energy transition and

create a cross-border European CO₂ market. In particular, this initiative symbolises the emergence of a shared vision among European countries for advancing common solutions in carbon management.

As of March 2024, Germany had not ratified the 2009 amendment to Article 6 of the London Protocol that can allow a country to export its CO₂ for storage in another country. However, the government has indicated its intent to rectify this situation.



Figure 3 - Multilateral and bilateral cooperation signed by Germany in the field of CCS in 2023

³¹ Joint Declaration - German-Norwegian Partnership on Climate, Renewable Energy and Green Industry, 5 January 2023. Available at: <https://www.regjeringen.no/en/whatsnew/dep/smk/press-releases/2023/closer-cooperation-between-norway-and-germany-to-develop-green-industry/joint-declaration-german-norwegian-partnership-on-climate-renewable-energy-and-green-industry/id2958104/>

³² Belgian-German Joint Declaration on Bilateral Cooperation on the Transition to Sustainable Carbon Neutral Economies, 14 February 2023. Available at: <https://www.bundesregierung.de/resource/blob/2196306/2165380/e1e0bbadae155a05e5877004de7ab756/2023-02-14-dt-bel-decl-data.pdf?download=1>

³³ Joint declaration of intent between the Federal Ministry for Economic Affairs and Climate Action of the Federal Republic of Germany and the Ministry of Climate, Energy and Utilities of Denmark on the cooperation on carbon capture utilisation and storage (CCUS), 24 April 2023. Available at: https://www.bmwk.de/Redaktion/DE/Downloads/Energie/joint-declaration-germany-denmark-cooperation-carbon-capture.pdf?__blob=publicationFile&v=6

³⁴ Aalborg Declaration on enabling cross-border carbon capture utilization and storage (CCUS) in Europe, 27 November 2023. Available at: <https://en.kefm.dk/Media/638366861585598350/EU%20CCUS%20Aalborg%20declaration%20231127%20SEFR.pdf>

7.0 RECOMMENDATIONS

To lay the foundation of the future carbon management value chain, the following recommendations should be considered:

1. Developing and promoting a strategic vision for the deployment of carbon capture. The German Federal Government should release as soon as possible its strategic vision for the role of CCS in energy transition to support CCS deployment aligning with the EU Industrial Carbon Management Strategy.
2. Clarifying the situation with domestic CO₂ storage amidst recent national and EU developments, including the EU CCS Directive guidance documents currently being revised. Enabling CO₂ storage in Germany would necessitate amendments to the Carbon Dioxide Storage Act, notably the removal of the application deadline for storage projects and streamlining the permit-granting process. Therefore, the draft bill put forward by the German Federal Ministry for Economic Affairs and Climate Action in February 2024 to amend this law serves as a crucial initial step.
3. Mapping CO₂ transport needs at regional, national and cross-border level, and optimising the different transport modalities (pipelines, ships, trains, trucks and barges). At the cross-border level, the ratification of the amendment to Article 6 of the 2009 London Protocol and declaration of provisional application in accordance with the 2019 decision would be needed to allow Germany to export its CO₂ for geological storage.
4. Integrating the recommendations provided by the European Commission in the context of the revision of the German NECP, namely indicating in the final version:
 - The annual volumes of CO₂ to be captured by 2030 according to their sources,
 - The planned CO₂ transport infrastructure,
 - The potential for domestic CO₂ storage capacity along with injection volumes that could be available by 2030.
5. Assessing the potential role of carbon dioxide removals, including Direct Air Capture (DAC) and Bioenergy with CCS (BECCS), in the German decarbonisation plans in order to address unavoidable residual emissions. Once the needs are established, this should be followed by policy and financial incentives.
6. Establishing a comprehensive policy framework to support CCS and CDR deployment. A package approach that combines various support tools is needed to speed up deployment of CCS and carbon removals in this early stage. Such a package could supplement the EU ETS price with additional tools such as carbon contract for differences, subsidies for early CCS projects, tax credits, clear and streamlined permitting procedures and one-stop shop for permitting, green public procurement supporting demand for low or zero carbon products, regulatory clarity, and multi-lateral collaboration by the government that facilitates project implementation.
7. Developing tools to communicate strategic vision on CCS and get public buy-in to improve public perception about CCS and its role in energy transition and contribution to safeguarding industrial jobs. A study conducted by the Wuppertal Institute highlighted that the public perception about CCS was determined by the level of information about the technology.

Negative perception may threaten implementation of CCS projects. The German federal and regional governments could play an important role in raising awareness and enhancing the understanding of the industrial carbon management value chain among the German public. Environmental think tanks and research organisations could contribute to providing information about economic and environmental benefits that CCS projects bring to local communities.

The Global CCS Institute stands ready to work with German stakeholders to increase knowledge on industrial carbon management.

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