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# WHITE PAPER

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## Carbon Capture Utilization and Storage in EMEA

In July 2025, Jones Day released a *White Paper* titled, "CCUS Regulation and Incentives in the Asia-Pacific Region: A Comparative Table for Strategic Decision-Making," followed by the publication in August of "Carbon Capture Utilization and Storage in the United States."

This *White Paper* is a continuation on these topics, covering carbon capture utilization and storage ("CCUS") in Europe, the Middle East, and Africa ("EMEA") and examining:

- Regulatory and policy environment around CCUS in EMEA;
- Recent developments;
- Potential opportunities and risks; and
- Future outlook of CCUS in the EMEA region.

## WHAT IS CCUS

CCUS broadly comprises three distinct approaches and associated technologies:

- Carbon capture and storage ("CCS");
- Carbon capture and utilization ("CCU"); and
- Carbon dioxide removal ("CDR") or "negative emissions technologies."

While sharing common elements, CCS, CCU, and CDR can be distinguished by:

- The source of captured CO2;
- The destination of captured CO2; and
- Ultimately, whether the approach has reduced CO2 emissions from an industrial or commercial process or removed CO2 already emitted into the atmosphere (i.e., "net negative").

Many of the technologies underpinning CCUS are mature and have been implemented for decades, such as conventional CCS and CCU used in enhanced oil recovery ("EOR"). However, as the importance of meeting emissions reduction targets increases, novel applications of both existing technologies and nascent technologies are emerging, backed by significant public and private investment. Unfortunately, many of the positive policy initiatives announced in recent years that would have otherwise improved financing prospects for CCUS projects have been offset by rising inflation, high interest rates, increasing project lead times, and permitting delays.

While deployment has trailed behind expectations, momentum has been growing in the development of a global CCUS industry (led, until recently at least, by the United States). As of July 2024, there were 628 projects in various stages of development and production across the value chain, including 50 operational facilities and 44 under construction. Although CCUS development has increased significantly in recent years, there is a long road ahead. Operational projects around the globe have an aggregate annual capture capacity of 51 million tons per annum ("Mtpa"), with a further 365 Mtpa projects in the pipeline. The International Energy Agency ("IEA") Net Zero Roadmap, which sets out global cross-industry targets for achieving net-zero CO2 emissions by 2050, currently estimates that 6,040 Mtpa of CO2 will need to be captured by 2050 (3,736 Mtpa from fossil fuel and industrial processes, 1,263 Mtpa from bioenergy, and 1,041 from direct air capture).

## CCUS AND THE ENERGY TRANSITION

The continuing development of new technologies can help reduce carbon emissions in hard-to-abate sectors, while significant sources of CO2 emissions, such as fossil fuel-based power generation and transportation are phased out and replaced with low-carbon alternatives.

As policymakers around the world accelerate their decarbonization efforts, there is a growing social acceptance that CCUS has a major role to play in achieving net-zero emissions. This has been apparent in the scientific community for some time. Both the United Nations' Intergovernmental Panel on Climate Change and the IEA have outlined a fundamental role for CCUS in reaching net-zero emissions by 2050, in particular for hard-to-abate sectors like cement, steel, and fertilizer production, power generation, and natural gas processing. According to the IEA, "reaching net zero will be virtually impossible without CCUS."

The IEA has identified four critical roles CCUS can play in the transition to net zero:

- Tackling emissions from existing energy assets;
- As a solution for sectors where emissions are hard to abate;
- As a platform for clean hydrogen production; and
- Removing carbon from the atmosphere to balance emissions that cannot be directly abated or avoided.

CCUS is by no means a silver bullet and will need to be deployed alongside other solutions, including renewables and battery technologies, sustainable fuels, and "green" hydrogen (noting that CCUS technologies also enable the production of "blue" hydrogen). CCUS has, however, a number of advantages that complement these other solutions:

- It is cost effective (at least for certain industrial and power generation applications);
- It relies in part on established technologies and knowledge; and
- It can be deployed to offset stubborn emissions that renewables struggle to replace.

## CCUS VALUE CHAIN

The CCUS Value Chain is divided into four key areas: capture, transport, storage, and utilization.

**Capture**

In order to capture CO2, it must be separated from other gases produced during industrial processes or fossil fuel combustion. Capturing carbon is often the most significant cost component of CCUS processes but also represents the best opportunity for value creation through increased efficiency and technological innovation. Different capture methods and technologies are available or in development that are suited to different applications.

**Transport**

Once captured, CO2 is transported to a storage or utilization site. To do so, CO2 needs to be compressed, with the increased pressure causing the dense-phase CO2 to behave like a liquid. The compressed CO2 is then dehydrated before being sent to a transport system, typically a pipeline.

Pipelines are the most common mode of transport for CO2, largely because they already operate as part of enhanced oil recovery activities; however, small-scale shipping of liquid CO2 via road and rail has already been undertaken. Large-scale shipping of CO2 is emerging as a key transport option and is not expected to face any significant technical barriers, given the experience of the gas industry in shipping gaseous fuels and cryogenic liquids.

Development of transport infrastructure for CCUS is crucial in expanding the availability of storage to industries that operate away from storage sites. Companies with experience in the transport and storage of fossil fuels are already playing a key role in the development of CO2 transport infrastructure.

**Storage**

Storage involves sequestering CO2 by injecting the captured CO2 into geological formations that are typically at least one kilometer underground. These formations include saline aquifers, oil and gas reservoirs, and formations of porous rock such as basalt and shale.

| No. | CCUS Technology | Description |
|---|---|---|
| 1 | Pre-combustion processes | Converts fossil fuels into a mixture of hydrogen and CO2 before combustion.<br>CO2 is separated and captured, which allows for the hydrogen to be burned as a fuel source without producing CO2. The main technology to achieve this is the use of physical solvents that operate at high pressures. Various adsorption and membrane technologies are also under development. |
| 2 | Post-combustion processes | Captures CO2 from the exhaust gases produced during fossil fuel combustion.<br>This process typically involves the use of solvents that can absorb CO2. The solvents are then heated to create a stream of high-purity CO2 for capture. Membrane separation technology is also under development for large-scale use.<br>Post-combustion technology is less efficient than pre-combustion capture but can be more readily retrofitted to existing industrial applications (such as power plants) than other processes. |

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| No. | CCUS Technology | Description |
|---|---|---|
| 3 | Oxy-fuel combustion processes | Burns fuel in a nearly pure-oxygen environment, which produces a concentrated stream of $CO_2$ that is easier to capture.<br>The downside of this process is that oxygen production is highly energy intensive, and boiler and material redesign is often required. |
| 4 | Direct air capture ("DAC") processes | Uses filter or chemical technology to capture carbon dioxide from the atmosphere directly, which is then concentrated for transport or storage.<br>Because $CO_2$ is much more dilute in the atmosphere, current DAC technology is more expensive and energy intensive than other capture methods. |

The higher temperatures and pressure in deep underground formations mean that $CO_2$ will stay in a concentrated state, allowing for the storage of greater volumes. Oil and gas reservoirs have unique strengths as storage sites as there may be opportunity to adapt existing production infrastructure, and extensive geological surveying of sites has already been undertaken.

**Utilization**

As an alternative to storage, $CO_2$ utilization technology, also known as carbon conversion or carbon recycling, aims to reuse captured $CO_2$ in existing processes or as an ingredient in new products, thereby displacing additional fossil fuel use. In addition to $CO_2$ use in enhanced oil recovery, $CO_2$ utilization technologies are currently deployed in the production of fuel alternatives, plastics, biofertilizers, and building materials.

Where the captured carbon's utilization results in a closed loop over many decades or centuries (e.g., when incorporated into building materials), CCU may be considered removal. However, many CCU applications merely delay the emission of carbon into the atmosphere, which will not positively impact emissions reduction targets.

## CCUS BUSINESS MODELS

CCUS business models generally fall into two project types: full-chain and part-chain. These project types reflect how much of the CCUS value chain is owned or managed by a single entity and the extent of the integration of the CCUS value chain within a single project. Within these business models, project ownership can be public/state-owned, private, or public–private partnership, and financing can be provided through either government or private sources.

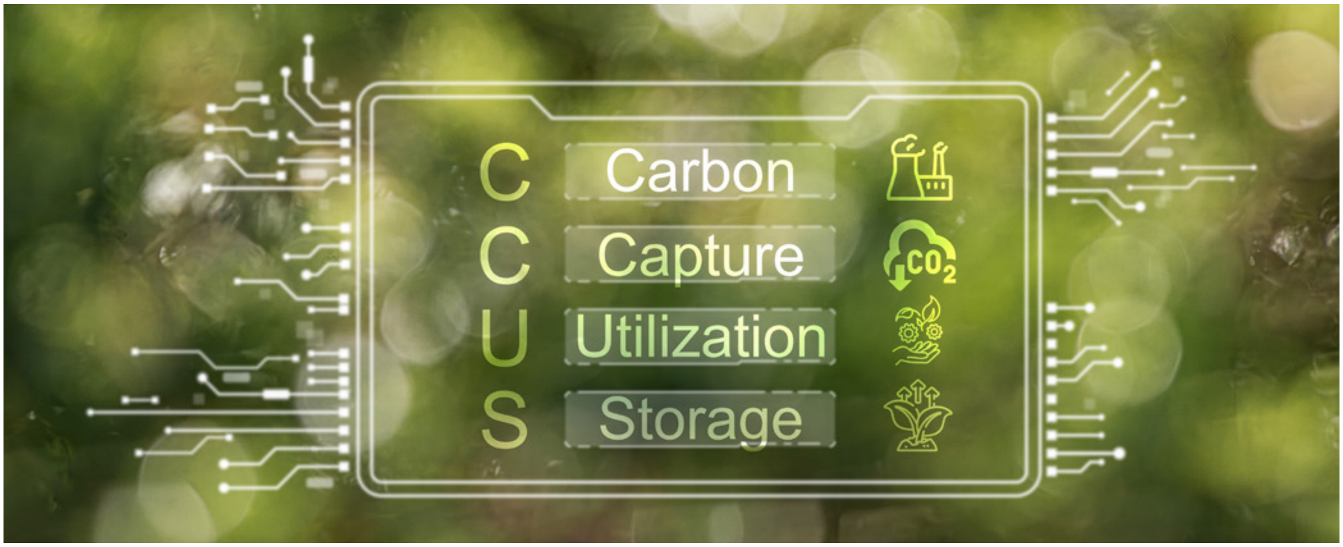
It is also important to understand the economic values derived from carbon capture. While captured $CO_2$ has limited value as a commodity, there is still high potential for revenue gains. These values differ for emitters (parties who supply $CO_2$) and transport and storage operators. Opportunities also exist for generation of carbon credits, depending on how the captured $CO_2$ is managed and the specific market or trading standard involved.

**Full-Chain Model**

The full-chain model represents the majority of CCUS projects currently in operation, with oil and gas companies operating the majority of these. ExxonMobil, Chevron, Shell, Occidental, Equinor, TotalEnergies, DRAX Group, and Saudi Aramco account for around 80% of CCUS projects currently in operation. This is not surprising given the vast technical and financial resources required to vertically integrate a CCUS supply chain within one organization.

In the full-chain model, the entire CCUS value chain is integrated into one project. The project manages the capture, transport, and storage of $CO_2$ from one emitter, often at a single site, to one injection facility.

The full-chain model is well suited to first-of-a-kind projects. The obvious advantage of the full-chain model is that there are fewer synchronization requirements. However, the cost and risk of these projects is significant, and, as a result, we anticipate (and have already begun to see) the full-chain model becoming less relevant. As CCUS technology and infrastructure matures and more participants are able to enter the industry and specialize in certain aspects of the supply chain, this should in turn reduce overall supply chain costs and risk for project proponents. In addition, breaking up the CCUS supply chain mitigates the risk of monopolistic behaviors by large




industry players—this is reflected by a surge of government interest in public–private partnerships for the development of shared infrastructure for CCUS hubs.

**Part-Chain Model**

In a part-chain model, participants focus on innovation and expertise in specific technologies or operations that form part of the CCUS value chain. The benefit of the part-chain model is that there are fewer technical and financial barriers to entry. This allows for more participants to emerge, facilitating access to the expertise and infrastructure needed to support decarbonization, bolstering innovation and reducing costs across the value chain.

Companies with complementary expertise are also able to drive CCUS innovation by expanding into part-chain projects that leverage their experience. For example, companies in the liquefied natural gas ("LNG") industry are adapting their expertise to the transport and storage of CO2, and specialist chemical and engineering companies are developing proprietary capture solutions.

However, part-chain models involve increased cross-chain and coordination risk. These models are also difficult to finance due to the certainty required by emitters as to where captured CO2 will be stored, and by transportation and storage operators as to the number of emitters committed to investing in capture plants. Government involvement may be necessary to provide financial and regulatory support.

A number of part-chain models have emerged whereby emitters outsource certain aspects of the CCUS value chain to specialist providers, or license capture technology from them, including:

- Self-capture with third-party CO2 offtake;
- CO2 transport and/or storage-as-a-service; and
- Capture-as-a-Service.

The key advantages of these services include:

- Flexibility and customization;
- Less upfront expenditure;
- Risk sharing; and
- Possible development of new revenue streams.

Drawbacks include:

- Risks associated with reliance on specialized service providers;
- Price variance between long-term contracts and spot prices;
- Uncertainty surrounding earning and allocating carbon credits; and
- Potential for long lead times and significant upfront expenditure without commitment from counterparties.

**Capture-as-a-Service.** The Capture-as-a-Service model is an emerging commercial approach in the CCUS landscape and is particularly appealing in EMEA, where many emitters may lack the capital, expertise, or strategic ability to develop CCUS infrastructure themselves (or see this as a non-core area of their business). Under this model, a third-party capture developer (often a specialist technology company or an investor-based platform) owns, finances, installs, and operates the carbon capture unit at an emitter's site. The emitter either:

- Pays a fee per ton of $CO_2$ captured (much like a utility service); or
- Enters into a long-term offtake or service contract to enable project financing.

The Capture-as-a-Service model has a number of advantages:

- The service provider funds the capture unit (via equity/debt), reducing the need for large capital expenditures by the emitter;
- Ability to deliver modular standardized systems, which reduces the complexity for the emitter (no need to build in-house CCUS expertise);
- Specialist providers usually move faster than emitters working through internal procurement cycles or board approvals;
- Speed of project delivery, assuming it is not a first-of-a-kind project; and
- Service providers can aggregate multiple small- to mid-sized emitters into bankable portfolios to create a saleable asset class.

However, there are also a number of drawbacks to consider:

While upfront capex is avoided for the emitter, lifetime cost per ton may be higher than owning/operating the asset directly and/or subject to carbon market volatility;

Long-term contracts, with some between 10-15 years, may reduce flexibility and inhibit innovation for the emitter; and

If the provider underperforms, goes bankrupt, or fails to integrate with infrastructure, the emitter could lose access to carbon reductions or face penalties. In such circumstances, a more complex contractual structure is expected.

**Ship Transport and Multimodal Logistics Model.** The ship transport and multimodal logistics model is becoming increasingly common throughout EMEA due to cross-border mechanics and infrastructure maturity. This model enables $CO_2$ emitters located away from pipeline infrastructure (or across national borders) to participate in CCUS by transporting $CO_2$ via ship, truck, rail, or barge to a storage hub.

The ship transport and multimodal logistics model has multiple benefits:

- Allows emitters not located proximate to storage sites or pipelines to participate in CCUS;
- Enables international $CO_2$ trade (i.e., capture in one country and storage in another), potentially supporting greater international cooperation in carbon markets;
- Mitigates land use issues, local opposition, long permitting timelines, and CAPEX intensive pipelines (for the exporter);
- Ships, ports and terminals can serve multiple emitters, enabling cost sharing and aggregation and
- Existing transferable expertise from the transportation of liquified fuels and cryogenic liquids.

However, there are also a number of drawbacks to consider:

- Shipping and terminal operations are energy and capital intensive;
- Transboundary transport of $CO_2$ is governed by waste and hazardous material frameworks;
- Emission volumes, shipping schedules, and storage site injection timing must align precisely;
- Carbon footprint associated with transport must be accounted for and will be higher than for the other models; and
- Ports may lack space, permits, or technical capability to build $CO_2$ materials.

**Hub-and-Spoke Model**

The hub-and-spoke model for CCUS offers a solution to challenges faced by actual and prospective participants in the CCUS industry by fostering collaborations between $CO_2$ emitters and other stakeholders. Under this model, emitters transport $CO_2$ from different sources to a central storage facility or cluster of industrial users (the hub) through a shared pipeline network (the spokes). Ideally, multiple co-located or clustered emitters would utilize shared transportation infrastructure to transport $CO_2$ to the hub.

The hub-and-spoke model has a number of advantages:

- Cost efficiency through consolidation of $CO_2$ transport and storage infrastructure;
- Risk sharing across multiple stakeholders;
- Reduction in per-unit costs through scalability and shared networks;
- Accelerated deployment of CCUS infrastructure through collaboration between industries, streamlining planning and permitting and reducing duplication of effort;
- Flexibility through versatile infrastructure that can support a wide variety of industries; and
- Innovation and knowledge-sharing through collaboration across industries and regions.

However, there are also a number of drawbacks to consider:

- High initial investment required to establish the hub-and-spoke model infrastructure;
- Regulatory challenges in coordinating across jurisdictions with differing regulatory requirements;
- Dependency on initial and continuing collaboration between stakeholders;
- Transportation risks where $CO_2$ is being transported over long distances;
- Long-term effectiveness and viability of CCUS hubs depends on continued technological advancements, regulatory support, and market conditions, which may not always align;
- Resistance or concerns from local communities regarding the construction of $CO_2$ storage sites or pipelines, particularly if the risks are not well understood or communicated; and
- Geographic limitations in regions that are not suitable for CCUS hubs. CCUS requires the availability of suitable geological formations for $CO_2$ storage, and the infrastructure needs to be in proximity to major emitters, which may not always be the case.

Despite these drawbacks, we anticipate the hub-and-spoke model (together with clustering of CCUS-linked industries and participants) will emerge as a key medium for the effective deployment of CCUS going forward.

**Business Model for Emitters**

The financial benefits of carbon capture stem from regulatory frameworks that enable emitters to generate revenue, offsetting the costs of installing and operating capture systems while covering storage expenses. These include compliance carbon markets and voluntary carbon markets.

Compliance carbon markets stem from government-mandated mechanisms for carbon management. Europe currently leads the way with this approach, with ambitious projects including the CCUS Longship project in Norway and the CCS Infrastructure Fund in the United Kingdom.

Frameworks employed by governments to facilitate development of revenue streams for emitters include:

- Tax credits for investment or production, to support emission reductions;
- Carbon tax schemes that incentivize emitters to reduce emissions;
- A cap-and-trade system limiting emissions, requiring excess emitters to buy credits; and
- Subsidies or grants covering carbon capture costs, either per ton or as a fixed amount.

In the absence of a compliance market, another mechanism for creating revenue is the voluntary carbon market, where emitters participating in a CCUS hub may generate certified emissions reductions, allowing them to sell carbon credits to other parties. In the United States, demand for durable high-quality credits surged in 2023, which drove revenue for projects that offer long-term carbon sequestration through CCUS, instead of lower-quality carbon credits commonly associated with renewable energy and conservation projects.

While there is some way to go in tightening legislation around regulating credits produced by CCUS projects and the voluntary international trading of carbon credits, the voluntary carbon market remains a viable option for emitters to benefit from revenues to support CCUS projects.

**Business Model for Transporters and Storage Facilities Operators**

The business model for CCUS transporters and storage facility operators involves providing infrastructure and services for capturing, transporting, and securely storing CO2. Revenue is typically generated in three ways:

- **Contractor to the government**: Investments are funded by the government, and the development and operations are managed by transporters and storage operators (Phase 1 of Norway's Longship project).
- **Hybrid enabled market**: An economic regulatory regime is linked to a user-pays revenue model that includes a government support package and a government-mandated open access network (the United Kingdom's East Coast cluster projects).
- **Liberalized free market**: This is used when market and policy incentives are widely available, and private companies develop CCUS projects with minimal government intervention (the Liberty Louisiana hub in the United States).

As carbon prices are low and the demand for low-carbon products is still in the early stages, it is evident that the selection of business models for all participants of the value chain largely depends on what government support and policy incentives are available to make the project profitable.

## CCUS IN EMEA

Notwithstanding that North America continues to lead in operational and planned CCUS projects, EMEA will play a vital role in the global scale up of CCUS deployment in the coming decade.

This growth is driven by strong policy support, strategic investment, the clustering of projects, and cross-border transport and storage infrastructure in the UK and Europe, where CCUS is widely acknowledged and being utilized as a key decarbonization lever. While policy frameworks across the region differ significantly in terms of maturity, ambitious targets, (discussed in more detail below), are also driving EMEA's robust CCUS value chain. According to the latest Global CCS Institute Report, Europe has five operational projects with 10 in construction,[1] while the Middle East and Africa have three operational projects and six projects in construction.[2] The North Sea cluster (United Kingdom, Netherlands, Norway, Denmark, and Belgium) is currently the dominant CO2 storage location in EMEA; however, the Middle East, North Africa, and the Mediterranean have significant CCUS ambition.

CCUS deployment will be crucial in EMEA's hard-to-abate sectors, where CO2 is not only emitted from fossil fuel use, but is inherent in the industrial process. In Europe, steel, cement, chemical production, and refining are expected to attract the most significant application of CCUS. In the Middle East and North Africa, where oil and gas, refining, and power are key emission sources, CCUS is increasingly linked to natural gas processing and blue hydrogen and ammonia production for export, especially to Europe. In contrast, Sub-Saharan Africa generally lacks policy and public investment support for CCUS.

Despite significant progress in EMEA, challenges in scaling up remain. This *White Paper* identifies key policy and regulatory frameworks relevant to the deployment of CCUS in EMEA and provides a snapshot of the main opportunities and risks faced by its growing CCUS industry.

**Regulatory and Policy Environment in EMEA**

The collaboration between governments, and through public-private partnerships entities, will be essential to scale CCUS deployment in EMEA and globally.

To explore EMEA's policy preparedness for a CCS/CCUS project deployment, a traffic light report for key jurisdictions is set out below, with **red** indicating no to low levels of policy developments (not ready-to-go), **amber** for low to medium levels of policy developments (almost ready-to-go), and **green** for established regulations (generally ready-to-go).

| COUNTRY | REGULATORY/POLICY DEVELOPMENT |
|---|---|
| **European Union** | |
| **General** | The EU has shifted from scattered pilot projects to a coherent, bloc-wide architecture that explicitly plans for capture, transport, use, and storage. The Commission's 2024 Industrial Carbon Management Strategy sets out a "single market for CO2" and a roadmap to scale carbon management across sectors. In parallel, the Net-Zero Industry Act ("NZIA") hard-codes a target of at least 50 Mtpa of CO2 injection capacity by 2030. In May 2025, the Commission operationalized NZIA Article 23 by assigning individual storage-capacity obligations to 44 EU oil and gas producers—an important move to de-risk storage availability and coordinate build-out across the single market.[3]<br><br>Market signals and public finance backstop this framework. The EU emissions trading scheme ("ETS") remains the anchor price signal, and ETS auction revenues feed the Innovation Fund. The latter is one of the world's largest clean-tech grant programs which, in October 2024, awarded €4.8 billion to 85 net-zero projects, including a significant CCUS cohort.[4] Together with evolving trade measures like the Carbon Border Adjustment Mechanism, this policy mix strengthens incentives for hard-to-abate industries to adopt carbon capture and, where appropriate, utilization tied to emissions reductions.<br><br>Finally, enabling infrastructure is advancing through the TEN-E/Connecting Europe Facility ("CEF") rules that now explicitly cover cross-border CO2 networks. Recent PCI/PMI lists and CEF awards funnel EU grants into pipelines and storage links, including Adriatic CO2 transport and multiple cross-border corridors—aimed at stitching together sources and sinks by 2030.[5] This combination of binding storage targets, obligated developers, carbon-pricing-funded grants, and priority infrastructure mechanisms places the EU among the most prepared jurisdictions globally for rapid CCUS scale up. |
| ● **Northern and Western Europe** | Northern and Western Europe are among the most advanced regions in terms of establishing regulatory frameworks for CCUS, reflecting strong national commitments. Norway, though outside the EU, has a long-standing regulatory regime for offshore storage under its Petroleum Activities Act and CO2 Storage Regulations.[6] These frameworks enable clear permitting, long-term liability provisions, and public–private risk sharing, which underpins the Longship project[7] and the Northern Lights[8] open-access storage infrastructure. The Norwegian government has also committed substantial state aid, providing a model for balancing public funding with private investment.<br><br>The Netherlands has embedded CCUS in its Climate Agreement and supports deployment through its SDE++ subsidy scheme, which provides technology-neutral operating support for emissions reductions, including industrial capture.[9] This has created bankability for large projects such as Porthos, which is also supported by EU state aid clearance and designated as a Project of Common Interest ("PCI"), ensuring streamlined permitting under the TEN-E regulation.[10] In addition, Dutch law provides clear liability frameworks for storage and long-term monitoring.[11]<br><br>Denmark has adopted a national CCUS strategy (2021)[12] and amended its Subsoil Act to allow permanent CO2 storage, supported by state funding rounds to accelerate infrastructure.[13] The Greensand project has benefited from these legal changes and EU Innovation Fund support, positioning Denmark as a regional hub for cross-border CO2 storage.[14]<br><br>Meanwhile, Belgium has integrated CCUS into its federal and regional climate strategies, with the Antwerp@C consortium advancing under the framework of EU PCI status and CEF support to develop transport and liquefaction infrastructure.[15] Belgian policy focuses less on domestic storage capacity and more on enabling cross-border utilization of storage in Norway and Denmark, in line with EU cross-border CO2 network provisions.[16] |

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| COUNTRY | REGULATORY / POLICY DEVELOPMENT |
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| **Central and Eastern Europe** | Central and Eastern Europe are at an earlier stage of CCUS deployment compared to Northern and Western Europe, but several countries are moving quickly to establish the necessary policy foundations.<br><br>Poland, the region's largest emitter, has amended its Geological and Mining Law to allow $CO_2$ storage permits and is conducting mapping studies of potential onshore and offshore storage sites. While large-scale deployment is pending, Poland has begun exploring CCUS in industrial clusters such as Płock and Bełchatów with EU Innovation Fund support for feasibility studies.[17]<br><br>Czechia and Slovakia are aligning their frameworks with EU requirements, focusing on integrating CCUS into their National Energy and Climate Plans.[18] These countries see CCUS as a complement to their heavy reliance on coal and industrial sectors, though concrete regulations for storage permitting remain in development. Both are collaborating in regional $CO_2$ transport initiatives under the EU's PCI framework to ensure eventual access to North Sea or Baltic storage sites.[19]<br><br>Romania has taken more concrete steps, adopting amendments to its petroleum and subsoil legislation to enable $CO_2$ storage and launching the Romanian Carbon Capture and Storage Technology Platform.[20] Romania is a participant in the EU-funded REPowerCCS project and has identified depleted gas fields in the Black Sea basin as promising storage sites.[21]<br><br>Hungary is also pursuing early-stage exploration, supported by EU research programs, while seeking to adapt its mining laws to allow storage.[22]<br><br>These developments illustrate a gradual but important shift in Central and Eastern Europe: While the regulatory base is less mature than in the North and West, EU Innovation Fund support, PCI recognition, and strong alignment with the EU Industrial Carbon Management Strategy are driving forward the first generation of CCUS policies and pilot projects. |

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| COUNTRY | REGULATORY / POLICY DEVELOPMENT |
|---|---|
| **United Kingdom** | |
| United Kingdom | The UK has established a comprehensive policy framework to support the deployment of CCUS as a key part of its strategy to achieve net-zero greenhouse gas emissions by 2050. The government recognizes CCUS as essential for decarbonizing industry, power generation, and supporting the production of low-carbon hydrogen, and in October 2024, committed £217 billion over 25 years to support the East Coast and Hynet CCUS clusters.[23]<br><br>The regulatory foundation is set by the Energy Act 2008[24] and its suite of secondary legislation governing CO2 storage licensing, monitoring, and long-term liability transfer to the Secretary of State. Oversight of offshore storage has been consolidated under the North Sea Transition Authority, which—following two competitive licensing rounds—has now awarded permits covering saline aquifers and depleted gas fields with an aggregate theoretical capacity well in excess of the government's 30 Mtpa by 2035[25] injection objective. Parallel amendments enacted through the Energy Act 2023,[26] which designate Ofgem as the economic regulator for CO2 transport and storage networks, introduce a cap-and-floor revenue regime and embed open-access and third-party access principles to de-risk utilization of shared pipeline systems.<br><br>Cluster sequencing is the organizing principle of UK deployment. The government has named the East Coast Cluster (which achieved financial close in December 2024[27]) and HyNet North West (which achieved financial close in April 2025) as Track 1 and confirmed Acorn and Viking as Track 2, collectively targeting 20–30 Mtpa of capture by 2030. Each cluster links multiple emitters to an open-access offshore storage complex and benefits from streamlined development consent orders under the Planning Act 2008.<br><br>To date, Track 1 emitters have closed on approximately £21.7bn of funding with a further £9.4bn of funding allocated in Spring 2026 for further CCUS development (including the Scottish Cluster, also Track 2, which has strong support from the Scottish government).<br><br>This model also anticipates cross-border flows: The UK has ratified the 2009 amendment to the London Protocol, signed bilateral arrangements with Norway and Denmark for transboundary CO2 transport, and is actively exploring shipping solutions for emitters outside the pipeline corridors. The UK has also introduced a dispatchable power agreement ("DPA") for power CCUS, and an industrial carbon capture ("ICC") contract for industrial CCUS, through which it incentivizes investments and development and supports project bankability by underwriting project revenues.<br><br>Policy continuity remains strong in the UK. The 2023 "Powering Up Britain" plan reaffirmed the cluster strategy,[28] while the 2024 Carbon Budget Delivery Plan[29] locks in interim targets and mandates annual progress reporting to Parliament. By combining a mature legal framework, clear long-term volume targets, robust price signals, and bespoke revenue support, the United Kingdom offers one of the most investable CCUS environments globally and serves as a template for integrated, hub-based deployment across the EMEA region.<br><br>CCUS transport and storage is operated under the T&S Regulatory Investment ("TRI") model consisting of an economic regulatory regime and further support arrangements (including risk mitigation measures, a revenue support agreement, and government support package). The East Coast Cluster financial close included both: (i) the support arrangements implemented under the TRI model and the associated government support package; and (ii) the closing of the DPA in connection with Net Zero Teesside Power Limited's power station as an emitter[30].<br><br>The UK has also recently implemented the CCS Network Code[31], governing the commercial and technical arrangements for CCS and the orderly operation of CCS infrastructure between licensed operators and end users. Under their license conditions, participants will need to either comply with the CCS Network Code or make an application for any derogation from it.<br><br>The UK framework for CCUS largely aims to create a risk environment similar to a mature regulated energy network, to incentivize early-stage investment. Through the TRI's economic regulatory regime and further support arrangements, key risks are either taken by government (e.g., volume, price, and change-in-law / policy) or shared between government and developers (e.g., cost overruns (reopeners are available in exceptional circumstances), CO2 leakage, construction / technology and decommissioning / end-of-life risks). |

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| COUNTRY | REGULATORY / POLICY DEVELOPMENT |
| --- | --- |
| **United Kingdom** *continued* | Further developments already in the pipeline include:<br>• Discussions around the unbundling of the TRI model, with debate regarding single operator versus dual operator models for the unbundling of onshore from offshore transportation;<br>• Consultation on future networks strategy for CCUS[32], due to close at the end of October 2025, which is aimed at considering how CCUS networks can transition away from reliance on government support as they develop (the Track 1 package being intended as a catalyst to create and encourage private debt and equity into, the market); and<br>• A call for evidence from the UK government's Department for Energy Security and Net Zero ("DESNZ") relating to the economic regulation of CO2 storage[33].<br>Beyond the framework created by UK government, a number of emitters in the UK have in parallel been pursuing their own carbon capture projects, essentially leading to the emergence of new clusters which are not necessarily within the Track 1 / Track 2 processes and the government support mechanisms summarized above. |
| **Middle East** | |
| **General** | The Middle East is rapidly increasing their CCUS capacity, with Gulf Cooperation Council ("GCC") member states setting ambitious commitments to achieve net-zero between 2050 and 2060. CCUS technologies will be crucial in decarbonizing the region's hard-to-abate energy and industrial sectors and its scale up is already supported by substantial investment by state-owned entities like Saudi Aramco, Abu Dhabi National Oil Company ("ADNOC") and Qatar Energy. With some of the largest operating CCUS facilities globally, and with a strong pipeline of projects either announced or in construction, the Middle East is targeting a regional CCS capacity of at least 65 Mtpa by 2035.[34] |
| **UAE** | At COP28, the UAE launched its Industrial Decarbonisation Roadmap which envisaged a cumulative emissions reduction target of 2.9 Gt (equivalent to 93%) by 2050.[35] To help achieve this, the UAE government has announced a Long-Term Strategy which prioritises the role of CCS in decarbonizing hard-to-abate industrial sectors, has updated their Energy Strategy 2050 and National Hydrogen Strategy to incentivise CCUS, including a potential cap-and-trade mechanism which is currently under development, and has announced a General Policy for SAF to establish a regional hub for low-carbon aviation fuel.[36]<br>In recent years the UAE also launched ALTÉRRA, the largest private investment vehicle for climate change action globally, with an initial commitment of US$30 billion, established a regulated and voluntary Air Carbon Exchange in Abu Dhabi to boost regional carbon trading, with an estimated market value of US$40 billion by 2030, and pledged to purchase US$450 million in African carbon credits by 2030 through the UAE Carbon Alliance.[37]<br>As a regional leader in CCUS alongside Saudi Arabia, key projects in the UAE include the operational Al Reyadah steel plant, with 0.8 Mtpa capacity, and the Habshan (which reached FID last year) and Ghasha Concession projects under construction, each with a 1.5 Mtpa capacity.<br>In terms of partnerships and other investment initiatives driving the deployment of CCUS in the UAE, ADNOC plays a pivotal role, recently:<br>• Acquiring a 10% stake in Storegga, a UK-based CCS developer and key player in the Acorn project in Scotland;[38]<br>• Signing an agreement with the Japan Bank for International Cooperation to establish a US$3 billion green financing facility;[39]<br>• Announcing a partnership with Pohang Iron and Steel Company to produce low carbon hydrogen at a facility in Gwangyang, South Korea;[40]<br>• Engaging with Australia's Santos to explore a carbon management platform and develop CO2 shipping and transportation infrastructure; and<br>• Partnering with Mitsubishi Heavy Industries to support the decarbonization of its oil and gas production sites and produce low-carbon hydrogen and ammonia.[41]<br>ADNOC itself has a carbon capture target of 10 Mtpa by 2030.[42] It is also worth mentioning the Sharjah National Oil Company ("SNOC"), another key player based in the UAE. SNOC is planning a CCS hub-project to capture CO2 from various emitters, store it in an onshore mature gas field, and potentially trade carbon credits, and has also signed an MoU with Sumitomo to study CCS feasibility in Sharjah.[43] |

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| COUNTRY | REGULATORY / POLICY DEVELOPMENT |
|---|---|
| **Saudi Arabia** | Saudi Arabia already has extensive expertise across the CCUS value chain, with operational CCUS projects and a high level of international collaboration, including:<br>• The operational 0.8 Mtpa Uthmaniyah demonstration project which uses $CO_2$ for enhanced oil recovery injection;<br>• The joint development of the Saudi Aramco Jubail CCUS-Hub between Saudi Aramco, SLB, Qatar Energy, and Linde, expected to achieve up to 9 Mtpa storage capacity by 2027;[44] and<br>• The Rabigh CCUS facility, which was launched to capture $CO_2$ from a mono-ethylene glycol plant;[45]<br>Saudi Arabia is also a member of international collaborations, including the Clean Energy Ministerial CCUS initiative, the Carbon Sequestration Leadership Forum, and Mission Innovation Carbon Capture Challenge,[46] and in 2024, launched its domestic carbon crediting scheme: the Greenhouse Gas Crediting and Offsetting mechanism. In recent years, Saudi Arabia has also collaborated extensively with the UK government on the Joint International Institute for Clean Hydrogen, invested into the UK's hydrogen mobility clusters, and provided ongoing sectoral cooperation on CCUS.[47] Collaborations have also been undertaken throughout 2024 with the European Union, United States, Mauritania, Uzbekistan, and Jordan.<br>These key projects and strategic partnerships in the CCUS sector globally will be crucial to assist Saudi Arabia in achieving its national target of 44 Mtpa $CO_2$ capture and storage by 2035.[48] |
| **Oman** | Similar to the UAE and Saudi Arabia, there is a growing recognition in Oman of the importance of CCUS in achieving their climate goals of net-zero emissions by 2050.[49]<br>In late 2023, the Omani Ministry of Energy and Minerals launched a CCUS and Blue Hydrogen Framework by signing a Memorandum of Cooperation with key industry stakeholders like Petroleum Development Oman. Supported by the Global CCS Institute, it will develop guidance to support the government in designing and implementing CCUS specific legislation and regulatory frameworks.[50] Other key initiatives and policies in Oman include the OQ Gas Network ("OQGN"), which aims to leverage extensive pipeline infrastructure for hydrogen and $CO_2$ transport to explore new CCUS projects. In recent years, OQGN has signed MoUs with key industry players, including Occidental Petroleum to jointly study the deployment of CCUS projects in Oman.[51] Oman has also updated its Nationally Determined Contributions in late 2023, integrating large-scale CCUS technologies with the aim of cutting emissions by 7% by 2030 compared to a business-as-usual scenario.[52]<br>Oman otherwise has multiple projects aimed at reducing $CO_2$ emissions, including:<br>• A $CO_2$ mineralization and DAC pilot project in the Hajar Mountains, which commenced operations with Aircapture with a projected 0.001 Mtpa capacity;[53] and<br>• The CCUS facility in the Sohar Port, supported by Oman's Sohar Net Zero Alliance, with other support entities like Sohar Aluminium Company, Vale Oman Pelletizing Company, and Jindal Shadeed Iron & Steel also progressing CCUS initiatives.[54]<br>Two key pilot projects have also been launched in Oman: one by Petroleum Development Oman to utilize $CO_2$ for EOR in northern Oman;[55] and a pilot plant to be established by Jindal Shadeed Iron and Steel to capture $CO_2$ flue gas, which aims to capture 0.7 Mtpa by 2027.[56] |
| **Other** | Beyond the regions identified above, Qatar and Bahrain are also making commitments to harness CCUS technologies to reduce carbon emissions.<br>For example, in 2024 the Global Carbon Council ("Carbon Council") based in Qatar published a methodology for CCUS projects to help project owners calculate and report emission reductions from eligible GHG mitigation projects and facilitate access to the global carbon market.[57] In 2023, the Carbon Council signed an agreement with Global Environmental Markets to acquire the Global Carbon Registry®, a fully integrated and potentially end-to-end carbon registry solution for nations willing to host Article 6.2 credits.[58]<br>In Bahrain, the Alba Aluminium Bahrain project is in advanced development. Whereas, Bapco Energies and Mitsui OSK Lines have signed a MoU to develop a cross-border $CO_2$ transport and sequestration with the goal of establishing a CCS value chain (with liquefied $CO_2$ shipped by Mitsui and sequestered by Bapco).[59]<br>In Qatar, the operational Ras Laffan LNG Facility has a 2.1 Mtpa capacity, with two key facilities under construction: the Petroleum North Field East project, a natural gas/LNG project with 2.9 Mtpa capacity, and the QAFCO Ammonia-7 Blue Ammonia project, a hydrogen, ammonia, and fertilizer facility with 1.5 Mtpa capacity. |

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| COUNTRY | REGULATORY / POLICY DEVELOPMENT |
|---|---|
| **Africa** | |
| **General** | CCUS in Africa remains at an early stage, with limited operational capacity, but a growing commitment to utilize CCUS for industrial decarbonization of hard-to-abate sectors and for future export opportunities.<br><br>The African Energy Chamber, as the voice of the African energy sector, is calling for private-public partnerships and strongly advocating for African governments to introduce financial incentives and policies that encourage CCUS adoption for oil and gas optimization and decarbonization.<br><br>We note that net-zero targets, conditional on international support, have been announced by Tanzania and South Africa by 2050, Ghana and Nigeria by 2060, and Uganda by 2065. |
| ● **Northern Africa** | Morocco is recognized to have vast CO2 storage potential and cross-border CCUS opportunities. Egypt also has preexisting oil and gas infrastructure that can be leveraged for CCUS projects, with feasibility studies already being undertaken to explore CO2 storage opportunities to support existing cross-border projects with Southern Europe and the Middle East.[60]<br><br>Key projects, initiatives and bilateral arrangements in Northern Africa include:<br>• The large-scale proposed facility, "Idku Egypt," which is still under evaluation;<br>• The screening and ranking initiatives by SLB of potential CO2 storage sites for Cheiron in Egypt's Western Desert;[61]<br>• The MoU signed between the government of Morocco and Norway, with a focus on carbon market mechanisms and capacity-building programs;[62] and<br>• The MoU signed between the governments of Egypt and Greece to identify projects and cooperate on utilization.<br><br>Egypt is also developing its CCUS policy. In 2024, its Financial Regulatory Authority approved several certification bodies for carbon emissions reductions projects; a crucial step in establishing a regulated carbon market.[63] Egypt is also one of 22 joiners to the Carbon Management Challenge, launched in 2023 as a global initiative to accelerate the development and deployment of CCUS. |
| ● **Sub-Saharan Africa** | Tunisia, Malawi, and Togo have embedded CCUS in their "Nationally Determined Contributions" submitted under the Paris Agreement. However, there is otherwise no concrete policy in Sub-Saharan Africa for CCUS deployment.<br><br>Key projects, initiatives, and bilateral arrangements include the following:<br>• The joint development of a 1 Mptpa capacity DAC (+ storage) project in Kenya between Climeworks and Great Carbon Valley, currently in an early development stage;[64]<br>• The completion of drilling for a CCUS pilot project in South Africa by the Council for Geoscience and Mzansi Exploration, Drilling and Mining;[65] and<br>• The MoU signed between the Council for Geoscience in South Africa and Exxaro to collaborate on CCUS initiatives.<br><br>There is limited explicit carbon pricing in Sub-Saharan Africa and there is a lack of public funding programs for CCUS-related initiatives. South Africa is the only country with a functioning carbon tax (of approximately USD 10 / tCO2), and while Nigeria has announced an emissions trading scheme, its implementation and regulatory framework remains unclear.<br><br>We note that Kenya, Mozambique, Nigeria, and Senegal are also joiners to the Carbon Management Challenge. |


## OPPORTUNITIES AND RISKS

There are several regional opportunities that we set out below:

**Encouraging Collaboration.** Collaboration between governments and public-private partnerships is accelerating in EMEA. The former is especially important where cross-border CCUS chains are being developed. As discussed above, the EU has the most developed arrangements to facilitate transnational CO2 transportation; a recent example being separate agreements between Denmark, the Netherlands, Belgium, and Sweden with Norway on the cross-border transport and storage of CO2 in 2024.[66] However, EMEA saw significant progress in 2024, with numerous projects, partnerships, and investments announced. The development of CCUS clusters, as seen in the UK, generates significant opportunities for private players across industries to collaborate strategically.

**Geological Advantages.** EMEA benefits from extensive geological formations suitable for large-scale CO2 storage, including deep saline aquifers, depleted oil and gas fields, and basalt formations. The North Sea basin is one of the world's premier CO2 storage regions, with similar opportunities in the Mediterranean, Middle East, and parts of North and Sub-Saharan Africa, where oil and gas legacy infrastructure can be repurposed for CO2 injection and monitoring.

**Leveraging Established Industrial Hubs.** Leveraging existing energy and industrial hubs, like the Port of Rotterdam, Teesside, the UAE's Ruwais and Jubail in Saudi Arabia will facilitate the rapid scale up of CCUS in EMEA by clustering emitters, transport infrastructure, and storage operations to achieve economies of scale. These hubs benefit from existing pipeline networks, skilled workforces, and regulatory experience and serve as anchor points for cross-border CO2 transport, offering opportunities for landlocked or storage-limited emitters in Europe, the Middle East, and North Africa to access secure storage via shared infrastructure.

**Revenue Streams.** The emergence of voluntary carbon markets and negative emissions technologies like DAC and BECCS are creating new revenue streams, by selling captured CO2 as a feedstock for synthetic fuels, chemicals, and building materials, or by receiving payment for the negative emissions services they provide to governments and industries. DAC projects are gaining popularity, particularly in the UAE, Saudi Arabia, Oman, and Kenya, where they are often combined with CO2 mineralization or SAF production.

**Integration with Low-Carbon Products.** EMEA is well-positioned to become a major exporter of low-carbon products, and the development of blue hydrogen and ammonia production is being broadly integrated with CCUS. The establishment of a CO2 transport network and supportive regulatory framework will be critical to achieve ambitious targets: for example, the UAE plans to produce 7 Mtpa of low-carbon hydrogen by 2050 and Saudi Arabia plans to produce up to 2 Mtpa by 2030.

**Emerging Storage Sites.** Most CO2 storage capacity developed in Europe has been concentrated around the North Sea; however, new storage opportunities are emerging in countries like Italy, Greece, Bulgaria, Romania, and in North Africa. It must be noted that, clear policy frameworks and public-private partnerships will be key. Both factors will be important to address regulatory barriers around cross-border CO2 transport and other cross-chain risks.

Key regional barriers and risks are set out below:

**Public Awareness and Trust.** Public acceptance remains a significant barrier to establishing CCUS infrastructure, especially for onshore storage and pipelines and more so where cross-border arrangements create a perception within importing countries of creating a "dumping ground." With many new technologies not yet tested at scale, apprehensions around the long-term efficacy and reliability of CCUS as a viable solution are affecting the attractiveness of CCUS projects to prospective investors, project permitting, and the establishment of value chains in EMEA.

**Policy Uncertainty.** Some form of government support is essential to scale up CCUS deployment. It is policy changes (not technology or costs) which have resulted in many CCUS project failures in EMEA, with the erosion of supporting policy tools in some jurisdictions due to high interest rates and other inflationary pressures making the financing of CCUS projects more challenging. While projects and international collaborations are advancing in the EU and UK, as regions with strong policy support, the lack of regulatory certainty and funding initiatives in Africa and parts of the Middle East will be major obstacles.

**Policy Differences.** Cross-border CO2 transportation enables regions that lack storage options to pursue CCUS initiatives; however, issues can arise in transnational projects in the absence of harmonized national regulatory frameworks. For example, the London Protocol aims to keep oceans clean by stopping waste dumping pollution activities and characterizes CO2 as 'waste,' which may have implications for offshore CO2 storage where participating nations are signatories to the London Protocol.

**Cross-Chain Risk.** Governments play a key role in mitigating cross-chain risks and large investments will be necessary for the coordinated development of capture, transport, and storage infrastructure, including new pipelines and shipping for CO2. While this risk is reduced in regions like the GCC states where state-owned enterprises lead full-chain development, it is harder to mitigate through contractual arrangements in regions where multiple private investors are involved.

## FUTURE OUTLOOK

The future of CCUS in the EMEA region is marked by a transition from isolated projects to integrated, networked systems that connect multiple emitters to shared transport and storage infrastructure. The North Sea will continue to serve as the primary storage hub for Europe, and policy-driven demand from hard-to-abate sectors, such as cement, steel, chemicals, and power, as well as the need for negative emissions technologies, will drive growth, with government support remaining essential for project viability.

In Europe, the EU's Industrial Carbon Management Strategy and Net-Zero Industry Act are establishing a robust framework for scaling up CCUS, with ambitious targets for CO2 injection capacity and the creation of a single market for CO2. Northern and Western Europe are expected to lead deployment, while Central and Eastern Europe will move from feasibility studies to early-stage projects as regulatory frameworks mature. The United Kingdom is advancing through a cluster-based approach, with major projects targeting significant capture capacity by 2030 and innovative business models (with UK government support) supporting investment and risk management.

The Middle East, particularly through the GCC states, is rapidly expanding its CCUS capacity, led by state-owned enterprises and integrated with low-carbon hydrogen and ammonia value chains for export. Regional leaders such as the UAE and Saudi Arabia are driving growth through ambitious capture targets and international partnerships, while new carbon market infrastructure is opening up additional revenue streams.

In Africa, North African countries are progressing with policy frameworks and cross-border projects, leveraging existing oil and gas infrastructure and proximity to European markets. Sub-Saharan Africa remains at an early stage, but pilot projects and mineralization opportunities could scale with targeted support and international collaboration.

Across the region, business models are evolving towards shared, open-access hubs and service-based offerings, supported by government-backed revenue mechanisms and growing carbon markets. Infrastructure development will increasingly rely on both pipelines and shipping to connect emitters with storage sites, while standardization and regulatory harmonization will be critical to reducing costs and cross-chain risks.

Key challenges remain, including policy and funding uncertainty, permitting and public acceptance, coordination across the value chain, regulatory fragmentation, and financing conditions. However, with continued progress on regulatory frameworks, infrastructure, and technology, EMEA is poised to become a global leader in CCUS by 2030, second only to North America. Beyond 2030, further diversification of storage sites, increased standardization, and integration with low-carbon product markets will be essential to achieving scale and cost reductions, with success ultimately depending on stable policy, cross-border cooperation, and effective stakeholder engagement.

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