2024 THOUGHT LEADERSHIP

CCS POLICY, LEGAL AND REGULATORY REVIEW

NOVEMBER 2024

GLOBAL CCS INSTITUTE

CONTENTS

Acronyms

BECCS	Bioenergy with Carbon Capture and Storage
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilisation
CCUS	Carbon Capture, Utilisation and Storage
CCFD	Carbon Contract for Difference
CDR	Carbon Dioxide Removal
CEF-E	Connecting Europe Facility for Energy
CMC	Carbon Management Challenge
CO_2	Carbon Dioxide
CRCF	Carbon Removal Certification Framework
DAC	Direct Air Capture
DACCS	Direct Air Capture with Carbon Storage
DOA	Department of Agriculture
DOC	Department of Commerce
DOE	Department of Energy
DOS	Department of State
DOT	Department of Transport
EEA	European Economic Area
EOR	Enhanced Oil Recovery
EPA	Environmental Protection Agency
ETS	Emissions Trading System
EU	European Union
FEED	Front-End Engineering Design
FID	Final Investment Decision
GCC	Gulf Cooperation Council
GHG	Greenhouse Gas
ICM	Industrial Carbon Management
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
LCFS	Low-Carbon Fuel Standard
MEM	Ministry of Energy and Minerals, Oman
MEMR	Ministry of Energy and Mineral Resources, Indonesia
MMV	Monitoring, Measurement and Verification
MRV [1]	Monitoring, Reporting and Verification
Mtpa	Million tonnes per annum
NDC	Nationally determined contribution
NSPS	New Source Performance Standards
NZIA	Net-Zero Industry Act
OPGGSA	Offshore Petroleum and Greenhouse Gas Storage Act
PCI	Project of Common Interest
PMI	Project of Mutual Interest
R&D	Research and Development
TEN-E	Trans-European Network for Energy
TIER	Technology Innovation and Emissions Reduction
UAE	United Arab Emirates
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America

[1] MRV refers to a site-specific plan requiring operators of storage facilities to delineate a monitoring area, wherein leakage of CO_2 when compared to a baseline can be detected and quantified.

1.0 PURPOSE AND FOCUS OF THE REPORT

This report provides an overview of global carbon capture and storage (CCS) policy, legal and regulatory developments over the past two decades, and the status of CCS governance regimes. It also provides insights into global and regional trends over recent years, including initiatives by governments to support the large-scale deployment of CCS.

The report covers the history of CCS policy, legal and regulatory developments across the four main global jurisdictions – the Americas, Europe, Asia Pacific (APAC), and Middle East and Africa – and discusses major trends in CCS activities in recent years. It also highlights current challenges to the large-scale deployment of the technology from a policy, legal, regulatory and commercial perspective.

2.0 KEY TAKEAWAYS AND OBSERVATIONS

2.1 Regional highlights and messaging

The Americas

North America represents one of the most mature policy and regulatory environments for CCS, with a history of development in this area spanning two decades. The US and Canada are in a phase of ongoing improvement and adjustment to policies, legislation and regulation to ensure investor confidence and support for large-scale deployment of the technology.

In the US, accelerated policy support for CCS in recent years includes improved fiscal incentives (tax credits) and direct financial support (including billions of dollars to expand the nation's CCS infrastructure). Additionally, commitment to the Carbon Management Challenge (CMC) also reflects the government's ongoing commitment to ensure CCS can contribute to reaching net-zero targets. At the time of publishing this report, the US federal government is reviewing and finalising regulatory programs for offshore storage and CO_2 pipeline transportation. In addition, specific guidance and initiatives, such as the release of the joint policy statement and principles for responsible participation in voluntary carbon markets (The White House, 2024) and the Voluntary Carbon Dioxide Removal (CDR) Purchasing Challenge, indicate a desire to use more advanced policy approaches to support decarbonisation and CDR deployment (Department of Energy, 2024).

CCS is also gaining interest at the US state level. With the growth in supportive federal policies, there is an increase in states taking responsibility for implementing federal laws and passing a plethora of state-level laws aimed at building the governance framework for CCS to support deployment of the technology in various industries. This includes legislation governing transport, storage, pore space, liability and other aspects of the CCS value chain, as well as granting primacy to various states.

CCS has seen similar support in Canada, with policy support from the federal government, in the form of Carbon Contracts for Difference (CCfDs) and the establishment of an Investment Tax Credit (ITC) in 2024, in parallel with stepped increases in the national carbon tax.

Brazil is beginning to establish itself as a leader in CCS in the rest of the Americas, with various CCS-related laws passing through the national parliament. Brazil achieved a major milestone with the passing of the Fuels of the Future Bill 528/2020, establishing obligations for operators of geologic storage sites. This law could create momentum for CCS developments in other South American countries.

Trinidad and Tobago made history by receiving the first ever funding for CCS from the Green Climate Fund (GCF).

Asia Pacific (APAC) and India

The APAC region is emerging as a key jurisdiction for CCS, as countries are intensifying their decarbonisation efforts through revised national emission reduction targets along with legal and regulatory support for CCS projects. In particular, Southeast Asia and Australia could play a key role in CO_2 storage in geological formations, as they offer promising storage reservoirs from a cost and capacity perspective. The attractiveness of these storage options has prompted private sector participants to start forming alliances for cross-border CCS value chains, including companies in Australia, Japan, Republic of Korea (South Korea), and Malaysia.

Crucial to these alliances will be the bilateral agreements/arrangements between governments for the cross-border transport and offshore, sub-seabed storage of CO_2, as required under the London Protocol. From an international law perspective, South Korea, the Philippines, Japan, China and Australia are the only countries in the region that are Parties to the London Protocol, while South Korea is the only nation that has ratified the 2009 amendment to the London Protocol. The Contracting Party status of countries will determine which country has responsibility for ensuring that an agreement/arrangement to conduct cross-border CO_2 transport activities between two countries is

compliant with the London Protocol. Non-contracting parties could avail themselves of the provisions of the 2009 amendment to Article 6 of the London Protocol, but agreements/arrangements will have to contain provisions at a minimum equivalent to the Protocol's provisions, and the countries are required to provide a declaration of provisional application and notification of any arrangements/agreements to the International Maritime Organization. A further hurdle to cross-border CCS value chains is uncertainty relating to the allocation of potential liabilities along the CCS value chain, accounting and verification requirements, and price signals arising under various emissions trading schemes.

A coherent, well-established policy, legal and regulatory environment will be imperative to the success of CCS deployment in the region. Although Australia and Indonesia have made significant progress in establishing enabling polices and regulations for CCS, in most APAC countries policy and regulatory developments are nascent or absent. In countries such as Malaysia, India and China, critical gaps remain in the regulatory frameworks relating to core aspects of the CCS project lifecycle, including post-closure transfer of liabilities and pore space ownership, monitoring reporting and verification, site characterisation and selection.

In addition, financial incentives that could improve the business case for CCS are lacking. While countries such as Malaysia, Thailand and Indonesia have outlined tax incentives to facilitate investment in CCS, the adequacy of these incentives and practical implementation requirements remain unclear. Adequate financial support from governments will facilitate private investment and enable the deployment of commercial-scale CCS projects.

While emissions trading mechanisms are currently in place in several countries such as Australia, China, Japan and Indonesia, which support credit generation by CCS projects, current price signals from these schemes do not adequately incentivise widespread CCS deployment. Clarity in terms of eligibility criteria, credit generating methods and accounting requirements is needed to improve participation and market liquidity.

Europe

The European Union (EU) and countries in the wider European Economic Area (EEA) have historically been leading the charge around decarbonisation efforts to reach global climate neutrality. In 2014, the EU committed under the Paris Agreement to reduce greenhouse gas (GHG) emissions by 40% against 1990 levels by 2030 and reach climate neutrality by 2050. With the launch of the European Green Deal in 2019, the EU raised its commitment to a 55% reduction by 2030. These commitments were written into law with the adoption of the European Climate Law in 2021 and implementation measures established as part of the Fit for 55 package (Official Journal of the EU, 2021). CCS has been part of these commitments since 2009, when the EU CCS Directive was adopted.

The role of CCS in reaching carbon neutrality was amplified in the Industrial Carbon Management (ICM) Strategy, released in 2024, jointly with another European Commission communication that set a climate goal for 2040 (European Commission, 2024e, 2024d). The ICM highlighted the need for 450 million tonnes per annum (Mtpa) of CO_2 to be captured and stored or utilised by 2050. The ICM Strategy is a significant step towards the harmonisation of CO_2 utilisation, storage and removal in the EU.

The ICM Strategy has given new impetus to CCS activities in the EEA. A number of national carbon management strategies and roadmaps have been published since, and countries previously restricting CO_2 storage activities are reassessing their policy positions. Another development is the increase in regional collaboration efforts, most notably through the increase in bilateral agreements/arrangements signed between countries in the EEA in anticipation of cross-border transportation and storage of CO_2.

Looking ahead, the European Commission has identified additional policy, legislative, regulatory and funding needs in its EU industrial carbon management strategy. Key forthcoming actions include laying the groundwork for a possible future CO_2 transport regulatory framework, building an investment atlas of potential CO_2 storage sites, and supporting the development of a knowledge-sharing platform. These areas will be addressed by the incoming European Commission (2024-2029).

However, several key issues remain unresolved, particularly concerning bioenergy with CCS (BECCS) and direct air carbon capture and storage (DACCS). The EU's carbon removal certification framework is still pending approval by the Council of the EU (European Parliament, 2024). Additionally, uncertainty surrounds the potential integration of CDR into EU ETS, with the European Commission expected to submit a report to the European Parliament and the Council assessing this possibility by July 2026.

The United Kingdom (UK) released its vision for a competitive CCUS market in December 2023, with an

ambitious goal of capturing 20-30 Mtpa of CO_2 by 2030 (UK Department for Energy Security & Net Zero, 2023a). Currently, emitters in the EEA cannot claim emissions reduction under the EU ETS for CO_2 stored outside of the EEA, leading to uncertainty among these emitters about future storage opportunities in the UK.

Middle East and Africa

Although many countries have contemplated CCS for decades - In-Salah was one of the first projects in the world - progress towards the establishment of policies and legislative frameworks has been slow. However, initiatives are being developed to build capacity and expertise that support CCS activities; for example, the Middle East Green Initiative is aiming to establish a regional CCS hub to facilitate knowledge sharing and capacity building. In addition, ADNOC in the United Arab Emirates (UAE) has commenced work on a CO_2 injection well, for CO_2 sequestration in Abu Dhabi's carbonate saline aquifer. This project builds on ADNOC's carbon capture facility at Al Reyadah that has a capture capacity of up to 800,000 tonnes per year of CO_2 (ADNOC, 2023a).

Recognising the potential for CCS in South Africa, the World Bank launched a US$1.35 million program in 2009 to support capacity building and knowledge development around CCS (GIZ, 2024).

Over the past few years, however, as the urgency for global decarbonisation efforts has increased, the region has started showing new impetus for CCS development. At present, 12 out of 32 countries in the region have CCS/CCUS mentioned in their nationally determined contributions (NDCs) or included in national decarbonisation policies.

Despite an increased policy focus, countries in the Middle East and Africa largely lack legal and regulatory frameworks for CCS, but some countries, such as Oman, are actively working to establish CCS-specific frameworks in anticipation of a large-scale deployment of the technology. Due to the significant presence of state-owned energy companies in most of the Middle East, the legal and regulatory frameworks will most likely be different to other regions, given existing commercial arrangements and constraints surrounding those. For instance, in the absence of a CCS-specific legal and regulatory framework, certain aspects of CCS activities may be governed through concession agreements and existing legislation pertaining to the oil and gas industry.

Currently, only three countries in the Middle East – Iran, Iraq, and Saudi Arabia – and ten countries in Africa – Angola, Egypt, Ghana, Kenya, Madagascar, Morocco, Nigeria, Democratic Republic of the Congo, Sierra Leone, and South Africa – are Contracting Parties to the London Protocol (Overheid, 2024). Among these, Iran is the only country that has ratified the 2009 amendment to Article 6 of the Protocol. This could be pivotal to any cross-country collaboration in CCS projects, where transportation of CO_2 for offshore, sub-seabed storage in another country is contemplated. Non-contracting parties wishing to transport and store CO_2 cross-border must fulfill the requirements described in the Asia Pacific and India section above.

2.2 Broader identification of key trends and issues

Beyond growing acknowledgement that CCS is a vital pathway to decarbonisation, countries are actively pursuing various mechanisms to support the deployment of CCS, ranging from policy and market mechanisms – such as carbon pricing and emissions trading systems (ETSs), to direct funding and other fiscal incentives for project development. Global trends over the past two years evidencing the acceleration of support for CCS include:

Growing fiscal incentives, resulting in more project announcements

Globally, there has been an increase in fiscal incentives and direct funding for CCS projects. Most notably:

- The EU Innovation Fund, with a total budget of €40 billion from 2020 to 2030 depending on EU ETS prices, has funded 26 CCUS projects through its first three large and small-scale funding calls (European Commission, 2024e). In October 2024, following the 2023 call for proposals which for the first time included projects of different scales, the European Commission selected 16 additional industrial carbon management projects for grant agreement preparation (European Commission, 2024f).

- The US has significantly increased the 45Q tax credits, expanded eligibility, and has made provisions to make the credit more accessible to a broader range of project configurations and partners. This

has led to a flood of new applications being made to the Environmental Protection Agency (EPA) for CO_2 storage permits (i.e., Class VI applications). The 45Q tax credit will reduce the cost of qualifying decarbonisation projects, including power plants, industrial emitters, direct air capture (DAC), and storage projects (IEA, 2023b). The Bipartisan Infrastructure Law (BIL) of 2021 also allocated US$12 billion to the Department of Energy for CCUS and DAC projects. (IEA, 2023b).

- Canada has introduced a CCUS ITC, estimated to be worth CA$5.7 billion from 2022/23 to 2027/28.

Greater regulatory certainty, leading to more projects reaching FID

CCS-specific legislative and regulatory frameworks are key to reduce project risks and provide more certainty to investors. Significant developments include the enactment of CCS-specific legislation in Japan and South Korea, the release of CCS regulations in Indonesia, refinement of regulations in the US and the EU, and development of national roadmaps and carbon management strategies in the UAE, Oman, EU and the UK, among others. Several licensing rounds have also been announced, and licences approved for onshore and offshore storage, most notably in Australia, the UK, Norway, Denmark and Texas. As of July 2024, there were 247 projects in advanced development, mostly across North America and Europe. This is the largest number yet. (Global CCS Institute (2024d)).

Increase in regional and international collaboration on transboundary CCS value chains

Various cooperation agreements on CCS have been entered into between governments, and a plethora of arrangements have been established between private sector participants to establish transboundary CCS value chains. In terms of governmental initiatives, in the first half of 2024 alone:

- Saudi Arabia and the UK have explored mutual cooperation in the fields of energy, including in clean hydrogen standards and the formulation of policies pertaining to CCS. Saudi Arabia and Jordan have signed an energy cooperation agreement to explore collaboration on decarbonisation technologies including carbon capture, reuse, transportation and storage.
- 14 cross-border CO_2 infrastructure projects in the EU have been designated and confirmed as Projects of Common Interest (PCIs) and Projects of Mutual Interest (PMIs) under the revised Trans-European Networks for Energy (TEN-E) Regulation.
- The Aalborg Declaration was signed between France, Denmark, Germany, the Netherlands, and Sweden to jointly support CCUS and a European CO_2 market.
- A JOGMEC-METI workshop was held to contribute to the social implementation of CCS, including cross-border transport of CO_2 in the APAC region.
- The Australian government has released its Future Gas Strategy, with next actions to "establish a new transboundary carbon capture and storage program which will provide options for energy security and carbon management solutions for our regional partners" and "continue to release offshore acreage for GHG storage".

A greater focus on carbon dioxide removal (CDR)

In order to achieve the Paris climate goals, negative GHG emissions will be required. This could be achieved through various nature-based and technical solutions, the latter including direct capture from air and seawater. Recent project developments include Climeworks' Mammoth DAC project in Iceland, that started operations in 2024, and Phase 1 of Oxy Low Carbon Venture's Stratos project in Texas, US – the world's largest DAC plant at 0.5 Mtpa – that is expected to become operational in 2025. In a first for Texas, the US EPA has issued Class VI injection well storage draft permits for the geological storage of CO_2 captured through the Stratos project (US EPA, 2024). A DAC pilot project is also being developed in Kenya.

In addition, 2024 has also seen the launch of Elimini, a wholly owned subsidiary of the Drax Group, that aims to deliver mega-tonne carbon removals using only renewable energy. Drax has also entered into eleven CDR deals with eight companies and established four collaborations to advance research into CDR technologies (Drax, 2024) (Govtrack US, 2024). Focus on CDR technologies is expected to continue in the coming years.

Conclusion

Despite these positive trends, the large-scale deployment of CCS still faces challenges. These relate largely to:

- The pace at which legal and regulatory regimes are being established in jurisdictions outside the US, Canada, the EEA, Australia and the UK. Many countries in Southeast Asia and the Middle East are showing interest in developing their own national CCS legal and regulatory frameworks, however this is generally not the highest priority policy focus, leading to delays in developing these regimes.

- The generally long processes globally for permitting and development of storage facilities. The International Energy Agency (IEA) notes it can take three to ten years to develop storage resources into operating facilities, including required permitting processes (IEA, no date). Although the number of announced and early phase CCS projects have increased exponentially in the last decade, permitting and storage development timelines will need to be shortened to meet ambitious climate goals by 2050. Shorter permitting timelines must however be balanced with thorough permitting processes.

- Management of long-term stewardship and liability for stored CO_2. The Intergovernmental Panel on Climate Change (IPCC) defines permanent geologic storage of captured CO_2, as 10,000 years or longer (IPCC, 2005). Clarity around ongoing stewardship and liability beyond an operator's lifespan is crucial to reduce project risk and to attract private investment. There is no standard model for ongoing stewardship and liability for stored CO_2, although in some jurisdictions operators are allowed to transfer stewardship and liability to a competent authority at a certain point post-operation, subject to meeting stringent regulatory requirements. Governments need to find a balance between providing relief to project proponents, i.e., the ability to transfer long-term storage liability to a competent authority (to encourage CCS deployment) and any financial security required to cover the any legal and financial obligations flowing from a potential future CO_2 leakage event on the government and ultimately, the public.

- Commerciality of CCS. Few CCS projects are currently commercially feasible without government support. Commercialisation will require regulatory certainty and the creation of sufficient and stable revenue streams during operation. Business models such as CO_2 transport and storage networks delivering services to capture facilities could support commerciality. Another challenge is storage resource development that is highly capital intensive in stages before reaching FID, and investment is at risk if a resource is found not suitable for development.

All the above could be addressed through a comprehensive policy approach (including incentives) and strengthening existing CCS-specific regulatory regimes. This should include a focus on shortening storage approval processes (whilst maintaining robust review processes), providing incentives for investment in storage development, and providing regulatory certainty for CCS projects, including cross-border value chains.

3.0 INTRODUCTION

Global momentum to decarbonise has been building since the Paris Agreement came into effect in 2015, with progress being made on various fronts – from national and corporate emissions reduction targets to greater renewable energy uptake, and bold steps to move away from fossil fuels. However, at present the announced reduction measures are not enough to align with the 2˚C pathway, and much less with the 1.5˚C scenario (IPCC, 2022). Analyses by the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) have consistently highlighted the critical role of CCS in facilitating the global transition to a net-zero emissions economy. Three out of the four pathways modelled by the IPCC to limit global warming to 1.5°C by 2050 incorporate a significant role for CCS and require its widespread adoption (IPCC, 2018). In the IPCC's Sixth Assessment Synthesis Report (AR6 Synthesis Report), CCS still plays a prominent role in reaching net zero by 2050 (IPCC, 2023). In its updated Net Zero Roadmap report, the IEA continues to attribute significant emissions reduction by 2050 to CO_2 captured and removed, under its net-zero scenario (IEA, 2023a).[2]

Over the past decade – and even earlier in some jurisdictions – several countries have expanded their policy frameworks to formally include support and guidance for CCS. These policy frameworks are broad and cover a range of attributes from voluntary approaches, international collaboration, knowledge sharing, and direct commitments by governments. Additionally, many countries have developed and implemented laws and established the associated regulations to provide clarity for safe and effective CCS activities within their jurisdictions. The enhanced policy support, development of legal and regulatory frameworks, establishment of market mechanisms, provision of public finance, and fiscal incentives provide long-term stability and certainty to CCS-related activities.

While early-mover jurisdictions including the US, EU, Canada and the UK have continued to refine their policies and regulatory frameworks to support project development and large-scale deployment, a second wave of legal and regulatory developments is underway, largely in APAC. Although there are still challenges to large-scale deployment in many jurisdictions, continued financial support, streamlined licensing, and well-defined and efficient permitting processes could significantly contribute to CCS projects being deployed at scale in the coming years.

4.0 REGIONAL ANALYSIS

4.1 The Americas

4.1.1 Overview

The Americas region has three main jurisdictions with active CCS-related developments and activities currently - the United States, Canada, and Brazil.

United States

The US has committed through its NDC to reduce GHG emissions 50%-52% below 2005 levels by 2030 and has included CCS as a pathway to achieve this target. The US is a mature CCS jurisdiction with longstanding governance structures in place and recent policy support for CCS through:

- The 45Q tax credits. The passing of the Inflation Reduction Act (IRA) in 2022 increased the CCS tax credit; see Table 1 for details.
- Grants, loans, and loan guarantees made possible by funding from the Infrastructure, Investment, and Jobs Act passed in 2021; also known as the Bipartisan Infrastructure Law (BIL).

These two laws and the promise of fiscal and public finance support resulted in a corresponding increase in project announcements. CCS activity is highly dependent on policy support, such as tax credits and subsidies, to provide the financial certainty the private sector can rely on to invest in projects. The passage of these laws, and associated regulatory guidance, provided a boost to both financial support and more certainty around funding availability and timeframes. The IRA also lowered capture thresholds for facilities to become eligible for the tax credit.

The US also benefits from having strong institutional support and from having enabled investments in the CCS industry early on, through decades of research and development efforts in CCS technologies and building regionally-focused partnerships to support pilot and commercial-scale projects. Examples include the Regional Carbon Sequestration Partnerships (RCSPs), and CarbonSAFE program (see box). Future policy support has further strengthened this position and made it possible for more industry participants to invest in CCS.

ACTIVITY		BEFORE IRA (IN US$ PER TONNE OF CO_2)	AFTER IRA (IN US$ PER TONNE OF CO_2)
Geological storage of CO_2	From power generation and industrial facilities	50	85
	From DAC facilities[2]	50	180
Utilisation of CO_2	From power generation and industrial facilities	35	60
	From DAC facilities	35	130

Table 1 - Increases to the 45Q tax credit from the Inflation Reduction Act of 2022

[2] DAC was added to 45Q in 2018 through the Bipartisan Budget Act of 2018

REGIONAL CARBON SEQUESTRATION PARTNERSHIPS AND CARBONSAFE

The Regional Carbon Sequestration Partnerships (RCSP) are run by the National Energy Technology Laboratory (NETL) at the US Department of Energy (DOE) (United States Department of Energy and National Energy Technology Laboratory, 2022c) and fall under the jurisdiction of the Carbon Storage program at this national laboratory. The NETL is one of several national laboratories in the US and is specifically a part of the DOE's Office of Fossil Energy and Carbon Management (FECM) (US Department of Energy and National Energy Technology Laboratory, 2022b).

Originally there were seven RCSPs in the Carbon Storage program in different geographical regions across the US and Canada (United States Department of Energy and National Energy Technology Laboratory, 2022d), namely the Midwest Regional Carbon Sequestration Partnership (MRCSP, 2022), the Midwest Geological Sequestration Consortium (MGSC, 2022), the Plains CO_2 Reduction Partnership (PCOR, 2022), the Southeast Regional Carbon Sequestration Partnership (SECARB, 2022), the Southwest Regional Partnership on Carbon Sequestration (Southwest Partnership (SWP), 2022), the West Coast Regional Carbon Sequestration Partnership (WESTCARB, 2022), and the Big Sky Carbon Sequestration Partnership (BSCSP, 2022).

Having achieved the goals of the RSCPs, the DOE currently executes the Carbon Storage Assurance Facility Enterprise (CarbonSAFE) program (US Department of Energy and National Energy Technology Laboratory, 2022a). The DOE also leverages the learnings of the vast RSCP stakeholder base through their four Regional Initiatives. (United States Department of Energy and National Energy Technology Laboratory, 2022a)

In 2021, the Council on Environmental Quality, a division of the Executive Office of the President, released a report entitled 'Council on Environmental Quality Report to Congress on Carbon Capture, Utilization, and Sequestration' (Council of Environmental Quality and The White House, 2021). The report was developed with input from various federal departments, agencies and offices – namely the EPA, the DOE, the DOI, the DOT and the Federal Permitting Improvement Steering Council. The report is a broad discussion of the state of play on CCS, incentives, public engagement, opportunities and includes all components of the value chain – capture, transport, and storage.

The momentum in policy and regulatory development in the US has extended to the states. Many states have been active in passing carbon management legislation and in addressing Class VI primacy, pore space rights and CO_2 ownership, permitting, CO_2 pipelines, long-term stewardship, and site closure requirements, to name a few. There is also an acknowledgement at the state level that market mechanisms will be necessary to self-sustain CCS activity.

CLASS VI PRIMACY

The US federal Environmental Protection Agency (EPA) has the primary enforcement authority to implement the Underground Injection Control (UIC) program. There are six categories of wells in this program, designated by Class. Class VI wells, the newest category, are exclusively for geological storage of CO_2. The EPA can grant primary enforcement authority – also known as primacy – to states that apply and meet the EPA's Class VI requirements. So far three states have Class VI primacy: North Dakota, Wyoming, and Louisiana. West Virginia, Arizona, and Texas are in the process of applying.

Canada

Canada is another mature jurisdiction for CCS, with CCS activities supported at both the federal and provincial levels. The country has also benefited from research and development efforts between the public and private sectors. The Quest CCS project in Alberta is an example of a public-private partnership between the province and Shell.

Canada also has provided strong institutional support for CCS. In its current NDC submitted in 2021, Canada has committed to reducing GHG emissions by 40%-45% below 2005 levels by 2023 (Government of Canada, 2021). Also in 2021, the federal government passed the Net-Zero Emissions Accountability Act (Government of Canada, 2024a). The law requires the Canadian government to be accountable and transparent in its commitment to achieving net-zero emissions by 2050, and to elicit public input along with independent advisory in achieving the target. Several studies have shown that while CCS has already contributed to the safe storage of nearly 45 million tonnes of CO_2 to meet these targets, the sector will have to grow to capture and store at least 15 Mtpa by 2030 (Center for Strategic and International Studies, Nikos Tsafos and Stephen Naimoli, 2022; Global CCS Institute, 2023b; International CCS Knowledge Centre, 2023).

With its prominent position in geological storage capacity, Canada has recognised the potential of CCS to help decarbonise its prominent heavy industry sectors (Center for Strategic and International Studies, Nikos Tsafos and Stephen Naimoli, 2022; Government of Canada, 2023). References have been made to the cement, fertiliser, mining, oil and gas, power generation, and steel industries in its Carbon Management Strategy (Government of Canada, 2023). The federal government has several programs backed by policy, law, and regulation that can support CCS projects (Government of Canada, 2023). Some notable ones are:

- The CCUS Investment Tax Credit
- GHG Offset Credit System Regulations, which includes a DAC protocol
- Investments from the Canada Infrastructure Bank for CCUS infrastructure
- Clean Fuel Regulations
- Canada Growth Fund

In 2020, the federal government released a plan to achieve its environmental goals, 'A Healthy Environment and a Healthy Economy', which includes a proposal to develop a comprehensive CCUS strategy. This proposal was included in a discussion to eliminate pollution from developing natural resources and from heavy industry.

Recent federal incentives include:

- Compliance credits for Canada's Clean Fuel Standard that can be created through projects that use CCS as a carbon reduction technology
- An ITC for CCUS projects, established through the Canadian federal government Bill C-59 and passed into law in June 2024. Support for the ITC dates back to 2022 when Canada's federal budget of that year proposed a CCUS ITC
- Two CCfDs established by the Canada Growth Fund as of June 2024

CCS is also mentioned as a part of the Hydrogen Strategy for Canada, a strategy document released in 2020 that features an extensive discussion on hydrogen production pathways. Hydrogen that is produced with CCS (sometimes referred to as low-carbon or blue hydrogen) is mentioned, along with the federal Natural Resources Canada department considering opportunities to develop a CCUS sector which would also include negative emissions technologies like DAC and BECCS.

At the provincial level, Alberta's Technology Innovation and Emissions Reduction (TIER) system provides pricing regulation for GHGs. The regulation covers about 60% of emissions within the province. TIER-regulated facilities must keep emissions below a benchmark value and functioning like other trading systems, and generate performance credits if emissions are below the benchmark. If emissions are above the benchmark, facilities comply through generating Alberta Emissions Offsets, submitting emissions performance credits or buying TIER fund credits that provide the financial support for the TIER fund. Regulated facilities can create emissions offsets using CCS or EOR as an emissions reduction technology, which in turn can be converted to sequestration credits. Sequestration credits function like emissions performance credits and can be traded. TIER-regulated facilities can capture CO_2 and geologically store it onsite or send it to another facility for geological storage or EOR (Government of Alberta, 2022). Proceeds from the TIER fund also support organisations like Emissions Reduction Alberta, which in turn provides funding for CCUS technology development (Emissions Reduction Alberta, 2020).

Brazil

Brazil's bill 1425/2022 has been passed into law, establishing a comprehensive legal and regulatory framework for CCS in the country. Brazil is the first South American nation to enact CCS-specific legislation, which could provide a replicable CCS framework for other nations in the region.

A lack of access to financing or fiscal support through tax credits or other incentives can have an impact on project development. Public-private partnerships to develop options for CO_2 transportation through pipelines or other vectors could help integrate the CCS value chain, which in turn could support project development. There is also uncertainty around public perception of CO_2 storage, which will require sufficient engagement with communities on potential CCS projects.

4.1.2 Key trends in North America

Growing fiscal incentives and a resultant increase in project announcements

Fiscal support in the form of tax incentives have created considerable interest from the private sector. The passing of the IRA in the US in 2022, with its enhancements to the 45Q tax credits for CCS, has resulted in several announcements being made in the past year. The enhancements to 45Q have sparked conversations in several other global jurisdictions looking to replicate similar measures domestically. The IRA also introduced Direct Pay, the rules for which were finalised by the Internal Revenue Service (IRS) earlier this year, which enables tax-paying organisations to receive a direct payment, and tax-exempt organisations like public utilities and local governments to claim the tax credit as a direct payment from the IRS. In June 2024, the Canadian Parliament passed Bill C-59, which established a tax credit that includes CCUS (Global CCS Institute, 2024c; Government of Canada, 2024b), while India released a CCUS report in late 2022 with a discussion on how a similar measure to 45Q could work in India (NITI Aayog, Government of India and M. N. Dastur and Company (P) Ltd., 2022).

Continued public finance support for projects

Public finance is the strongest mechanism offering support to CCS projects. The US and Canada have the most developed government financing programs for CCS including several revenue streams, namely grants, subsidies, RD&D funding, and loan guarantees. The BIL and IRA in the US have made grants and loans available for CCS projects. As of August 2024, awarded projects include:

- Two demonstration projects, one in Texas and another in California. There is a third project in North Dakota under award negotiation (Office of Clean Energy Demonstrations (OCED) and US DOE, 2024b).
- Six front-end engineering design (FEED) projects. Two projects are under award negotiation (Office of Clean Energy Demonstrations (OCED) and US DOE, 2024a).

National policies that support public finance along with sub-national policy support, like in Canada's Alberta province, can unlock further opportunities for CCS. Public finance and fiscal incentives are both still crucial to ensure CCS project development continues, even in mature jurisdictions; for example, the public finance model can be complemented through public-private partnerships. Quest in Canada and all of DOE's projects including ADM in the US are examples of public-private partnerships that have successfully collaborated on CCS projects.

National and sub-national institutional support offer stability for projects

Policy support is often the result of institutional support and coordination amongst several branches or levels of government. This includes the presence of agencies or other government offices with mandates to oversee CCS-related activities, emissions management targets, or carbon budgets. In North America, while it is more common for national governments to offer support for CCS, government support at the sub-national level is also prominent and growing in the US and Canada. Operators of projects that start activities in this policy environment can rely on institutional stability, along with the possibility of it strengthening further as the CCS economy develops.

4.1.3 Specific national policy, legal, regulatory and commercial developments

North America

The G7, which includes the US and Canada, have reaffirmed their net-zero ambitions and pledge to accelerate carbon management which includes CCS and CO_2 removal. The US and Canada are also co-sponsors of the Carbon Management Challenge (Carbon Management Challenge, 2024).

CARBON MANAGEMENT CHALLENGE

Carbon Management Challenge (CMC) is an international undertaking to accelerate the deployment of CCUS. Its co-sponsors include Brazil, Canada, Indonesia, the UK and the US.

Additionally, as of September 2024, CMC participants include Australia, Bahrain, Denmark, Egypt, the European Commission, Iceland, Indonesia, Japan, Kenya, Saudi Arabia, Mozambique, Netherlands, Nigeria, Norway, Romania, Senegal, Sweden, and the UAE.

CMC participants recognise that global warming must be limited to 1.5 °C and to do so will require increasing the speed and scale at which carbon management technologies are adopted.

Participants agree to advance carbon management projects that globally will reach gigatonne scale by 2030 – that is, collectively managing 1 Gtpa or more – to ensure their actions align with the science. The gigatonne-scale target includes projects in the development pipeline and those operational by 2030.

United States

A timeline showing the evolution of policies, legislation and regulation relevant to CCS in the US is presented in Figure 1.

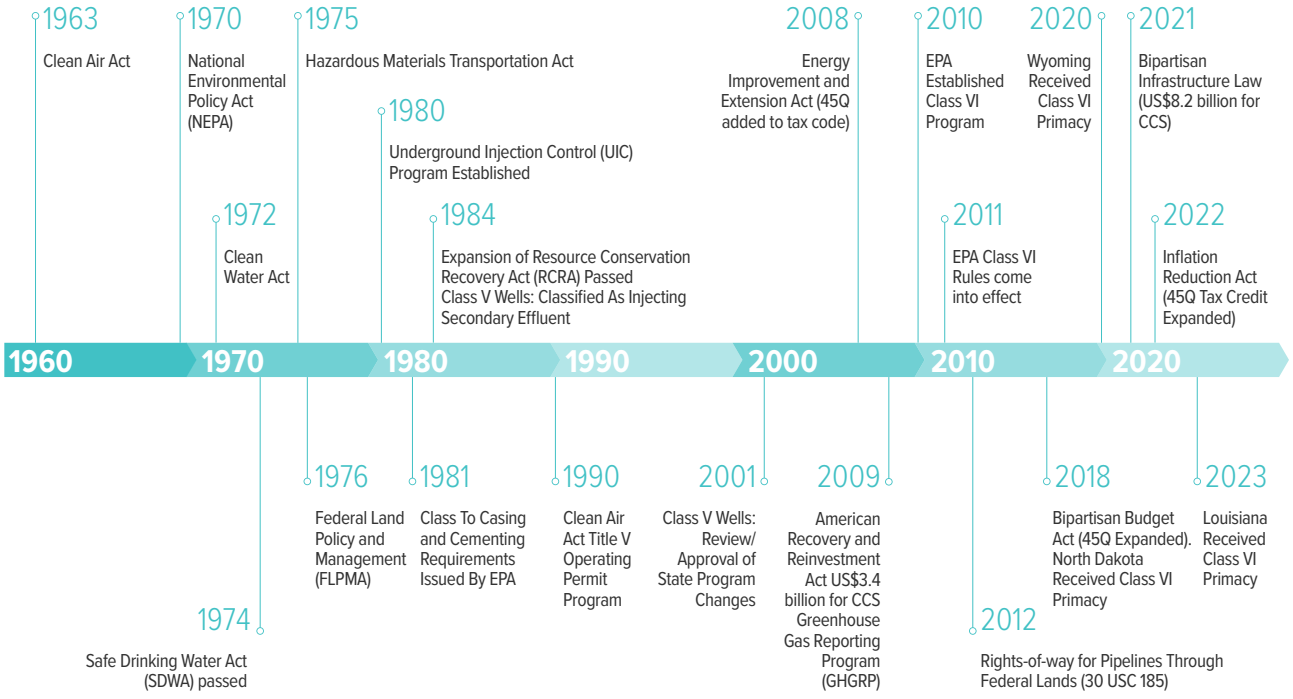


Figure 1 - Main CCS policy, legal and regulatory developments in the US

Federal-level developments

Policy developments that have occurred in 2024, as well as updates to select policy instruments from legislation enacted over the last three years, are detailed in Table 2.

TYPE OF POLICY INSTRUMENT		JURISDICTION (DEPARTMENT)	INSTRUMENT NAME (LAW)	STATUS	DETAILS
Direct policy requirements	CCS-related regulatory framework	Federal (EPA)	New source performance standards	In effect	The EPA released new source performance standards (NSPSs) for GHG emissions from existing coal-fired power plants and new base-load gas-fired plants. They are mandated to capture 90% of their CO_2 emissions by 2032. CCS has been identified as "the best system of emission reduction (BSER) for the longest-running existing coal units and most heavily utilised new gas turbines".
Financial incentives for operators	Tax incentives	Federal	45Q tax incentives (IRA)	In effect	CCS deployment in the US is accelerated by policy incentives and funding from the BIL, the IRA and the CHIPS & Science Act. For details, consult the Global CCS Institute's Global Status of CCS 2024.
	Public finance		Grants, loans, and loan guarantees (BIL)		
Supportive policies and programs	Joint policy statement	Federal (multi-agency)	VCMs Joint Policy Statement and Principles	In effect	The Department of the Treasury, together with the secretaries of the Department of Agriculture and Department of Energy (DOE), and the National Economic and Climate Advisors, released a joint policy statement and principles for responsible participation in voluntary carbon markets, wherein CDR is included.
	Departmental Initiative	Federal (DOE)	Voluntary CDR Purchasing Challenge	In effect	The DOE through the Office of Fossil Energy and Carbon Management announced an initiative called the Voluntary CDR Purchasing Challenge to increase purchases of CDR credits.
Legal and regulatory governance structure	Regulatory framework for CO_2 transport	Federal (DOT)	Pipeline safety standards	In progress	The Department of Transportation, through the Pipeline and Hazardous Materials Safety Administration, has drafted updated safety standards for CO_2 pipelines. It is now in an interagency review phase.
	Regulatory framework for offshore CO_2 storage	Federal (DOI)	Offshore CO_2 storage regulation	In progress	The BIL of 2021 authorised the Department of the Interior (DOI) to regulate the injection of CO_2 in offshore geological formations. Two DOI agencies, the Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement, are drafting regulations.

Table 2 - Main CCS policy, legal and regulatory instruments in the US

State-level legislative developments

US state-level CCS policy and legislative developments have accelerated in recent years, cementing CCS as a major tool for decarbonisation at the state level. In 2023, state legislatives enacted 22 bills which had provisions related to Carbon Management (Great Plains Institute (GPI), 2023).

The Great Plains Institute maintains a comprehensive tracker of ongoing legislative developments in 2024 related to Carbon Management at the US state level (Great Plains Institute, 2024). Notable developments in legislation enacted in 2024 are included in Table 3.

TOPIC	LEGISLATION
CO_2 pipelines	Illinois passed the SAFE CCS Act under which CO_2 pipelines cannot be developed until the PHMSA's proposed CO_2 pipeline rulemaking is finalised or 1 July 2026, whichever is earlier. Minnesota enacted SF 4942, which requires that an independent third-party organisation conduct a study on CO_2 pipelines to assess the associated health, safety and environmental impacts and make recommendations on regulatory measures.
CO_2 transportation and storage	Illinois' SAFE CCS Act (SB 1289) lays out a regulatory framework for CO_2 transportation and storage related activities. Other stipulations are covered, some of which are: • CO_2 transportation cannot be carried out until PHMSA has finalised revisions to pipeline safety rules. • Operators are required to pay a permit fee and have detailed closure and post-injection site care plans for at least 30 years. • Funds from the fees will be allocated to various funds including the CO_2 Storage Administrative Fund. • The operator owns the stored CO_2. • A CO_2 Storage Long-term Trust Fund will be used to cover remedial action. • Using CO_2 for EOR is prohibited. Louisiana also enacted HB 516, which proposes the development of a regulatory framework for CO_2 storage. Topics include mapping, placement of storage facilities, zoning, and annual testing, and HB 492, which clarifies the state's existing legislation on eminent domain with relevance to the transport and storage of CO_2.
Pore space rights, landowner rights, land management	Louisiana enacted HB 966, which, like land rules for oil and gas developments, authorises the Commissioner of Conservation to order the consolidation of reservoirs, unitisation, and pooling for CO_2 geological storage. Pennsylvania enacted SB 831, which lays out a protocol for obtaining property owner consent for pore space unitisation. The operator of the storage facility must obtain a minimum of 75% ownership interest in the pore space for the storage facility. Operators will also pay a fee for CO_2 injection, which will fund a CO_2 Storage Facility Fund. The state can issue a certificate of project completion 10 years after CO_2 injection has ceased and monitoring and management of the closed facility meet the state's requirements. Colorado enacted HB 24-1346, enabling the Energy and Carbon Management Commission to regulate geologic storage. The bill also clarifies that pore space rights belong with the surface owner. Alabama enacted HB 327, which clarifies pore space rights in the state. The surface owner owns the pore space. South Dakota passed bills that would establish a "landowner bill of rights". Bills SB 201, HB 1185, and HB 1186 aim to support and streamline Midwest CO_2 pipeline development projects.
Liability	Louisiana enacted HB 937 to streamline the CO_2 storage regulatory framework. The bill also clarifies that landowners do not have to incur undue liability-related burdens for actively that were not directly under their control. West Virginia enacted HB 5045, which extended the period for the state to issue a certificate of completion with compliance requirements, after CO_2 injection has ceased for at least 50 years. The law also states that the operator is not released from liability of non-compliance with permit requirements, regulations, and related laws after the state has assumed liability from the operator.

TOPIC	LEGISLATION
CCS financing, allocation of funds	California enacted AB 2731, which emends the California Pollution Control Financing Authority Act to finance pollution control/reduction that include CO_2 capture facilities. Illinois enacted SB 0251 and, effective 1 July, funds have been allocated to implement the SAFE CCS Act. Alaska enacted SB 187, which allocates US$11.1 million to the University of Alaska at Fairbanks for the Railbelt CCS project. Utah in March enacted HB 452, which establishes the CO_2 Storage Fund by repealing two other CCS-related funds and combining them into one. Regulatory expenses for permitting, construction, operation and storage facilities, including construction, operation, monitoring, pre-closure, remediation and repair of storage facilities and injection wells, can be financed from this fund.
State tax credits	Utah enacted HB 124 to include CCUS as an emissions reduction technology. Emissions reduction projects are now added to definition of infrastructure projects. This makes them – and CCUS projects – by extension eligible to obtain tax credits for infrastructure development.
Class VI primacy	Michigan enacted SB 0747, which allocated funding to the state's Department of Environment, Great Lakes, and Energy, for a project that would help the state obtain Class VI primacy and to hire staff to implement it.
Alternative fuels and CCS	Nebraska enacted LB 937 and through it created a tax credit that incentivises utilising and producing sustainable aviation fuel (SAF). The bill requires that SAF must provide for at least a 50% reduction in lifecycle GHG emissions, and CCS can be used. Mississippi enacted SB 2059 on March 22 which assigns a renewable and carbon-neutral classification to bioenergy from biomass. It can be assigned carbon-negative if it is paired with CCS.

Table 3 - State-level legislative developments in 2024

Engagement, including Community Engagement

The National Petroleum Council released a report in 2019 entitled 'Meeting the Dual Challenge: A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage' (National Petroleum Council (NPC), 2019). While dated, the three-volume report is comprehensive and offers an exhaustive analysis of the role of CCUS, including the policy, legal, and regulatory enablers necessary to make it successful. Amongst the key findings are how CCUS is crucial to meeting the dual challenge of providing affordable energy options while addressing the effects of climate change.

Finalised in August 2024, the Responsible Carbon Management Initiative (RCMI) is an initiative run by the Office of Fossil Energy and Carbon Management (FECM) at the DOE. The FECM requested information from stakeholders between August and September 2023 that the report takes into consideration. At a high level, the RCMI is comprised of the following 10 principles.

- Principle I: Community Engagement
- Principle II: Workforce Development and Quality Jobs
- Principle III: Tribal Engagement
- Principle IV: Environmental Justice
- Principle V: Environmental Responsibility
- Principle VI: Air, Water, and Soil Quality
- Principle VII: Health and Safety
- Principle VIII: Emergency Response
- Principle IX: Transparency
- Principle X: Long-term Stewardship

The following US Federal permits and reviews require engaging with the public through either a combination of awareness, communications, comments, hearings, notices, notifications, petitions, stakeholder engagement, and citizen suits (Council of Environmental Quality and The White House, 2021). The list below provides the relevant laws, the programs listed under these laws, the federal department and the agency or agencies that require them, if applicable:

- Clean Air Act Title V Operating Permit
  - EPA for states that do not have an EPA-approved program.
- Prevention of Significant Deterioration (PSD)/New Source Review
  - EPA for states that do not have an EPA-approved program.
- Underground Injection Control (UIC) Program – the Class VI program is included
  - EPA for states that do not possess Class VI primary enforcement responsibility/authority: also known as primacy.
- National Pollutant Discharge Elimination System
  - EPA
- Hazardous Liquid Pipeline Act
  - DOT, PHMSA
- Clean Water Act Section 404
  - DOD, US Army Corps of Engineers
- Endangered Species Act – Federal Lands
  - DOI, for land and freshwater species
  - DOC, for marine species
- Rights-of-Way for pipelines through Federal Lands.
  - DOI, Bureau of Land Management
  - DOA, US Forest Service
- Federal Land Policy and Management Act
  - DOI, Bureau of Land Management
  - DOA, US Forest Service
- National Forest Management Act
  - DOA, US Forest Service
- Mineral Leasing Act
  - DOI, Bureau of Land Management
  - DOA, US Forest Service
- National Environmental Policy Act
  - Council on Environmental Quality
- National Historic Preservation Act – Federal Lands
- Marine Protection, Research, and Sanctuaries Act
  - EPA
- Outer Continental Shelf Lands Act
  - DOI, Bureau of Offshore Energy Management (BEOM) – this is for offshore activities only. The regulation that will govern CCS-related activities is being formulated by the DOI through BEOM's engagement with Bureau of Safety and Environmental Enforcement; see Table 2.

The departments of State (DOS) and Commerce (DOC) released the CCUS handbook for policymakers. It was jointly developed by the DOC's Commercial Law Development Program and the DOS's Bureau of Energy Resources.

The American Petroleum Institute released a recommended practice, RP 1185, for public engagement on pipelines, which includes CO_2 pipelines (Global CCS Institute, 2024e).

Canada

The timeline in Figure 2 highlights the development of laws and regulations in Canada at both the federal and provincial levels that have been influential in supporting CCS projects. While more recent legislation has been more focused on CCS directly, their frameworks have been influenced by the structure of earlier legislation that focused on resource development.

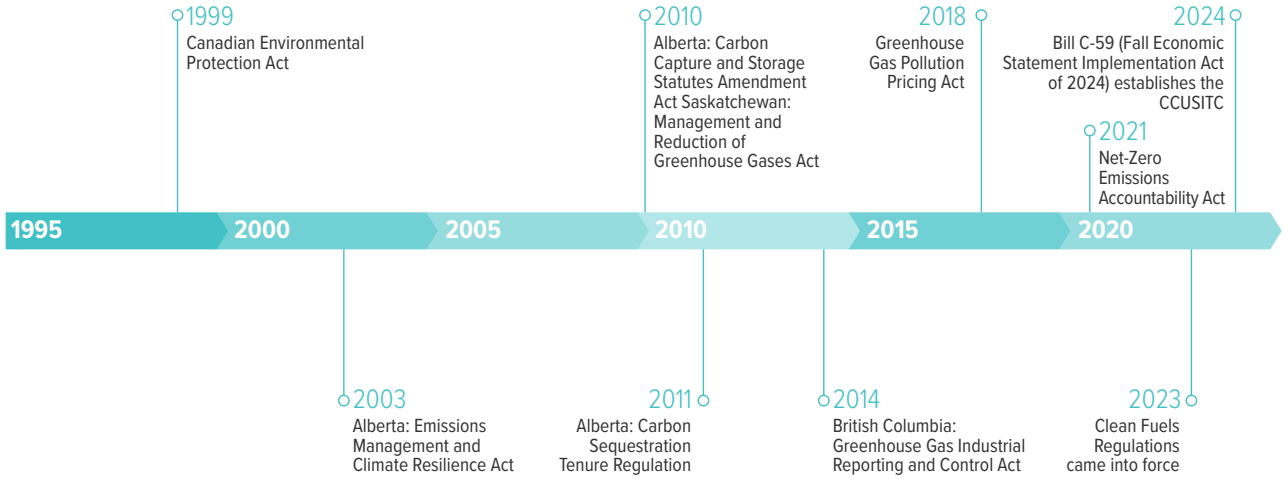


Figure 2 - Main CCS policy, legal and regulatory developments in Canada

Background on the laws and regulations in the timeline:

The Net-Zero Emissions Accountability Act passed in 2021. After the passage of this law, the federal government places legislative certainty on Canada's goal of achieving net-zero GHG emissions by 2050. The law also establishes a framework and provides transparency and accountability. Furthermore, it legally binds Canada's five-year emissions-reduction targets and requires plans to be developed to meet them.

The Canadian Environmental Protection Act enacted in 1999 forms the basis for the Clean Fuels Regulation (CFR) finalised in 2022. CCUS is included in the CFR as a technology that can create compliance credits.

The Greenhouse Gas Pollution Pricing Act of 2018 established the pricing of carbon pollution. The law set up a pricing system that incentivised lowering GHG emissions. This output-based pricing system (OBPS) recognises carbon management technologies like storage in deep saline aquifers and depleted oil and gas reservoirs (Government of Canada, 2023).

Alberta's Emissions Management and Climate Resilience Act enacted in 2003 recognised that carbon management will be necessary to protect the environment.

Alberta enacted legislation and established regulations that supported CCUS, namely through the:

- Carbon Capture Storage Funding Act, which formally encourages the development of CCS projects in Alberta.
- Carbon Capture and Storage Statutes Amendment Act, which amended several older existing laws in the province such as the Mines and Minerals Act, the Surface Rights Act, the Public Lands Act, and the Oil and Gas Conservation Act. These amendments included CCS-related provisions.
- Carbon Sequestration Tenure Regulation, which provides the basis for Alberta to grant a tenure agreement – or the rights – to sequester CO_2.

British Columbia's Greenhouse Gas Industrial Reporting and Control Act includes CCUS among several technologies that can be regulated.

Saskatchewan's Management and Reduction of Greenhouse Gases Act allows offset credits to be generated for capturing and sequestering GHGs.

Policy updates

- The Canada Growth Fund is supporting Varme Energy Inc. in its second contract for difference. CGF will purchase 200,000 tonnes per year of carbon credits for 15 years at CA$85/tonne plus escalation.

Legislative updates

- Canada's federal government passed into law Bill C-59 that established an ITC for CCUS projects. Support dates back to 2022, when Canada's federal budget that year proposed a CCUS ITC.

CANADA'S CCUS ITC

The CCUS ITC applies to eligible expenses from 1 January 2022 and takes the form of a refundable credit from 2022 to 2030 of up to:

- 60% of DAC equipment
- 50% of other capture equipment
- 37.5% of qualified carbon transportation, storage and usage equipment

From 2031 to 2040, the above rates will be halved, and no credits will be available after 2040. This arrangement encourages early investment in capture, transport and storage equipment, to meet decarbonisation targets.

The CCUS ITC is available in Alberta, Saskatchewan, and British Columbia (Tossou, Nahornick and Scholz, 2024).

Rest of the Americas

Brazil

Brazil enacted the Fuels of the Future Bill (PL 528/2023) in October 2024, which establishes the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (also known as ANP) as the regulatory authority for CCS activities (Brazilian National Agency of Petroleum, 2024).

Bill 1425/2022 aims to establish a legal framework for CCS. The bill was approved by a special committee in the Ministry of Mines and Energy in late November 2023 and requires approval from the Chamber of Deputies to be enacted.

Trinidad and Tobago

The Green Climate Fund (GCF) has announced funding for a CCS project in Trinidad and Tobago, the first time that the GCF will support CCS-related activities. The project will assess the CO_2 storage potential of deep saline geological formations and prepare a national storage atlas.

4.2 Asia Pacific and India

4.2.1 Overview

Momentum for CCS in the APAC region is growing, from jurisdictions such as Australia, Japan, China and India to South Korea and the Association of Southeast Asian Nations (ASEAN) block of nations. Some countries in the region pledged to achieve net-zero emissions and established interim targets for 2030, and several have subsequently established CCS-specific policy or regulatory support, building on their announced, or in the case of Australia, legislated, targets. Developments in the region, some implemented, some announced, include:

- Market mechanisms such as emissions trading schemes (ETSs).
- Establishment of or increase in carbon tax/price.
- Government commitments and policy strategies to roll out CCS, such as roadmaps, energy transition strategies referencing the anticipated emissions reduction contribution, and mapping pathways for decarbonisation.
- Fiscal incentives, including tax credits, grant funding or government finance such as bonds for projects to improve commerciality of CCS investment.
- Legal and regulatory developments, including permitting pathways, post-closure liability and monitoring, reporting and verification (MRV) protocols to accommodate emerging business models.
- Hubs and cross-border projects supported by international collaboration initiatives, and bilateral agreements/arrangements.

Australia, Japan and China have positioned themselves as leaders through established and early policy and regulatory support for the technology. In Japan and Australia, early support has taken the form of grant funding, eligibility for credits under market mechanisms, and amendments to legal frameworks, to facilitate CO_2 storage.

- Australia's domestic policy landscape consists of well-developed legal and regulatory frameworks, current and historic grant funding for projects amounting to over AU$850 million and eligibility for credits under market mechanisms, such as the ACCU Scheme and Safeguard Mechanism. The federal government is now building upon this foundation to facilitate regional collaboration on transboundary CCS value chains.
- While Japan's efforts in clean energy, project finance, and technology transfer since the 2000s marked its early involvement in the region, in recent years, it has intensified efforts through strategic roadmaps and an integrated legal and regulatory framework to advance full-scale CCS deployment.
- China historically supported pilot and large-scale demonstration programs and investment in commercial-scale CCS projects through state-owned enterprises. Since its pledge in 2020 to reach net-zero emissions by 2060, multiple policy documents have included CCS in decarbonisation pathways and funding allocated to projects. These policy documents mark the first detailed involvement of the central government in coordinating CCS deployment, indicating a steady exploration of various policy avenues to accelerate CCS in China.

In Southeast Asia, Indonesia and Malaysia have emerged as forerunners in the region through the establishment of a variety of support mechanisms for deployment of CCS:

- Indonesia's recently released regulatory framework for CCS is the first in the region to facilitate CCS activities across multiple sectors and address transboundary CCS considerations such as monitoring and reporting and the allocation of liabilities.
- Malaysia has released several national policy documents with clear commitments and targets to support CCS initiatives, including becoming a regional hub, and providing CCS services to neighbouring countries.

Thailand has recently announced the implementation of a carbon tax by 2025, and Singapore increased its carbon tax to S$25/t$CO_2$-e, aiming to reach S$50-80/tCO_2-e by 2030, which could begin to incentivise mitigation options like CCS. Policy and regulatory frameworks for CCS remain nascent in the rest of the APAC region.

In India, there is progress in terms of direct government recognition and policy support for the technology. However, policy, legal, and regulatory developments remain at a nascent stage and uncertainties in the policy and regulatory landscape continue to present barriers to progress.

4.2.2 Key trends

Accelerated development of regulatory frameworks

Several countries including South Korea, Indonesia, Japan, Thailand and Malaysia have established regulatory frameworks that build on the foundations of frameworks developed by early-mover jurisdictions such as Australia and the European Union. However, in some instances, the new regulatory frameworks lack clarity on key details, such as permitting, and will require the development of supporting regulations or guidance documents.

A further feature of these frameworks is the focus on improving commerciality of CCS through facilitating hub development and transboundary CCS value chains. For example, specific provisions under Indonesia and South Korea's frameworks outline eligibility of third-party access to utilise CO_2 storage sites and government support for the creation of CCS industrial clusters. Indonesia, Thailand, Japan and South Korea's CCS-specific legislation refer to the eligibility of CCS "business" entities to undertake CCS activities, indicating a commitment to facilitating a conducive regulatory environment for companies aiming to provide CCS as a business or service.

In contrast, Australia has focused on streamlining and improving legal frameworks to accommodate project developments and efficiencies. Sub-national developments also strengthen Australia's regulatory infrastructure. In 2024, for example, the state of Western Australia established legislation to regulate CCS.

Enablement of transboundary CCS value chains

High domestic emissions, inequalities in geological storage resource capacity, and proximity to neighbouring countries with ample storage are making transboundary CCS value chains an attractive opportunity.

Accordingly, Australia and Indonesia have both established legislation enabling or recognising transboundary CCS activities. As a party to the London Protocol, Australia has established a permitting pathway for CO_2 export and import activities in compliance with the Protocol. Indonesia has enabled CO_2 storage permit holders and contractors to allocate 30% of total carbon storage capacity for foreign use (with this percentage subject to adjustment based on national policy) and has outlined requirements for the country to enter into bilateral agreements with other countries to conduct cross-border CO_2 transport. South Korea, which is a party to the London Protocol, has accepted the 2009 amendment and deposited a declaration of provisional application of the 2009 amendment with the International Maritime Organisation to conduct transboundary CCS activities. South Korea's new CCS Act also provides for international cooperation on CCS, including securing overseas CO_2 storage sites.

Malaysia, Singapore and Japan have committed through various policy mechanisms to enabling cross-border CO_2 transport and storage. To this end, Singapore has signed a Letter of Intent (LOI) with Indonesia, while Japan has announced funding support for nine CCS projects in line with its Long-Term CCS Roadmap, four of which involve cross-border CO_2 transport and storage value chains.

Establishment of regional collaboration platforms

The challenge facing the APAC region is balancing its predominantly fossil fuel-reliant energy systems with rising energy demand driven by economic growth, all while achieving climate change mitigation targets. This has led countries in the region to pursue opportunities to collaborate on decarbonisation goals, including in the context of accelerating CCS deployment. The nature of collaborative initiatives has varied and include bilateral agreements, knowledge-sharing forums and regional crediting and funding mechanisms, among others. in 2020, Australia and Singapore signed the Green Economy Agreement, which aims to facilitate collaborative efforts between the two nations to achieve net-zero emissions. The text of the Agreement in the "Principles of Green Economy Cooperation" section specifically mentions both CCS technology and cooperation on its deployment.

Further evidence of strategic collaboration is the establishment of regional collaboration platforms. A key example is the Asia Zero Emission Center (AZEC), supported by the governments of Japan, Australia and the ASEAN block of nations. AZEC aims to support policy development, coordination, and the promotion of public-private partnerships to advance decarbonisation efforts in Asia, focusing on technologies such as hydrogen, ammonia, and CCS (The Government of Japan, 2024). AZEC joins existing government-supported regional platforms such as the Asia CCUS Network, which provides a platform for policymakers, industry players, financial institutions and other stakeholders to collaborate on CCUS deployment in the region. Key initiatives of the latter include knowledge sharing, the

creation of common rules and realisation of storage networks across Asia. The Economic Research Institute for ASEAN and East Asia (ERIA) currently hosts both the AZEC and the Asia CCUS Network under its platform.

Establishment of national carbon pricing/tax regimes

A variety of carbon pricing mechanisms or support for such mechanisms has also begun to emerge in the region, signaling a commitment from governments to enhance the role of CO_2 markets to achieve emissions reduction targets. Singapore established a carbon tax in 2019, which was initially set at S$5/t$CO_2$-e until 2023 and raised in 2024 to S$25/t$CO_2$-e (National Climate Change Secretariat Singapore, 2024a). Further increments are expected, to S$45/t$CO_2$-e in 2026 and 2027, to ultimately reach S$50-80/t$CO_2$-e by 2030. Similarly, Thailand has announced a CO_2 tax, to be implemented from 2025.

The region is also home to a plethora of ETS programs, with China, Australia, Indonesia, Japan and South Korea leading the region with the establishment of regulated systems. The incentive for CCS deployment under these mechanisms varies. For example, China hosts the largest ETS in the world, covering over 40% of the country's GHG emissions, primarily in the power sector (International Carbon Action Partnership, 2024a). The scheme currently sets pre-determined emissions intensity benchmarks for coal and gas units, however there is no explicit reference to the role or eligibility of CCS-related emissions reductions from these units within the ETS (International Energy Agency, 2020, 2024).

On the other hand, Indonesia's regulatory framework makes explicit provision for the eligibility of CCS projects to generate credits under the country's recently launched carbon pricing scheme. Similarly, the scope of sectors covered by Australia's ETS mechanisms provide an incentive for undertaking CCS-related emissions reductions.

The region is also seeing the establishment of voluntary carbon markets. Indonesia launched IDX Carbon in 2023 enabling the trade of credit certificates called Sertifikat Pengurangan Emisi Gas Rumah Kaca (SPE-GRK) (Indonesia Stock Exchange, 2023). Malaysia launched Bursa Carbon Exchange in 2022 allowing the trading of credits registered under voluntary trading schemes (Bursa Malaysia, 2022).

Several countries have also begun efforts to collaborate bilaterally on emissions reduction under the Paris Agreement's Article 6 mechanism. Singapore and Vietnam have both initiated bilateral agreement negotiations with partner countries to enable collaboration on carbon credits (National Climate Change Secretariat Singapore, 2024b). India has also listed CCUS as a removal activity as part of its finalised list of activities under Article 6.2 (Ministry of Environment, 2024).

4.2.3 Specific national policy, legal, regulatory and commercial developments

Table 4 highlights specific policy, legal, regulatory and commercial developments in the APAC region.

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Direct policy requirements and financial incentives for operators	Regulated emissions trading schemes with eligibility for CCS projects	Australia	Safeguard Mechanism reforms	In force	The Safeguard Mechanism sets emissions baselines for facilities exceeding a certain threshold of CO_2-e emissions. The government introduced reforms to the Safeguard Mechanism in 2023, setting baselines for covered facilities that decrease by 4.9% on an annual basis. The reforms allow facilities that emit below their baseline to generate Safeguard Mechanism Credits (SMCs), which can be sold to other covered facilities or surrendered to maintain their baselines. Covered facilities can utilise carbon capture technology on site to meet their baselines and generate tradeable SMCs where emissions reduction exceeds the annual requirement.
		Indonesia	Economic Value of Carbon (Nilai Ekonomi Karbon) Trading Scheme	In force	Indonesia launched a mandatory emissions-intensity based ETS in 2023 focused on coal-fired power plants. The ETS is expected to be expanded to oil and gas-fired power plants (International Carbon Action Partnership, 2024b). Regulations introduced in 2023 and 2024 enable CCS project operators to generate carbon credits to meet emissions reduction requirements under the new ETS. However, a clear methodology for generating credits through CCS operations is yet to be established.
		India	Carbon Credit Trading Scheme (CCTS)	Proposed	India's central government in June 2023 passed an amendment to the Energy Conservation bill that would set up a domestic carbon credits trading scheme. CCS is not yet included in the CCTS (Global CCS Institute, 2023d).

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Direct policy requirements and financial incentives for operators	Carbon tax and incentives	Thailand	Carbon Tax	Proposed	The Thai government plans to implement a carbon tax from 2025
		Singapore	Carbon Tax	Current	Singapore's carbon tax was first implemented in 2019, making it the first country within the region to introduce a CO_2 pricing scheme. The tax covers 80% of GHG emissions from facilities in the manufacturing, power, waste and water sectors. From 2019-2023, Singapore's CO_2 tax was set at S$5/t$CO_2$-e. In 2024, the tax was increased to S$25/t$CO_2$-e, with the aim of reaching S$50-80/t$CO_2$-e by 2030.
		Malaysia	Tax credits	In force	Malaysia's 2023 federal budget introduced tax incentives to support the commercial viability of CCS projects. Companies conducting in-house CCS activities can benefit from a 100% Investment Tax Allowance (ITA) on qualifying capital expenditure for 10 years, full import duty and sales tax exemptions on CCS equipment until 2027, and tax deductions for pre-commencement expenses within five years. Companies providing CCS services can receive the same ITA benefits, along with a 70% tax exemption on statutory income for 10 years, and similar import duty and sales tax exemptions on CCS equipment.
	International carbon credit eligibility	Singapore	Article 6 International Cooperation	In force	Singapore has initiated carbon credits collaboration under the Paris Agreement's Article 6 mechanisms through various bilateral engagement initiatives. These bilateral agreements establish a framework for the international transfer of mitigation outcomes and identify several Article 6-compliant mitigation activities that will facilitate both countries achieve their NDCs (National Climate Change Secretariat Singapore, 2024b). To this end, carbon credit developers will be required to contribute 5% of the proceeds of Article 6-authorised carbon credits generated under these bilateral agreements towards adaptation initiatives of the host country. Singapore has concluded legally binding Article 6 implementation agreements with Papua New Guinea and Ghana, while negotiations are underway with Bhutan, Paraguay and Vietnam.
		India	Article 6 International Cooperation	Proposed	The Ministry of Environment, Forestry and Climate Change has listed CCUS as a removal activity as part of its finalised list of activities under the Article 6.2 mechanism of the Paris Agreement, which will facilitate the mobilisation of international finance and the simultaneous transfer of emerging technologies through the trading of carbon credits (Global CCS Institute, 2023d; Ministry of Environment, 2024).

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Other supportive policies and programs	Strategies/ Roadmaps	Malaysia	National Energy Transition Roadmap	Published	The National Energy Transition Roadmap (NETR), released in 2023, outlines Malaysia's plans to achieve an economy-wide transition to net zero. The NETR outlines 10 flagship projects focused on six key energy transition strategies, one of which is CCUS. Under the CCUS strategy, the government aims to establish three CCS hubs by 2030, with a total storage capacity of up to 15 Mtpa. The NETR recognises the necessity of developing CCS regulations to facilitate domestic and transboundary CCS value chains and promoting adoption across relevant industries through policy incentives to achieve its targets.
		Japan	Long-Term CCS Roadmap	Published	The CCS Long-term Roadmap highlights the development of CCS and establishes a target of achieving a CO_2 storage capacity of between 120 and 140 Mt by 2050.
		South Korea	National Basic Plan for Carbon Neutrality and Green Growth	Published	South Korea's first National Basic Plan for Carbon Neutrality and Green Growth sets a reduction target of 11.2 million tonnes of CO_2 by 2030 from CCUS technologies (Presidential Committee on Carbon Neutrality and Green Growth 2050 Korea, no date).
		Australia	Future Gas Strategy	Published	Released in May 2024, Future Gas Strategy maps out the government's plan for how gas will support the transition to net zero. Action item five of the strategy is "promoting geological storage of CO_2 and support our region's transition to net zero". Key measures envisaged under this action item include the release of offshore acreage for GHG storage activities and the establishment of a new transboundary CCS program that provides carbon management solutions to regional partners (Australian Government, 2024b)
		China	Implementation Plan for Green and Low-Carbon Technology Demonstration	Published	The central government will, for the first time, use its budget to support selected projects. Of the 47 projects listed as eligible to receive funding under this program, six are CCS-related.
	Direct grant funding	Australia	Carbon Capture, Use and Storage Development Fund	Closed	Established in 2023, the fund allocated AU$50 million (about US$39 million) to provide financial support for select CO_2 capture projects. The government awarded six new CCS projects a share of the AU$50 million fund.
			Federal Budget Allocations	In force	The 2024/25 budget allocated AU$556.1 million over 10 years for Geoscience Australia to comprehensively map Australia's subsurface resources, including geological resources with the potential to store CO_2.

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Other supportive policies and programs	International/ regional collaboration on CCS	Australia	Various international partnership and collaboration agreements	In force	Australia has negotiated several international partnership agreements and collaboration initiatives to share knowledge and promote dialogue on advancing clean technologies, including CCS. Key initiatives include: • The Singapore-Australia Green Economy Agreement • Japan-Australia partnership on decarbonisation through technology • Australia-Republic of Korea Low and Zero Emissions Technology Partnership
		Singapore	Letter of Intent with Indonesia and various other collaborative initiatives	Signed	Singapore and Indonesia have signed a Letter of Intent to conduct cross-border CO_2 transport between the two countries. The government is also in early-stage negotiations with the Malaysian government and Petronas to undertake CO_2 exports to Malaysia.
Legal and regulatory governance	CCS-specific regulatory framework addressing key elements of the project lifecycle	Indonesia	MEMR 2/2023, PR 14/2024 and PTK 070	Enacted	Indonesia has established a suite of regulations to support the uptake of CCS activities in multiple sectors such as oil and gas and industrial processes. Three main regimes are applicable to CCS in Indonesia: • Ministry of Energy and Mineral Resources (MEMR) Regulation No. 2 of 2023 on the Implementation of CCS and CCUS in Upstream Oil and Gas Business Activities (Issued March 2023). • Presidential Regulation No. 14 of 2024 on the Organisation of CCS Activities (Issued January 2024). • PTK 070 on the Implementation of CCS and CCUS in Oil & Gas Work Areas (Issued January 2024).
		South Korea	The Carbon Dioxide Capture, Usage and Storage Act	Enacted	Establishes a permitting model for CCS activities both onshore and offshore for key phases such as transport and storage site exploration and injection, the allocation of regulatory roles and responsibilities for approvals and oversight, and compliance requirements for proponents relating to aspects such as capture facility installation, operating CO_2 pipelines and monitoring and reporting during operations and post-closure.
		Japan	Carbon Dioxide Storage Business Act	Enacted	Key features of the Act include: • Incentivising CCS activities as a business in Japan and overseas. • Creating exploration and storage rights. • Licensing by the Minister of Economy, Trade and Industry. • Operator contributions to post-closure monitoring. • Project plan approvals and authority to require modification or cancellation of plans.

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Legal and regulatory governance	Promulgation of regulations and guidance	Australia	Various	In force	• Updates to the regulations accompanying the Offshore Petroleum and Greenhouse Gas Act (OPGGSA) to enable project developers to navigate the permitting processes under the OPGGSA. • Release of guidelines for complying with the provisions of the OPGGSA. • Establishment of appropriate governance structures within regulatory agencies to streamline the administration of the provisions of the OPGGSA.
	CCS-specific regulatory frameworks addressing transboundary issues	Australia	Environment Protection (Sea Dumping) Amendment (Using New Technologies to Fight Climate Change) Bill 2023	Passed	Australia is the first country in the region to establish a domestic permitting regime for transboundary CO_2 export and import for geological storage, pursuant to the provisions of the London Protocol.
		Indonesia	PR 14/2024	In force	Enables cross-border CO_2 transport and empowers Indonesia to enter into bilateral agreements with another country to conduct cross-border CO_2 transport.

Table 4 - Overview of main CCS policy, legal and regulatory instruments in selected APAC countries

Australia

Australia has provided support for CCS through a combination of new policy mechanisms, including:

- In the 2024-25 federal budget, the government provided AU$556.1 million over 10 years for Geoscience Australia to comprehensively map Australia's subsurface resources, including geological resources with the potential to store CO_2 (Department of Industry Science and Resources, 2024).

- The Carbon Capture, Use and Storage Development Fund allocated AU$50 million (about US$39 million) to provide financial support for select CO_2 capture projects. The government awarded six new CCS projects a share of the AU$50 million fund (Business Australia, 2023).

- The government recently introduced amendments to the Safeguard mechanism, establishing strengthened baselines that facilities must meet and that decrease by 4.9% on an annual basis. Covered facilities building new installations can utilise carbon capture technology on site to meet their baselines, providing an incentive for CCS applications (Department of Climate Change Energy the Environment and Water, 2024).

Mobilising its domestic policy and regulatory landscape, Australia has begun to position itself for CCS-related international collaboration initiatives with regional countries and to facilitate transboundary CCS value chains.

- In November 2023, the federal parliament passed the Environment Protection (Sea Dumping) Amendment (Using New Technologies to Fight Climate Change) Bill 2023 enabling transboundary CO_2 export and import activities. With its passage, Australia has become the first country in the region to establish a domestic permitting regime for transboundary CO_2 export and import activities pursuant to the provisions of the London Protocol (Parliament of Australia, 2023).

- The 2024-25 federal budget included AU$32.6 million over four years for regional cooperation on carbon sequestration to support the establishment of regulatory frameworks and bilateral agreements (Australian Government, 2024a).

- Australia has negotiated several international partnership agreements and collaboration initiatives to share knowledge and promote dialogue on advancing clean technologies, including CCS, with countries such as Singapore, Japan, Indonesia, and South Korea (Department of Industry Science and Resources, 2021; Australian Government Department of Foreign Affairs and Trade, 2022; Australia-Korea Business Council, 2024). Key initiatives include:

    - The Singapore-Australia Green Economy Agreement

    - Japan-Australia partnership on decarbonisation through technology

    - Australia-Republic of Korea Low and Zero Emissions Technology Partnership

Australia's status as an early-mover jurisdiction in establishing the regulatory foundations for permitting CO_2 storage activities has enabled the nation to subsequently improve its legal frameworks to support project developments and improve efficiencies. In recent years, regulators and policymakers at the federal level have:

- Amended the OPGGSA to enable the grant and administration of single GHG titles that straddle the boundary between Commonwealth waters and state or Northern Territory coastal waters (Parliament of Australia, 2020).

- Updated the regulations accompanying the OPGGSA to enable project developers to navigate the permitting processes under the OPGGSA(Department of Industry Science and Resources Australia, 2024).

- Released guidelines for complying with the provisions of the OPGGSA(Department of Industry Science and Resources Australia, 2021), and

- Established appropriate governance structures within regulatory agencies to streamline the administration of the provisions of the OPGGSA (Department of Industry Science and Resources, Department of Climate Change Energy the Environment and Water and National Offshore Petroleum Safety and Environmental Management Authority, 2023).

Developments at the sub-national level have also strengthened Australia's regulatory frameworks. In 2024, the state of Western Australia joined the early-mover states of Victoria, South Australia and Queensland in establishing legislation via the Petroleum Legislation Amendment Bill (2023) to regulate CCS in alignment with the OPGGSA (Western Australian Government, 2024). The government is also developing secondary regulations to accompany the Act.

The timeline in Figure 3 shows the evolution of policies, legislation and regulation relevant to CCS in Australia.

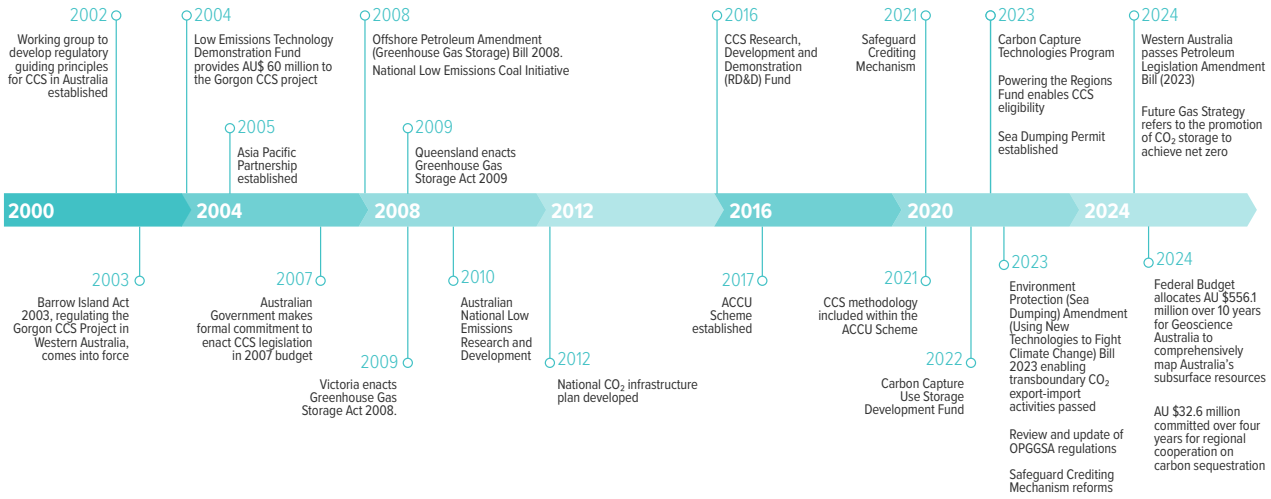


Figure 3 - Main CCS policy, legal and regulatory developments in Australia

Indonesia

Indonesia has established a suite of regulations to support the uptake of CCS activities in multiple sectors such as oil and gas and industrial processes. The three main regimes that are applicable to CCS in Indonesia are:

- MEMR Regulation No. 2 of 2023 on the Implementation of CCS and CCUS in Upstream Oil and Gas Business Activities, issued in March 2023
- Presidential Regulation No. 14 of 2024 on the Organisation of CCS Activities, issued in January 2024, and
- PTK 070 on the Implementation of CCS and CCUS in Oil & Gas Work Areas, issued in January 2024

The timeline in Figure 4 shows the evolution of policies, legislation and regulation relevant to CCS in Indonesia.

INDONESIA'S REGULATORY FRAMEWORK FOR CCS

The suite of CCS regulations in Indonesia is modelled on its existing permitting model for oil and gas activities. They establish a comprehensive and integrated regulatory framework for CCS activities by providing for key issues arising across the phases of the CCS project lifecycle and allocating regulatory roles and responsibilities between relevant government regulators and project proponents. In particular, the regulations cover:

- Multiple permitting pathways for authorising CCS activities, involving both licensing schemes and Cooperation Contracts (a form of production sharing agreement used to permit oil and gas operations)
- Site characterisation
- Third-party access rights providing a favourable environment for collaboration/joint ventures and development of multi-user CCS hubs
- Monitoring, Reporting and Verification requirements across each stage of the project lifecycle
- Closure and decommissioning
- Post-closure activities, including allowing post-closure transfer of liability to the state

In addition, the regulations establish a variety of monetisation opportunities for project proponents, including:

- Allowing operators to impose storage fees.
- Eligibility of project operators for carbon trading
- Reimbursement of operating costs for the use of shared facilities

A key novel aspect addressed under Presidential Regulation 14 of 2024 is cross-border CO_2 transport and the allocation of liabilities for leakage along the value chain. Although Indonesia is not a Party to the London Protocol, the Regulation empowers Indonesia to enter into bilateral agreements with another country to conduct cross-border CO_2 transport. To this end, Singapore and Indonesia have signed an LOI to conduct cross-border CO_2 transport between the two countries. The two governments are currently negotiating to formalise the LOI into a legal binding instrument. The Regulation also allows proponents to benefit from tax exemptions for investment in CCS facilities (Central Government of Indonesia, 2024).

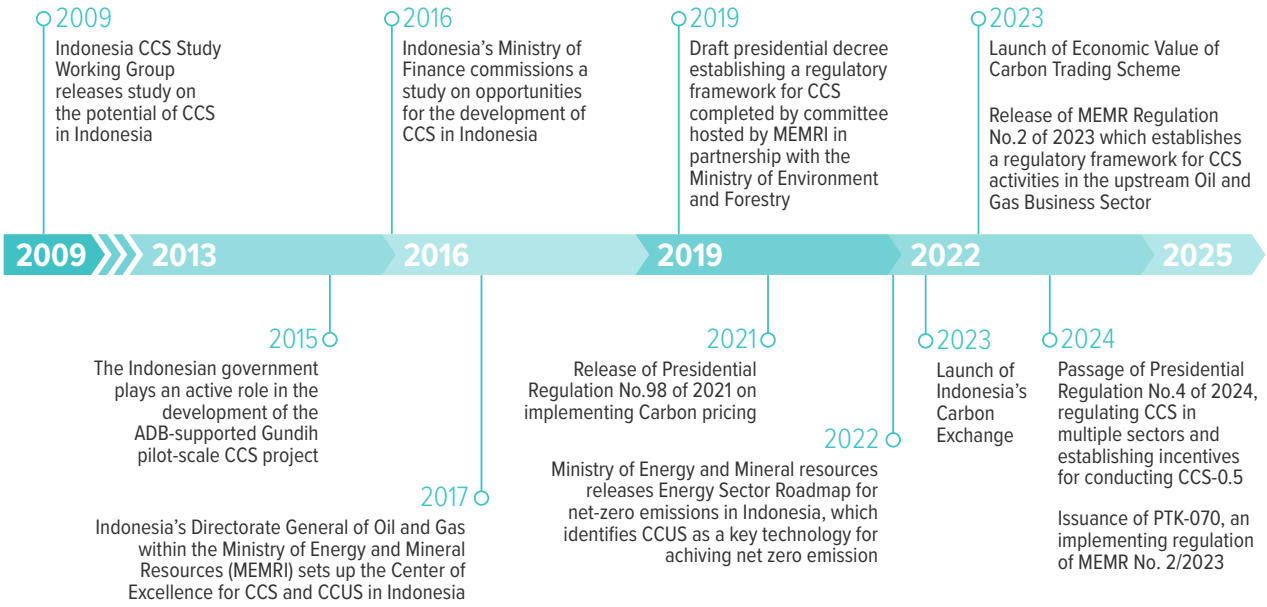


Figure 4 - Main CCS policy, legal and regulatory developments in Indonesia

Japan

As an early-mover jurisdiction with established support for CCS, Japan is now aiming to further bolster support and improve commerciality of CCS through:

- The release of the CCS Long-term Roadmap in 2023, which highlights the development of CCS and establishes a target of achieving a CO_2 storage capacity of between 120 and 240 Mt by 2050. In line with this strategy, Japan selected the country's first nine CCS projects which will store up to 20 Mtpa of CO_2 by 2030, domestically and overseas(Ministry of Economy Trade and Industry Japan, 2023).
- In line with the target under the Long-Term CCS Roadmap, the Japanese Diet in 2024 passed the Carbon Dioxide Storage Business Act (Ministry of Economy Trade and Industry Japan, 2024). The Act takes the form of framework legislation, with much of the detail still to be clarified. Key features of the Act include:
  - Incentivising CCS activities as a business in Japan and overseas
  - The creation of exploration and storage rights
  - Licensing by the Minister of Economy, Trade and Industry
  - Operator contributions to post-closure monitoring
  - Project plan approvals and authority to require modification or cancellation of plans

Japan is also taking steps to enable transboundary CO_2 value chains, as evidenced by the Japanese Diet's approval of ratifying the 2009 amendment to the London Protocol in 2024 (House of Councillors of the National Diet of Japan, 2024).

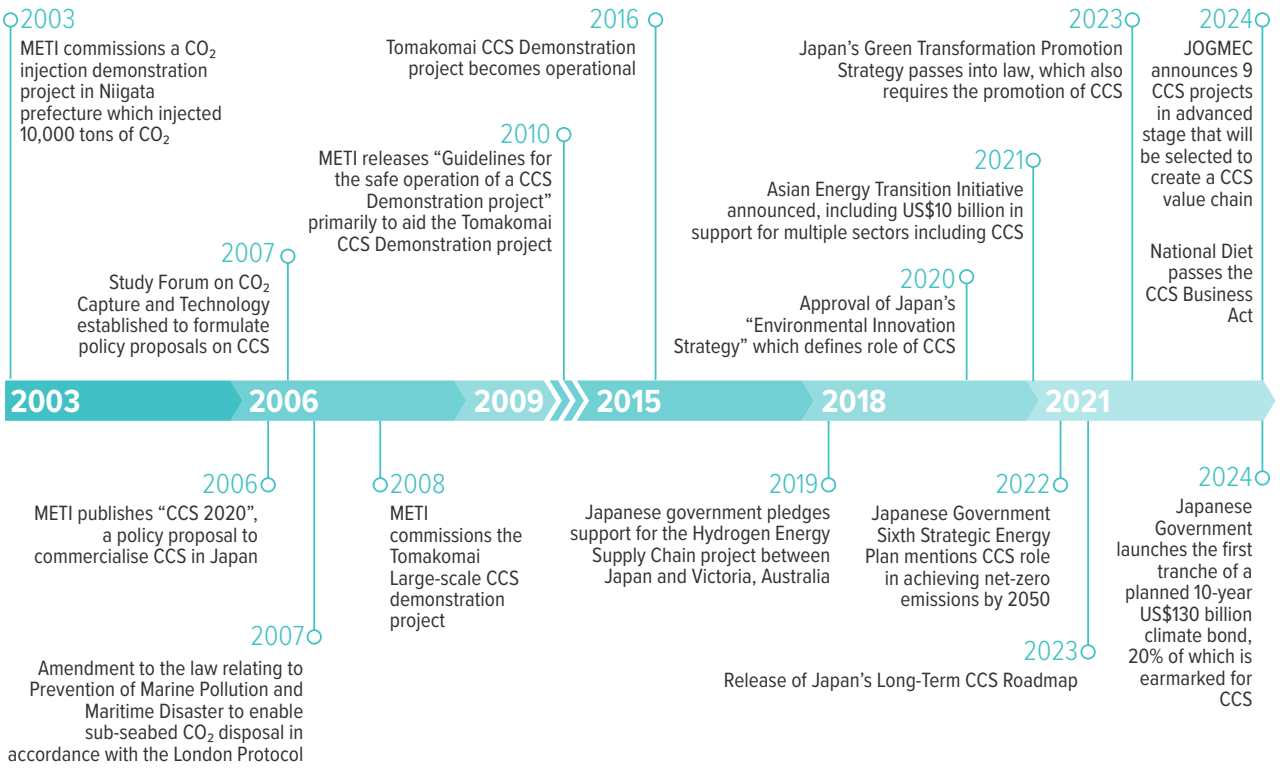


Figure 5 - Main CCS policy, legal and regulatory developments in Japan

Malaysia

Over the past 2 years Malaysia has released several national policy documents with explicit strategies for the deployment of CCS across key sectors. Notable examples include:

- The National Energy Transition Roadmap (NETR), released in 2023, which outlines Malaysia's plans to achieve an economy-wide transition to net zero. The NETR outlines 10 flagship projects focused on six key energy transition strategies, one of which is CCUS. Under the CCS strategy, the government aims to establish three CCS hubs by 2030, with a total storage capacity of up to 15 Mtpa. The NETR recognises the necessity of developing CCS regulations to facilitate domestic and transboundary CCS value chains and promoting adoption across relevant industries through policy incentives to achieve its targets (Ministry of Economy Malaysia, 2023).

- The New Industrial Master Plan 2030 (NIMP 2030), which aims to enhance the Malaysian manufacturing sector's global competitiveness. The NIMP has four missions that incorporate 21 strategies and 62 action plans. Under the third mission, Push for Net Zero, the NIMP recognises and includes the role of CCS in supporting the decarbonisation of hard-to-abate sectors while also establishing CCUS as its own sector (Malaysian Investment Development Authority, 2023).

The Malaysian government has indicated that a federal regulatory framework will be established by December 2024. The state of Sarawak has already established a regulatory framework in 2023, called the Land (Carbon Storage) Rules 2022, to facilitate onshore and offshore CCS activities in the state, building on its existing oil and gas permitting regime (Government of Sarawak Malaysia, 2022) (Government of Sarawak Malaysia, 2022).

Malaysia also took steps to integrate tax incentives in its federal 2023 budget to facilitate commerciality of CCS projects (Ministry of Finance Malaysia, 2023). These include:

- Companies undertaking in-house CCS activities can receive an Investment Tax Allowance (ITA) of 100% on qualifying capital expenditure for 10 years, a full import duty and sales tax exemption on CCS equipment until 2027, and tax deductions for pre-commencement expenses within five years.

- Companies providing CCS services can receive the same ITA benefits, along with a 70% tax exemption on statutory income for 10 years, and similar import duty and sales tax exemptions on CCS equipment.

Singapore

Singapore policymakers have released several policy documents since 2020 outlining the contribution of CCS to achieving Singapore's emissions reduction targets. A key example is the Green Plan 2030, which outlines plans to establish Singapore as a global centre of expertise and service delivery for initiatives associated with CCUS projects (The Government of Singapore, 2021).

Due to a lack of suitable storage capacity, transboundary value chains have become the preferred mode of CCS deployment in Singapore. The government has established several agreements and MOUs with neighbouring countries to date, including, most notably, a LOI with Indonesia (Ministry of Trade and Industry Singapore, 2024). In addition, the government is in early-stage negotiations with the Malaysian government and Petronas to undertake CO_2 exports to Malaysia.

South Korea

In January 2024, South Korea passed the Carbon Dioxide Capture, Usage and Storage Act, which will come into effect in January 2025 (Ministry of Trade Industry and Energy South Korea, 2024). The Act establishes a permitting model for CCS activities both onshore and offshore for key phases such as transport and storage site exploration and injection, the allocation of regulatory roles and responsibilities for approvals and oversight, and compliance requirements for proponents relating to aspects such as capture facility installation, operating CO_2 pipelines and monitoring and reporting during operations and post-closure. Notably, the Act provides for the accounting of GHG emissions reductions achieved at capture facilities, certification of CCS-related products, and subsidies and loans to support CCS-related investment.

South Korea is also pursuing several regional collaboration initiatives to advance CCS:

- Six major South Korean companies signed an MOU with Malaysia's Petronas to advance the Shepherd CCS project, which involves capturing CO_2 from South Korea's industrial regions and transporting it to Malaysia for storage (Shepherd CCS, 2024).

- South Korea and Australia have also agreed to expedite processes to advance a bilateral CCS project focusing on cross-border CO_2 transport and storage in Australia (Australia-Korea Business Council, 2024).

Thailand

in March 2023, Thailand's cabinet tasked the Department of Mineral Fuels (DMF) with developing a regulatory framework for CCS activities and to investigate and ensure that CCS-specific regulations are consistent with Thailand's laws. Soon after, the government released a draft amendment to the existing Petroleum Act for public consultation. The draft amendment provides a definition of carbon-related activities under the term "carbon businesses", which covers exploration for carbon storage areas, and the injection of CO_2 into such sites and introduces licensing requirements for CCS activities. The Act defines the terms and conditions of carbon storage licenses and enables post-closure transfer of liability to DMF upon fulfillment of closure obligations (Norton Rose Fulbright, 2023).

Thailand has also announced that incentives for CCS/CCU activities are to be included in the Investment Promotion Act 1977 (Thailand Board of Investment, 2023).

The Thai government plans to implement a carbon tax from 2025 (The Government of Public Relations Department Thailand, 2024).

Vietnam, Cambodia, Timor Leste, Brunei

While policy, legal and regulatory developments are largely absent in these four countries, some notable developments include:

- Brunei - in 2020 the Brunei government announced it was investigating the role of CCUS in addressing the country's industrial emissions. Shell Eastern Petroleum and Brunei Shell Petroleum signed an MOU to explore CO_2 transport and storage options in Brunei and Singapore in 2022 (Shell Singapore, 2022).

- Timor-Leste - Australia and Timor-Leste are collaborating on enabling the transboundary movement of CO_2 between the two countries. A regulatory framework for CCS in Timor-Leste is currently under development (Government of Timor-Leste, 2024).

India

Several developments in India since 2022 indicate a shift in the government's climate change policies and commitment to the role of CCS in its decarbonisation agenda. Prior to 2022, the extent of the government's involvement in CCS has largely been in coordinating research and development activities relating to CCS under the Indian Ministry of Science and Technology. The shift from 2022 has been through a variety of concerted measures within a context of wider formal emissions-mitigation policy mechanisms, which indicate direct government recognition and investigation of the role and contribution of CCS in achieving India's national decarbonisation goals.

- In 2022, the Indian parliament passed an amendment bill incorporating changes to the Energy Conservation Law, which called for the establishment of a domestic CO_2 trading mechanism (Ministry of Law and Justice - Legislative Department, 2022).

- NITI Aayog, a central government think tank, in 2022 released a wide-ranging CCUS report covering a variety of topics including the policy framework, sector-wide emissions, technologies, and storage. The report acknowledges that CCUS can contribute to decarbonisation and to the energy transition and recommends carbon credits as a policy mechanism, with a further recommendation of carbon taxes in the future. The report also recommends establishing a public-sector corporation to promote and help finance CCUS projects in the country (NITI Aayog, 2022).

- Following the Niti Aayog report, the Department of Science and Technology established two National Centres of Excellence in CCUS (NCoE) in 2022 and supported a third NCoE in 2023 (Department of Science & Technology India, 2022).

After a brief pause in CCS-related policy advancements, in 2024 the government announced that the development of a new policy framework for the adoption of CCUS technologies is underway (Times of India, 2024).

China

With the role of CCS becoming more acute in the context of China's ambitions to achieve carbon neutrality by 2060, the central government has begun to test various avenues to support the financing of CCS projects. To this end, the government has launched or published a variety of macro and sectoral level policy documents and instruments since 2020, with coverage of CCS. Key examples include:

- In 2021, the People's Bank of China (PBoC) established the Carbon Reduction Facility, a monetary policy tool which enables financial institutions to finance decarbonisation projects such as renewables, energy conservation, and CCS,

subject to carbon reduction disclosures (People's Bank of China, 2021). At the beginning of 2023, the PBoC had lent approximately US$44 billion to banks to support emissions reduction projects (People's Bank of China, 2023).

- The National Development and Reform Commission (NDRC) launched the Implementation Plan for Green and Low-Carbon Technology Demonstration, a first-of-a-kind policy initiative that utilises the central government's budget to support selected projects (National Development and Reform Commission China, 2023). CCS is covered by the program, and in April 2024, six out of the 47 projects selected under the program for funding were CCUS-related (National Development and Reform Commission China, 2024a).

- In July 2024, China announced an ambitious new action plan aimed at decarbonising its coal-fired power plant fleet. Among the three main strategies, the plan includes the implementation of CCUS as one pathway to achieve targets. The government will back these decarbonisation initiatives through a combination of policy measures and financial support (National Development and Reform Commission China, 2024b).

On the regulatory front, China's existing regulatory framework for oil and gas exploration and production provides a comprehensive foundation for the regulation of CCS in China. However, gaps in the framework remain, particularly across key aspects such as pore space ownership, monitoring reporting and verification, site characterisation and selection, and post-closure responsibility. To address these aspects and provide much-needed regulatory certainty, policymakers will be required to introduce new legislation or amendments to existing legislation to facilitate current CCS projects under development in China (Global CCS Institute, 2024a).

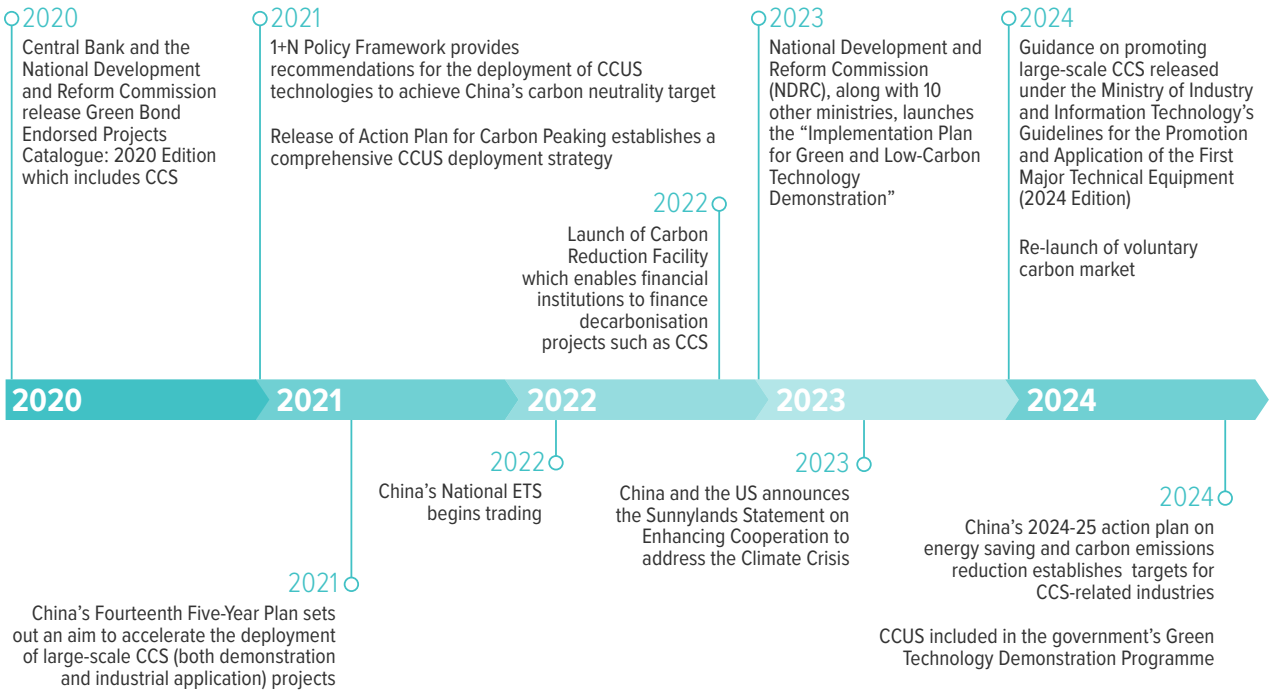


Figure 6 - Main CCS policy, legal and regulatory developments in China

4.3 Europe

4.3.1 Overview

The commitment to CCS is gaining substantial momentum across Europe. Nine countries, in addition to the European Union, have introduced or announced their own industrial carbon management strategies or roadmaps for CCS deployment. As of July 2024, 191 CCS commercial-scale projects are in various stages of development.

To advance CCS, the European Commission and national governments employ a diverse array of policy, legal, and regulatory mechanisms, which can be categorised into three main areas:

- **Direct policy requirements and financial incentives:** This includes regulations, tax incentives, carbon contracts for difference, and other measures that directly encourage operators to invest in CCS technologies.
- **Supportive policies and programs:** These encompass formal expressions of ambition or strategic statements, direct funding or grants, loan programs, and other initiatives that provide indirect support to CCS projects.
- **Legal and regulatory governance structures:** This involves regulatory frameworks for CO_2 transport and storage, including addressing transboundary issues, permitting processes, as well as national-level monitoring, reporting, and verification protocols.

Policy mechanisms favoured in Europe differ from those in other regions such as North America that implement significant tax credits for CO_2 storage. Furthermore, while governments in Europe and the European Commission have adopted diverse approaches to CCS policy, evidence indicates that the most successful projects typically benefit from a combination of direct policy requirements and financial incentives, supportive policies and programs, and robust legal and regulatory governance structures, as detailed in Table 5[3]. This multi-layered policy and regulatory support can result from the interplay between the EU and national governance structures. For example, within two years following the entry into force of the EU CCS Directive, EU Member States had to transpose it into law and implement a regulatory framework for CCS[4]. To further incentivise CCS development at the national level, European governments that support CCS have also introduced policies and programmes including direct funding and grants.

This section explores key policy, legal and regulatory trends in Europe and analyses specific developments within the EU and selected countries such as Denmark, the Netherlands, Iceland, Norway and the UK, with additional countries analysed in the appendices.

[3] Table 5 focuses on the six selected jurisdictions - the European Union, Denmark, the Netherlands, Iceland, Norway and the UK - that are further analysed in Part 3 of this section.

[4] Iceland, Liechtenstein and Norway were also required to transpose the EU CCS Directive into national law following the incorporation of the EU CCS Directive into the EEA agreement in 2012.

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Direct policy requirements and financial incentives	Dedicated CCS regulatory framework	European Union	EU CCS Directive	In force	Dedicated legislation that established a legal framework for the environmentally safe storage of CO_2, requiring EU Member States to transpose it at the national level within two years.
		United Kingdom	Energy Act 2008 and Carbon Dioxide (Licensing etc.) Regulations 2010	In force	Dedicated legislation that established a legal framework for CO_2 storage and introduced a licensing regime for offshore CCS (Energy Act), as well as onshore areas and adjacent internal waters (Carbon Dioxide Regulations 2010)
	Emissions trading schemes	EEA[5] and Switzerland	EU ETS	In force	Cap-and-trade system operational since 2005 which covers emissions from over 10,000 installations and airlines operating in the EEA.
		UK	UK ETS	In force	Cap-and-trade system operational since 2021 following the exit of the UK from the EU ETS and applying to energy-intensive industries, the power generation sector and aviation.
Financial incentives for operators	Carbon contracts for difference	Denmark	Danish CCUS Fund (1st round)	In force	Subsidy scheme awarded through a competitive bidding process for up to 20 years of project operation, allocated for the establishment of an integrated value chain for the capture, transport and storage of CO_2.
		The Netherlands	SDE++	In force	Subsidy that lasts 15 years for CCS projects and compensates the difference between the EU ETS price and the project's cost to capture, transport and store CO_2.
		UK	Industrial CCS Contract	In force	Private law contracts agreed between CO_2 capture projects and the Low Carbon Contracts Company (LCCC) which compensates facilities for a proportion of allowances at the reference price for a period of 10 years, with option to extend it by up to 5 years.
	Carbon tax	Norway	CO_2 tax on offshore oil and gas	In force	Specific CO_2 tax introduced in 1991 and applying to emissions from petroleum activities on the continental shelf (including offshore oil and gas), paid based on the amount of oil and gas combusted or emitted directly to air on platforms, installations or facilities.
Supportive policies and programs	Industrial carbon management strategies and roadmaps for CCS deployment	Denmark	A roadmap for CO_2 storage	Published in June 2021 (first part) and December 2021 (second part)	Strategy targeting first operational CCS facilities by 2025 to make Denmark a European hub for CCS.
		European Union	Towards an ambitious Industrial Carbon Management for the EU	Published in February 2024	Strategy announcing targets to store 50 Mtpa of CO_2 by 2030, capture 280 Mtpa by 2040 and 450 Mtpa by 2050.

[5] The EEA includes the 27 EU Member States alongside Iceland, Liechtenstein and Norway.

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Supportive policies and programs	Industrial carbon management strategies and roadmaps for CCS deployment	Norway	-	Published in 2015	Strategy that targets the establishment of at least one full-scale CCS facility by 2020.
		United Kingdom	CCUS: A vision to establish a competitive market	Published in December 2023	Strategy that targets to capture and store 20-30 Mtpa of CO_2 by 2030.
	Direct funding, grants and loans	European Union	Horizon Europe	In force	Fund that can support research, pilot and small-scale demonstration projects in various fields, including CCS.
			Innovation Fund	In force	Fund supporting the commercial implementation of innovative decarbonisation technologies, including CCS and CDR, and sourced from the EU ETS revenue.
			Connecting Europe Facility for Energy	In force	Fund supporting investment in trans-European energy infrastructure, including CO_2 ones, that are designated projects of common interest or projects of mutual interest.
			Just Transition Fund	In force	Fund supporting regions and industries facing socio-economic challenges associated with climate neutrality, including through the development of CCS projects.
			Recovery and Resilience Facility	In force	Fund designed to help EU Member States to recover from the social and economic impacts of Covid-19 that could support CCS development if included in a country's recovery and resilience plan.
			LIFE	In force	Fund that can support capacity-building projects and best practices in CCS.
		Denmark	NECCS fund	In force	Fund of DKK 2.5 billion aimed to support exclusively the capture of biogenic CO_2 and subsequent geological storage of 0.5 Mtpa from 2025 onwards.
		Iceland	Icelandic Climate Fund	In force	Fund that supports innovation in the field and education on the impact of climate change, including CCS.
		Norway	CLIMIT	In force	Fund that provides part-financing for projects that develop CCS technologies, supporting projects from research and development to demonstration.
		United Kingdom	CCUS Infrastructure Fund	In force	Fund that supports the capital costs of strategic CCUS infrastructure, transport and storage networks, and industrial carbon capture projects.
			Industrial Strategy Challenge Fund	In force	Fund designed to support the development of low-carbon technologies and infrastructure from 2019 to 2024, focused on helping the UK's six largest industrial clusters to decarbonise.
			Net Zero Innovation Portfolio	In force	Fund announced in the 10-point plan for a green industrial revolution to accelerate the commercialisation of low-carbon technologies, systems and business models in power, buildings and industry, including through CCS and CDR.

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Legal and regulatory governance structure	Regulatory framework for CO_2 transport	United Kingdom	Energy Act 2003	In force	Specific licensing regime for CO_2 transport applying to CO_2 pipelines or any other means of transportation if it is used for transporting CO_2 all or part of the way to a site for the geological storage of CO_2.
	Monitoring, reporting and verification protocols	European Union	EU Monitoring and Reporting Regulation	In force	Implementing regulation that establishes monitoring and reporting requirements for CO_2 capture, transport via pipelines and geological storage.
		United Kingdom	Greenhouse Gas Emissions Trading Scheme Order 2020	In force	Order that establishes monitoring and reporting requirements for entities regulated under the UK ETS, including CO_2 capture, transport via pipelines and geological storage.
	Guidance on permitting processes	European Union	Revised EU CCS Directive Guidance Documents	Published in July 2024	Guidance documents aimed to assist stakeholders in the implementation of the EU CCS Directive on several aspects: CO_2 storage life cycle risk management framework, characterisation of storage complex, CO_2 stream composition, monitoring and corrective measures, transfer of responsibility to the competent authority and financial security.

Table 5 - Main CCS policy, legal and regulatory instruments in selected European jurisdictions

4.3.2 Key trends

As Europe deepens its commitment to achieving climate neutrality by 2050 and reaching 55% emissions reduction by 2030 compared to 1990, several key trends have shaped the CCS policy, legal and regulatory landscape across the continent in 2024.

Direct policy requirements and financial incentives.

Enhancing the Union's regulatory framework for CCS

The EU has made substantial advancements in its policy, legislative and regulatory framework for CCS in 2024 with the adoption of several regulations, directives and communications. The Net-Zero Industry Act (NZIA), which introduced an EU-wide target of 50 Mtpa of CO_2 injection capacity by 2030, and the revised Gas Directive, which sets rules for the development of renewable and low-carbon hydrogen, including hydrogen produced from natural gas with CCS, are poised to play pivotal roles in driving CCS deployment. Additionally, the EU ICM Strategy released in February lists a number of future actions aimed at accelerating CCS deployment across the continent. The anticipated Carbon Removal Certification Framework (CRCF) remains pending, but its potential introduction could significantly enhance CDR initiatives.

Reconsideration of CO_2 storage restrictions at national level

Some European countries that previously restricted CO_2 storage activities are reassessing their positions in 2024. Germany is a notable example, with the federal cabinet adopting a draft law in May 2024 to amend the Carbon Dioxide Storage Act. This amendment followed the release of a draft bill and national key considerations on CCUS in February 2024. Similarly, Austria's Government, in its national CCUS strategy published in July 2024, recommended lifting restrictions that currently prevent CO_2 geological storage for emissions from hard-to-abate industries. These shifts signal a growing recognition of the need to expand CO_2 storage options across the continent.

Expansion of carbon contracts for difference schemes including CCS

European governments are intensifying efforts to reduce the risks and costs associated with CCS. Building on the success of the Netherlands, Denmark, and the UK, countries like France and Germany are now implementing CCfD schemes. In March 2024, Germany launched its first CCfD pilot program, signalling a strong commitment to providing financial stability for CCS developers. France collected stakeholder feedback on its future scheme as part of public consultation on its national CCUS strategy updated in July 2024. Meanwhile, the Dutch SDE++ program continues to support CCS initiatives, with a new funding round scheduled for September 2024.

Supportive policies and programs:

Wave of industrial carbon management strategies and roadmaps for CCS deployment

A growing number of jurisdictions across Europe are rolling out industrial carbon management strategies and roadmaps. As of mid-year, the European Commission and six countries[6] had released their strategies, with three more countries[7] drafting their plans for publication by year-end. These strategies and roadmaps are driving the adoption of various policy, regulatory and economic instruments to create the necessary conditions for scaling up CCS technology.

Continued use of direct grants and subsidies

Direct grants and subsidies remain a crucial component of EU and national policies to reduce upfront costs and de-risk investment in CCS projects in 2024. The EU has allocated funding to CCS through programs such as the Innovation Fund and the Connecting Europe Facility for Energy, with new calls for proposals aimed at accelerating CCS deployment this year. Similarly, European governments continue to offer substantial funding to CCS initiatives through direct grants and subsidy programs. In particular, the UK government has expanded its support for CCS through its 2024 Spring budget.

Increased focus on funding bioenergy with CCS (BECCS)

In 2024, European governments are bolstering investments in BECCS to enhance negative emissions capabilities. The UK updated its 'Power BECCS' business model aimed at incentivising the production of negative emissions while generating low-carbon electricity in December 2023. Denmark completed its negative emissions via CCS (NECCS) pool, awarding contracts to three companies to capture and store biogenic CO_2, in April 2024. The European Commission also approved a

[6] Austria, Denmark, France, Norway, Switzerland and the UK.

[7] Germany and Poland. In addition, Sweden is developing a national strategy on CDR.

€3 billion Swedish state aid scheme in July 2024, aimed at rolling out BECCS with the first auction anticipated by the end of the year.

Legal and regulatory governance structure:

Enhanced international cooperation on cross-border CO_2 transport

The issue of international cooperation has gained prominence in 2024, particularly concerning the cross-border transport of CO_2 for geological storage. Several European countries are making significant strides toward ratifying the 2009 amendment to the London Protocol, which governs the export of waste for offshore dumping or incineration, including CO_2, for offshore geological storage. In November 2023, Switzerland ratified this amendment, and France and Germany have expressed similar ambitions. Meanwhile, bilateral agreements between North Sea-bordering countries, such as those secured by Norway with Belgium, Denmark, the Netherlands, and Sweden, are paving the way for cross-border CO_2 transport ahead of the full implementation of the London Protocol amendment.

COUNTRIES	ACCEPTANCE OR RATIFICATION OF THE LONDON PROTOCOL	RATIFICATION OF THE 2009 AMENDMENTS TO ARTICLE 6 OF THE LONDON PROTOCOL	BILATERAL AGREEMENTS/ ARRANGEMENTS IN PLACE FOR CROSS-BORDER CO_2 TRANSPORT
Austria	-	-	-
Belgium	February 2006	September 2022	Denmark (September 2022), the Netherlands (June 2023) and Norway (April 2024)
Bulgaria	January 2006	-	-
Croatia	-	-	-
Cyprus	-	-	-
Czech Republic	-	-	-
Denmark	April 1997	January 2022	Belgium (September 2022), the Netherlands (October 2023), France (March 2024), Norway (April 2024) and Sweden (April 2024)
Estonia	July 2013	February 2019	-
Finland	October 2017	October 2017	-
France	January 2004	-	Denmark (March 2024)
Germany	October 1998	-	-
Greece	-	-	-
Hungary	-	-	-
Iceland	May 2003	-	-
Ireland	April 2001	-	-
Italy	October 2006	-	-
Latvia	-	-	-
Lithuania	-	-	-
Luxembourg	November 2005	-	-
Malta	-	-	-
Netherlands	September 2008	November 2014	Belgium (June 2023), Denmark (October 2023) and Norway (April 2024)
Norway	December 1999	July 2011	Belgium (April 2024), Denmark (April 2024), the Netherlands (April 2024) and Sweden (April 2024)
Poland	-	-	-
Portugal	-	-	-
Romania	-	-	-
Slovakia	-	-	-
Slovenia	March 2006	-	-
Spain	March 1999	-	-
Sweden	October 2000	July 2020	Denmark (April 2024) and Norway (April 2024)
Switzerland	September 2000	November 2023	-
United Kingdom	December 1998	November 2011	-

Table 6 - Status of EU Member States and selected countries regarding the London Protocol and bilateral agreements/ arrangements for cross-border transport of CO_2

4.3.3 Specific supranational and national policy, legal, regulatory and commercial developments

This section focuses on the latest policy, legal, regulatory, and commercial advancements within the European Union and key countries – Denmark, the Netherlands, Iceland, Norway and the UK. These jurisdictions were selected because of their pioneering leadership in CCS policy and project developments, positioning them as frontrunners in the deployment of this technology. Appendix 6.1 includes CCS developments in other European countries.

European Union

The EU is steadfast in its commitment to achieving climate neutrality by 2050 and reducing net emissions by at least 55% by 2030. Recognising the role that CCS could play in its decarbonisation strategy as early as 2009, the EU adopted the CCS Directive, establishing a comprehensive regulatory framework dedicated to this technology, to ensure the environmentally safe storage of CO_2 (Official Journal of the EU, 2009). To complement this, the EU ETS Directive offers the possibility to participants to avoid surrendering emissions allowances if their CO_2 is successfully captured, transported and stored at sites permitted under the CCS Directive or permanently chemically bound in a product so that they do not enter the atmosphere under normal use. The latest revision, published in May 2023, expanded the EU ETS to cover all means of CO_2 transport, no longer limiting it to CO_2 pipelines alone (Official Journal of the EU, 2023).

The 2019-2024 European Commission and European Parliament made significant policy, legal and regulatory advancements, with substantial progress achieved in the last year through the adoption of several key regulations, directives, implementing acts and guidance documents:

- In May 2024, the EU approved the revised gas directive, which includes a provision mandating the European Commission to develop a Delegated Act by August 2025 to define the methodology for assessing emissions associated with low-carbon hydrogen, including hydrogen produced from natural gas with CCS (Official Journal of the EU, 2024b). In September 2024, the European Commission initiated a public consultation on the draft methodology, that closed on 25 October 2024.

- In June 2024, the EU passed the NZIA, setting an ambitious EU-wide target of 50 Mtpa of CO_2 injection capacity by 2030. The NZIA also designates CCS as a net-zero strategic technology, offering streamlined and fast-tracked permitting pathways for project developers (Official Journal of the EU, 2024c).

- In July 2024, the European Commission updated the four CCS Directive guidance documents, originally released in 2011, to incorporate new technological developments. While not binding, they provide EU Member States with additional guidance on identifying suitable geological areas for CO_2 storage or exploration (European Commission, 2024g).

- In September 2024, the European Commission adopted a revision of the EU Monitoring and Reporting Implementation Regulation, clarifying how operators of CO_2 ships and other decentralised CO_2 transport methods should measure and report emissions, as well as account for potential leakages (Official Journal of the EU, 2024a). These rules will take effect on 1 January 2025.

From a funding perspective, the EU has continued to offer substantial financial support to advance the development of CCS pilot, demonstration and commercial-scale projects, in particular through its EU Innovation Fund and Connecting Europe Facility for Energy (CEF-E). The EU Innovation Fund, which aims to bolster the commercial implementation of innovative decarbonisation technologies through revenues from the EU ETS, allocated a record €4 billion for the deployment of decarbonisation technologies, including CCS and CDR, in its last call for proposals from November 2023 to April 2024 (European Commission, 2024c). In October 2024, building on this call for proposals – which, for the first time, invited projects at varying scales –, the European Commission selected 16 additional industrial carbon management projects for grant agreement preparations (European Commission, 2024f).

Moreover, the first biennial PCI-PMI list under the revised Trans-European Networks for Energy (TEN-E) Regulation, published in December 2023, featured 14 cross-border CO_2 infrastructure projects (Global CCS Institute, 2023a). Following the approval of this list by the European Parliament and the Council in April 2024, these projects became eligible to apply for up to €850 million in funding from the CEF-E through a call for proposals that concluded in October 2024. In parallel, a new call for applications to be selected for the second PCI-PMI list opened on 18 September 2024 and will run until 18 December (European Commission, 2024a).

EU INNOVATION FUND

Based on a record budget of €4 billion, the latest Innovation Fund's call for proposals ran from 23 November 2023 to 9 April 2024. For the first time, project developers could apply under five distinct categories encompassing different budget ranges and capital expenditure (CAPEX) requirements:

- **General decarbonisation (large scale):** €1.7 billion for projects with CAPEX above €100 million
- **General decarbonisation (medium scale):** €500 million for projects with CAPEX between €20 million and €100 million
- **General decarbonisation (small scale):** €200 million for projects with CAPEX between €2.5 million and €20 million
- **Cleantech manufacturing:** €1.4 billion for projects with CAPEX above €2.5 million focusing on the manufacturing of components for renewable energy, energy storage, heat pumps, and hydrogen production
- **Pilot:** €200 million for projects with CAPEX above €2.5 million focusing on deep decarbonisation (limited to €40 million per project)

Relevance for CCS

From 2020 to 2022, the European Commission launched three calls for proposals for large-scale projects and three others for small-scale projects. More projects with a CCS component applied with each new call. Some 26 CCUS-related projects have been funded so far (European Commission, 2024e).

A timeline showing the evolution of policies, legislation and regulation relevant to CCS in the EU is presented below (Figure 7).

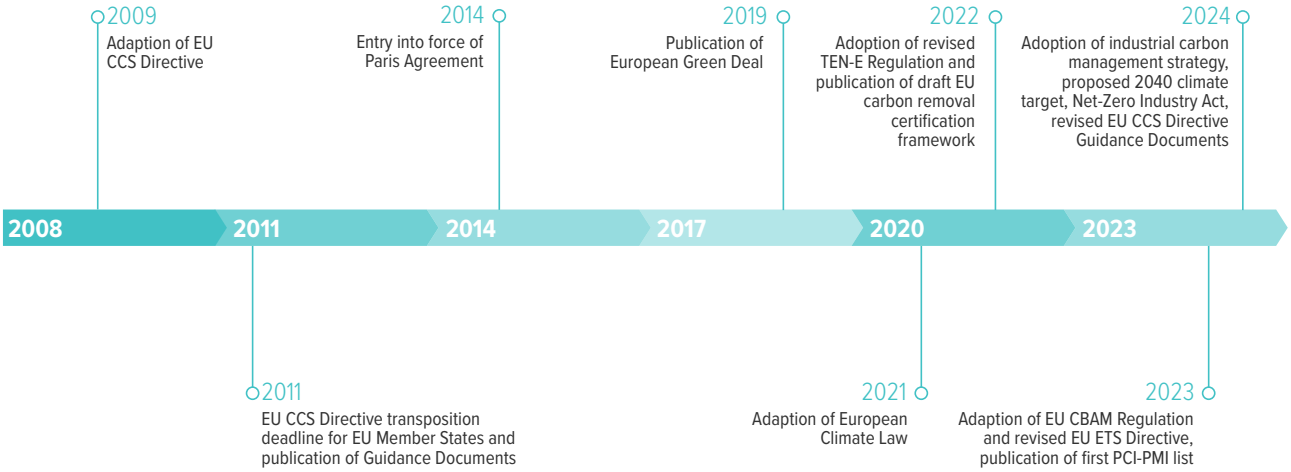


Figure 7 - Main CCS policy, legal and regulatory developments in the EU

EU Member States

Denmark

Recognising the crucial role of CCS in meeting its ambitious climate targets, Denmark has made significant strides in recent years. Before the geological storage and transport of CO_2 became legally possible in 2022 through an amendment to the Danish Marine Environment Act, Denmark demonstrated its commitment by releasing a two-part national CCS roadmap in June and December 2021, followed by a series of legislative developments in the following months, as outlined in Figure 8 (Danish Government, 2021a, 2021b).

Substantial developments in Denmark's CCS policy, legal and regulatory framework have occurred in 2024. Between March and April, the Danish government signed cross-border CO_2 transportation agreements with France, Sweden, and Norway, facilitating geological storage under the seabed in compliance with the London Protocol's requirements (French Ministry of the Economy, 2024a; Government of the Netherlands, 2024a). These agreements represent a major step toward Denmark's aspiration to become a central hub for CO_2 storage in the region.

In June, Denmark further advanced its CCS ambitions by granting the first licenses to explore the potential for onshore CO_2 storage (Danish Energy Agency, 2024b), as part of a broader strategy to diversify and expand CO_2 storage options beyond offshore depleted fields. CDR is also gaining prominence in the country's climate and energy landscape. In December 2023, Ørsted, Denmark's largest energy company, began constructing two carbon capture facilities aimed at capturing 430,000 tonnes of biogenic CO_2 annually from two combined heat and power plants, set to become operational in early 2026 (Ørsted, 2023). In April, the Danish Energy Agency awarded funding to three companies, BioCirc CO_2 ApS, Bioman ApS, and Carbon Capture Scotland, to support the capture and geological storage in Denmark of 0.5 Mtpa of biogenic CO_2 from 2025 onwards (Danish Energy Agency, 2024c). In October 2024, the Danish Energy Agency announced an additional tendering procedure to grant DKK 28.7 billion (approximately €3.85 billion) to support both CCS and CDR (Danish Energy Agency, 2024a). Open until March 2025, it will cover the costs of capture, transport and geological storage of fossil, biogenic or atmospheric CO_2 over a 15-year contract period.

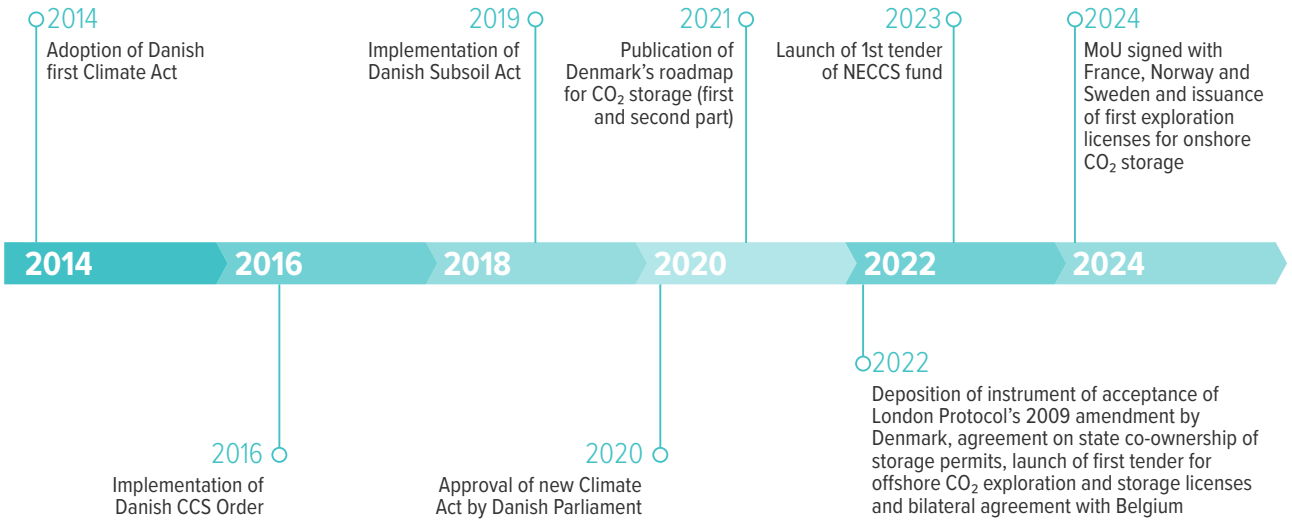


Figure 8 - Main CCS policy, legal and regulatory developments in Denmark

Netherlands

The Netherlands, one of the EU's climate leaders alongside Denmark, has also identified CCS as a central and effective solution for achieving CO_2 emission reductions, particularly in sectors where affordable sustainable alternatives are not yet available.

In recent years, as illustrated in Figure 9, the country has undertaken several initiatives to advance its CCS policy, legal and regulatory framework. To enhance the financial viability of CCS projects, it implemented the SDE++ scheme at the end of 2020 (Netherlands Enterprise Agency, 2023). This support aims to bridge the gap between the construction and operation costs of CO_2 capture, transport and storage, and the current prices under the EU ETS. In 2023, the Dutch government removed the subsidy cap for CCS projects, though eligibility remains limited to CO_2 storage in Dutch gas fields and the Dutch continental shelf. The next round of funding was open until October 2024.

The SDE++ scheme has already facilitated several CCS projects, including Porthos, a joint venture by EBN, Gasunie and the Port of Rotterdam Authority. After receiving approval in August 2023, this project secured FID in October. Construction of the project's infrastructure part started in mid-April 2024 (Porthos, 2024). Porthos will transport CO_2 through the Port of Rotterdam to depleted gas fields in the North Sea, approximately 20 km off the coast, where it will store about 2.5 Mtpa over 15 years, totalling around 37 million tonnes.

The Aramis CCS project, a collaboration between TotalEnergies, Shell, Energie Beheer Nederland (EBN) and Gasunie, is another significant commercial development (Aramis, 2024). Aiming to provide storage capacity of 22 Mtpa of CO_2 after 2030, it will capture CO_2 from industrial clusters in the Port of Rotterdam and transport it to depleted fields under the North Sea. In April 2024, its status of PCI was confirmed by EU co-legislators, making it eligible for funding under the CEF-E. The FID is expected in 2025/26.

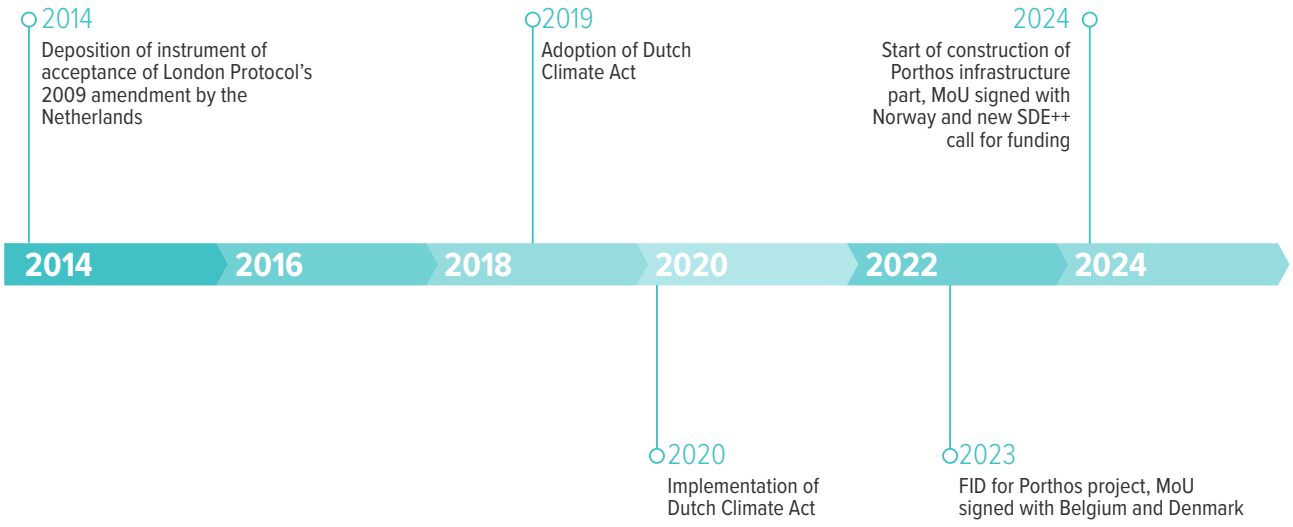


Figure 9 - Main CCS policy, legal and regulatory developments in the Netherlands

Non EU Member States

Several non-EU countries have also made significant strides in the deployment of CCS in 2024, reflecting a broader commitment across Europe to support and scale up this vital technology. Iceland, Norway and the UK have all emerged as key players in this field, each advancing CCS through a range of innovative policy, legal and regulatory measures and initiatives.

Iceland

Iceland, which has set one of the most ambitious decarbonisation strategies globally with its 2040 climate neutrality objective, has a strong track record in CCS, particularly in the area of carbon mineralisation (Government of Iceland, 2020).

Initially, the country's CCS legislative framework allowed CO_2 storage activities solely for research, development, or testing, as described in Figure 10. However, Iceland made a significant policy shift in 2021 following the success of its Carbfix project. An amendment to Iceland's Hygiene and Pollution Prevention Law permitted CO_2 storage on a commercial scale and recognised mineral storage as a viable method for permanent CO_2 sequestration alongside conventional methods (EFTA Surveillance Authority, 2023). In June 2024, the Icelandic Parliament approved legislative updates to further align its regulatory framework with the EU CCS Directive (Icelandic Supreme National Parliament, 2024).

In May 2024, the world's largest DAC project - Mammoth project in Iceland - commenced operations. (Climeworks, 2024). As a joint effort by Climeworks and Carbfix, the project captures CO_2 directly from the atmosphere and integrates it with the Carbfix mineralisation process, further advancing Iceland's CCS capabilities.

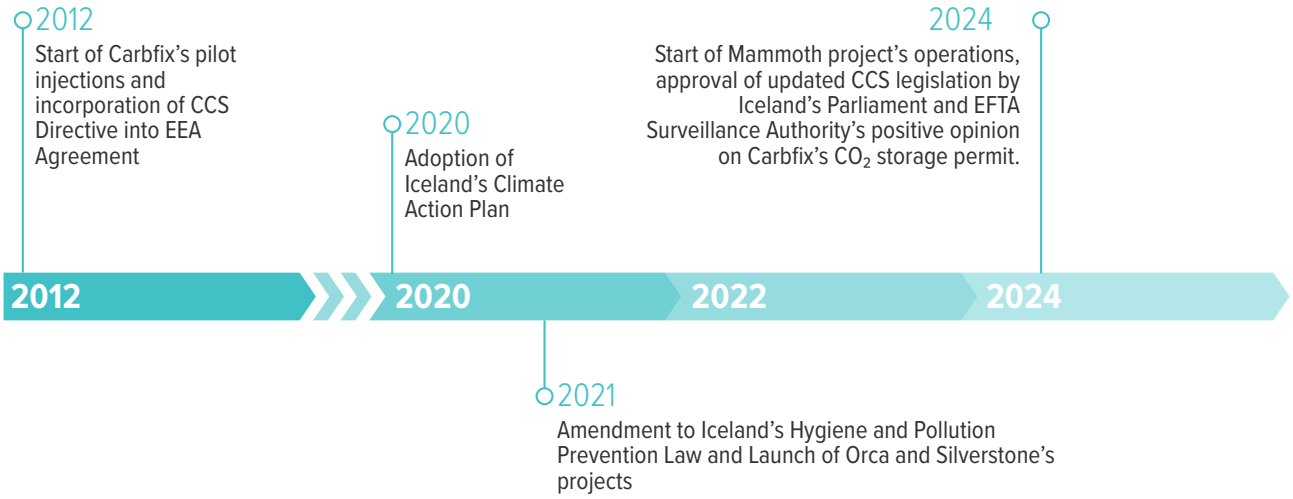


Figure 10 - Main CCS policy, legal and regulatory developments in Iceland

Norway

Since the launch of the Sleipner project in 1996, the world's first commercial CCS initiative aimed at addressing GHG emissions, Norway has established itself as a global frontrunner in this sector. Figure 11 summarises the key CCS policy, legal, regulatory and commercial developments over the past two decades.

In 2024, Norway has continued to solidify its leadership position. A significant highlight was the conclusion of several bilateral agreements facilitating cross-border transport of CO_2 for offshore geological storage. On 15 April 2024, Norway secured a record number of agreements with Belgium, Denmark, the Netherlands, and Sweden (Government of the Netherlands, 2024a). Additionally, the government is advancing further collaborations, as evidenced by the strategic partnership established with France in January to support the green industrial transformation, encompassing CCS, and the declaration of intent with Switzerland in May to enhance cooperation on CCS and CDR, including on cross-border CO_2 transport (Ministry of Energy and the Ministry of Climate and Environment of Norway and the Swiss Federal Department of Environment, 2024a; Norwegian Government, 2024a).

Building on the country's extensive CO_2 storage resources, the Norwegian Ministry of Energy initiated two new calls for CO_2 storage licenses in March and June 2024, bringing the total to seven rounds since 2018 (Norwegian Offshore Directorate, 2024b, 2024a).

Looking ahead, the Longship project, a full-scale industrial CCS value chain largely supported by the Norwegian state, is set to become operational by 2025 (Northern Lights, 2024a). This initiative will capture CO_2 from the Brevik cement factory operated by Heidelberg Materials for transport and storage (T&S) at the Northern Lights facility. The T&S infrastructure, which completed construction in September 2024, is managed by a joint venture between Equinor, Shell, and TotalEnergies. Due to its anticipated substantial impact across the continent, Northern Lights was designated by the EU as a PCI in March 2022 and received funding from the CEF-E in June 2024 (Northern Lights, 2024b).

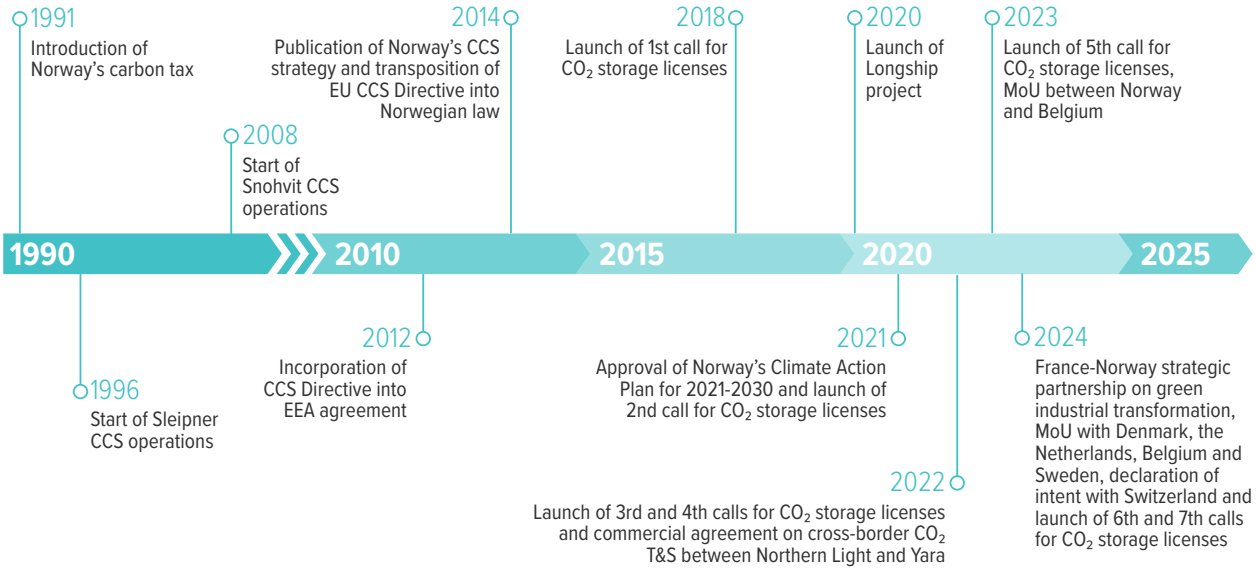


Figure 11 - Main CCS policy, legal and regulatory developments in Norway

United Kingdom

The UK stands out as another frontrunner in Europe's CCS landscape, having adopted various supportive policies and regulations, as outlined in Figure 12. In 2024, the country continued to advance its CCS initiatives as part of its broader strategy to reach climate neutrality by 2050. Following the release of the UK's vision for a competitive CCUS market in December 2023, the UK government is now focused on expanding its CCS capacity, with an ambitious goal of capturing 20-30 Mtpa of CO_2 by 2030 (UK Department for Energy Security & Net Zero, 2023b).

To bolster this effort, the government's 2024 Spring Budget, presented in March, introduced new funding aimed at bolstering the green industry and reducing the costs associated with the energy transition (Global CCS Institute, 2024g). The government increased the Green Industries Growth Accelerator budget by up to £120 million, bringing the total funding available to support the expansion of UK's low carbon manufacturing supply chains to over £1 billion. Up to £390 million will be allocated to CCUS and hydrogen supply chains. This financial commitment is expected to accelerate the deployment of CCUS technologies across the country.

In April, the government updated its proposed commercial frameworks for transport and storage, power, and industrial carbon capture business models (UK Department for Energy Security and Net Zero, 2024a).

Building on these measures, the government launched two public consultations in May 2024. The first consultation explored innovative methods for transporting captured CO_2 to facilitate wider adoption of CCS technologies across domestic industries (UK Department for Energy Security and Net Zero, 2024b). The second one sought input on integrating greenhouse gas removals into the UK ETS (UK Department for Energy Security and Net Zero, 2024c).

In October, the government announced £21.7 billion in public support for carbon capture projects located in the East Coast and HyNet clusters(UK Government, 2024). This funding, to be allocated over 25 years, marks a crucial step in developing large-scale CCUS hubs. These initiatives are expected to collectively reduce over 8.5 Mtpa of CO_2, significantly contributing to UK's climate goals.

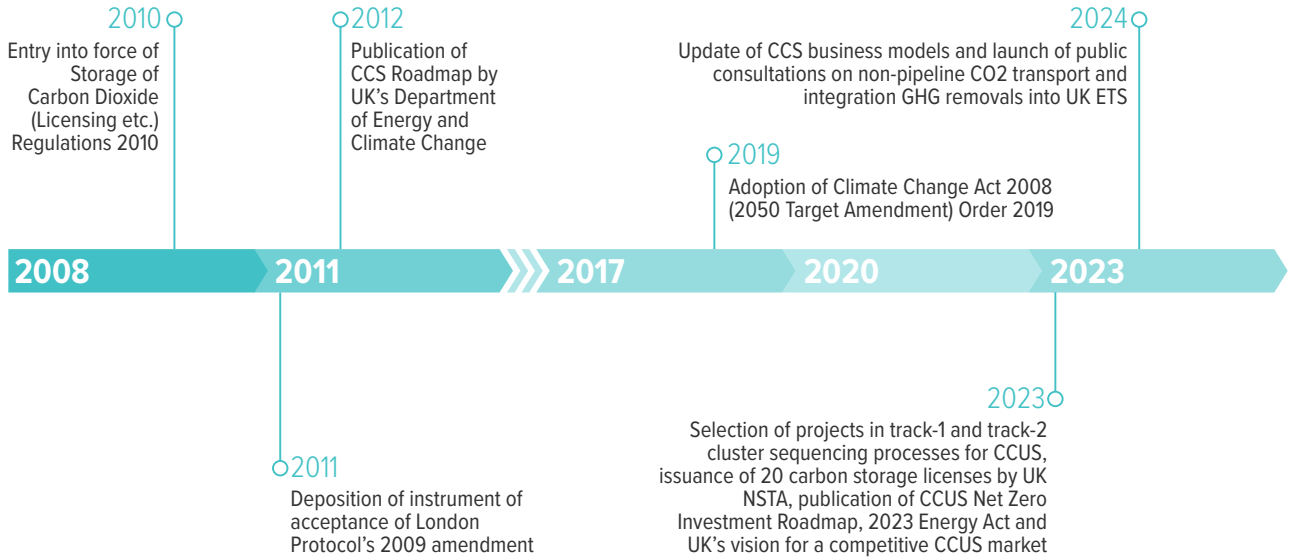


Figure 12 - Main CCS policy, legal and regulatory developments in the UK

4.4 Middle East and Africa

4.4.1 Overview

CCS is gaining momentum across the Middle East and Africa (MEA), where there are currently three operational commercial CCS facilities, situated in Saudi Arabia, Qatar, and the UAE. Six more facilities are in construction with expected commissioning dates between 2025 and 2027 (Global CCS Institute, 2024d). The Middle East holds 8% of current global CCS capacity (Global CCS Institute, 2023c) (Global CCS Institute, 2023c) and has the capability to scale this further through its considerable expertise in relevant areas due to its oil and gas industry.

The region is also home to various research centres and centres of excellence that can drive innovation. In Africa, new expertise is emerging, such as in South Africa and Nigeria, which have established a CCUS research site and a newly announced CCUS R&D Centre of Excellence in preparation, respectively.

The region's immediate priority is to implement a carbon pricing system that discourages the use of conventional, carbon-intensive industrial production methods in favour of more costly, low-carbon alternatives. As noted in the key trends section, there is ongoing progress across the Middle East and Africa toward establishing carbon markets, which could impose penalties on traditional, emissions-heavy production.

Despite the growing policy attention on CCS, this has not yet translated into sufficient financing mechanisms to accelerate project development. Most CCS projects in the region are operated by state-owned enterprises (SOEs), but there is a noticeable shift towards more public-private partnerships. To foster the growth of the commercial CCS sector in MEA, it is crucial to establish appropriate policy financing frameworks to attract investment. Additionally, policies in other regions, such as the Carbon Border Adjustment Mechanism (CBAM) in Europe, will penalise countries that do not adopt a similar carbon pricing mechanism, presenting a financial incentive for CCS adoption.

CCS regulatory frameworks are crucial for the successful deployment of projects in the region. While many countries are still in the early stages of developing such frameworks or lack them entirely, others are making notable progress. For instance, Petroleum Development Oman (PDO) is at the forefront of regulatory development, working closely with the Global CCS Institute. Qatar and Egypt have also established some basic frameworks and approval processes. Although there have not been major developments in the UAE, the country has emphasised the need for regulations to support CCS initiatives. In Nigeria, a draft regulatory approach for CCS was recently presented at the Annual International Conference, signalling growing attention to the issue (Ibe, 2024).

In Africa, more policy focus is needed to evaluate and identify geological storage resources. In contrast, the Middle East, with its established oil and gas industry, has a well-developed understanding of storage capacity, which can streamline project planning and development. From a policy standpoint, more Middle Eastern countries are acknowledging the importance of CCS for decarbonisation, with a modest number of countries in the region having included CCS in their NDCs.

To scale CCS effectively in the region, it is essential to build CCS networks and infrastructure. Currently, most projects are small-scale and cover the full value chain, but the extensive storage resources in the region present an opportunity to focus policy on establishing emitter clusters. These clusters could reduce costs through sharing infrastructure and achieve greater emission reductions.

Across the region, various initiatives are being developed to build capacity and expertise that support CCS activities. For instance, the Middle East Green Initiative, which aims to support regional climate action, is working on establishing a regional CCS hub to facilitate knowledge sharing and capacity building.

4.4.2 Key trends

CCS is gaining significant momentum in the MEA region, with 10 countries recognising it as a key decarbonisation technology in their NDCs and national strategies. Policy development around CCS is advancing in several countries, including Oman, UAE, Saudi Arabia, South Africa, and Kenya, where essential regulations, strategies, and business models are being established. However, to accelerate project deployment, further progress in these policy areas is essential. While the growth of carbon markets is encouraging, they alone may not provide sufficient economic justification for CCS projects. Additional financial instruments will be needed to complement these markets.

Equally important to CCS success is the development of legal and regulatory frameworks. Oman is leading in this area, and the UAE has expressed intentions to establish similar frameworks, but more progress is required across the region. In much of Africa, there is a need for further

exploration of storage capacity before legal frameworks can be advanced, in order to assess the broader potential for CCS projects.

Development of carbon markets

Carbon markets are rapidly emerging in the MEA region as part of efforts to reduce GHG emissions. Initially voluntary, these markets are expected to evolve into compliance systems. As more of these markets emerge throughout the region, there is an opportunity to establish region-wide market principles to ensure consistency in standards, policy coherence, and collaborative efforts.

Promising initiatives currently under development in the Middle East include Saudi Arabia's Greenhouse Gas Crediting and Offsetting Mechanism, launched in 2023 (Saudi Arabia Ministry of Energy, 2023a). Additionally, the Environment Agency-Abu Dhabi has invited proposals for implementing a MRV system for GHG emissions, paving the way for a cap-and-trade system. The UAE's long-term strategy emphasises plans to introduce carbon contracts for difference by 2025, which could support greater revenue certainty when launching a cap-and-trade system (United Arab Emirates Ministry of Climate Change and Environment, 2023). Oman's Sustainability Centre has also announced intentions to develop a carbon market to support trades in carbon credits.

Across Africa, there are some developments around carbon pricing and markets. South Africa imposed a carbon tax on emitters and introduced a new voluntary carbon market in late 2023. In July 2024, South Africa's National Treasury announced plans to introduce proposals in the coming months for regulating carbon markets in the country.

Nigeria has launched a US$2.5 billion carbon market plan. Meanwhile, Kenya has introduced the Climate Change Regulations 2024 to provide a legal framework for carbon projects and markets. The world's largest carbon market auction took place in Nairobi in 2024 (EY - Global, 2024).

To support CO_2 accounting and methodologies for appropriate carbon credit labelling in carbon markets, the Global Carbon Council has developed a framework for calculating and monitoring emissions in CCS project activities. This methodology enables project owners to quickly calculate on an ex-post basis, both the gross and net GHG removals achieved by a registered activity (Global Carbon Council, 2023).

Development of legal and regulatory frameworks

Oman has made significant strides in developing a legal and regulatory framework for CCUS. The Ministry of Energy and Minerals (MEM) has signed a memorandum of cooperation with key industry players, including PDO, Oman Shell, and OQGN, to establish an expertise body. This collaboration aims to drive the development of regulatory and strategic guidelines for CCUS. A CCUS Core Team has been formed, comprising various stakeholders from both industry and government. PDO,

leading the storage workstream within the core team, is working closely with the Global CCS Institute to provide guidance and expertise in creating regulations that will support CO_2 storage projects.

In the UAE, the long-term 2050 net-zero strategy includes plans to develop regulatory frameworks that address critical issues such as transport and storage fees, the transfer of storage liability to the state, and the establishment of a certification and approval process for CCS projects. These measures aim to expedite the deployment of projects.

Saudi Arabia currently lacks specific regulations for CCS. However, with ambitious national CCS targets and large-scale projects like the planned 9 Mtpa Jubail CCUS hub in the pipeline, the development of robust regulatory frameworks will be increasingly critical (GCCSI, 2024).

Low-carbon hydrogen and ammonia are scaling up with ambitious production targets

The Middle East is on track to become a major global producer of low-carbon hydrogen and ammonia, with several significant projects underway. Oman is progressing with its low-carbon hydrogen and ammonia initiative at Duqm, while Qatar plans to build the world's largest low-carbon ammonia plant, which is expected to produce 1.2 Mtpa (CMS Law-Now, 2023). Additionally, ADNOC in the UAE is developing a facility aimed at producing 1 Mtpa of low-carbon ammonia, set to commence operations in 2027.

In tandem, with project announcements, countries in the region are establishing supportive policies and targets to boost low-carbon hydrogen/ammonia development. Specifically, Oman is creating a low-carbon hydrogen legal and regulatory framework, Qatar is developing a roadmap to support hydrogen utilisation, the UAE has released a national hydrogen strategy that includes an ambitious target of producing 7 Mtpa of low-carbon hydrogen by 2050 (The Official Portal of the UAE Government, 2024), and Saudi Arabia's Aramco is planning 11 Mtpa of low-carbon ammonia, which is equivalent to 1.84 Mtpa of low-carbon hydrogen by 2030 (Ammonia Energy Association, 2022). South Africa is also actively planning to develop low-carbon hydrogen as part of its broader Hydrogen Society Roadmap (Bowmans, 2022).

State-owned enterprises play a critical role in advancing CCS projects

SOEs in the Middle East and Africa play a crucial role in advancing CCS development. The top 20 SOEs in MEA have emissions comparable to those of Canada, underscoring their capacity to drive sustainability action in the region (World Economic Forum, 2023). Given that SOEs typically contribute a significant share of national GDP, they possess both the financial resources to invest in CCS projects and the ability to manage the associated risks. For instance, ADNOC in the UAE has a decarbonisation budget of US$23 billion (Carbon Herald, 2024a). Additionally, many have extensive history in fossil fuel extraction, which equips them with the technical expertise and understanding necessary for successful CCS project execution. Currently, SOEs are leading many of the CCS efforts in the region. Of the 14 CCS developments in various stages of development, eight involve SOEs (Global CCS Institute, 2024d). These organisations often set the benchmark for other companies, further emphasising their role in driving CCS adoption. SOEs in the region have shown significant dedication to CCS. Organisations like Aramco, QatarEnergy LNG, and ADNOC have collectively committed to achieving a CO_2 storage capacity of 35 Mtpa by 2035.

Regional and international collaboration

Across the MEA region there is strong regional and international to accelerate climate action, CCS initiatives, and building capacity. A key example of this is the Middle East Green Initiative, led by Saudi Arabia, which is a regional effort to mitigate effects of climate change and to foster collaboration. Under the initiative, US$2.5 billion has been committed to support various projects and governance measures. Among its major goals are planting 50 billion trees and achieving a regional emissions reduction of 60% (Saudi and Middle East Green Initiative, 2024).

To achieve its ambition, the initiative includes the development of a cooperative platform aimed at accelerating a circular carbon economy, a regional investment fund to support technology solutions for carbon capture, and the establishment of a regional centre for carbon extraction, utilisation, and storage. This centre will play a crucial role in creating a comprehensive strategy for CCS project implementation across the region.

Additionally, countries across the MEA region including Mozambique, Kenya, Nigeria, Senegal, Saudi Arabia, the UAE, and Egypt are actively engaged in addressing the carbon management challenge, working to deploy CCS technologies at a gigatonne scale. Many of these nations also participate in broader global initiatives, such as Mission Innovation and the Clean Energy Ministerial, to further their climate and clean energy goals.

4.4.3 Specific national policy, legal, regulatory and commercial developments

Middle East and Africa

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Financial incentives for operators	Emissions trading schemes	UAE	Proposal for MRV system for cap-and-trade scheme	In development	The Environment Agency-Abu Dhabi is planning a cap-and-trade scheme and seeking proposals to develop a system for monitoring GHG emissions. It will use this data to assess the viability of an ETS and advise on next steps or alternative climate strategies.
		Saudi Arabia	The Greenhouse Gas Crediting and Offsetting Mechanism	In development	In 2023, Saudi Arabia launched a domestic carbon crediting mechanism, the Greenhouse Gas Crediting and Offsetting Mechanism
	Voluntary carbon markets	Saudi Arabia	Regional Voluntary Carbon Market Company (RVCMC)	In force	The Public Investment Fund announced the establishment of the Regional Voluntary Carbon Market Company, which will offer guidance and resourcing to support businesses and industry in the region as they participate in the global transition to net zero (Saudi Arabia Press Agency, 2023).
		South Africa	The Johannesburg Stock Exchange's (JSE) new voluntary carbon market	In force	The JSE Ventures Voluntary Carbon Market aims to accelerate the creation of carbon offset projects in South Africa and the greater African continent, to help meet the demand for credits by emitters (JSE, 2023).
		UAE	Full regulated carbon and renewable energy certificates exchange	In force	ACX is the first fully regulated carbon and renewable energy certificates exchange, connecting global voluntary carbon market participants to trade ACX contracts for spot carbon credits, renewable energy certificates and other environmental instruments (ACX, 2024).
		Egypt	Voluntary carbon market	In force	Prime Ministerial Decree No. 4664 of 2022 sets the stage for a voluntary carbon market platform within the Egyptian Stock Exchange. Recently, the Egyptian Financial Regulatory Authority introduced a series of groundbreaking regulations to create a robust framework for the accreditation, issuance, listing, delisting, and trading of carbon emissions reduction certificates (CERs). On 13 August 2024, the FRA officially launched the first regulated voluntary carbon market (Baker McKenzie InsightPlus, 2024).
		Nigeria	Plans for a carbon market	In development	Supported by the Africa Carbon Market Initiative (ACMI), the Nigerian government is spearheading efforts to implement a co-created blueprint of a carbon market (Carbon Herald, 2024b).
		Kenya	Carbon market regulations	In force	Kenya has introduced the Climate Change Regulations, 2024 to provide a legal framework for carbon projects and markets. The regulations provide clarity on the roles and responsibilities of the institutions that will oversee carbon market activities in Kenya.

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Financial incentives for operators	Carbon tax and incentives	South Africa	CO_2 tax	In force	South Africa introduced a carbon tax in June 2019, initially setting it at ZAR190 (approximately US$15) per tonne of CO_2-e emissions above specified thresholds.
		Morocco	Fiscal reform for carbon tax development	In development	In 2021, the government enacted a Framework Law (Loi Cadre) aimed at fiscal reform, which encompasses various potential new fiscal measures, including the introduction of a carbon tax.
		Saudi Arabia	Draft income tax incentive	In development	The draft laws introduce specific provisions for tax incentives for green investment (Deloitte, 2023).
	International carbon markets	Oman	Draft of a general policy framework for carbon markets	In development	Oman has completed the final draft of a general policy framework for carbon markets, aligning with the Paris Agreement's Article 6. The document aims to establish Oman as a leading carbon trading hub in the Middle East (Carbon Herald, 2024c).
Supportive policies and programs	Strategies/ Roadmaps/ NDCs	Egypt	National Climate Change Strategy 2050	Published	The strategy includes an objective to explore CCUS technologies (Ministry of Environment, 2022).
		UAE	Long term net zero strategy to UNFCCC	Published	This document delves into CCS policy frameworks designed to encourage deployment and a target of achieving a 32% contribution from CCS to the decarbonisation of the industrial sector.
		Qatar	Carbon capture roadmap	In development	QatarEnergy LNG partnered with General Electric to create a carbon capture roadmap. The focus is to explore the feasibility of developing a world-scale carbon hub at Ras Laffan Industrial City (GE Vernova, 2022).
		Saudi Arabia	Circular Carbon Economy approach	In force	To address GHG emissions systematically, Saudi Arabia has adopted a Circular Carbon Economy approach. At its core is the 4R's model: Reduce, Reuse, Recycle and Remove.
		Saudi Arabia	Saudia Arabia Green Initiative.	In force	The initiative aims to reduce emissions, increase afforestation and land restoration. Since the inauguration, 77 initiatives have been activated (Saudi & Middle East Green Initiatives, no date).
		Bahrain, Egypt, Iran, Kuwait, Oman, Qatar, Saudi Arabia, Tunisia, Turkey and UAE	Inclusion of CCS on NDC	Published	Ten countries in the Middle East and Africa include CCS in their NDCs.
	Targets (Corporate and national)	Qatar	CCS corporate target	In force	QatarEnergy LNG has set a target to store over 11 Mtpa of CO_2 by 2035.
		UAE	Low-carbon hydrogen production target	In force	New hydrogen strategy with a 7 Mtpa of low-carbon hydrogen by 2050 target (Ministry of Energy and Infrastructure, 2023)

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Supportive policies and programs	Targets (Corporate and national)	Saudi Arabia	Low-carbon ammonia target	In force	Aramco is planning 11 Mtpa of low-carbon ammonia, which is equivalent to 1.84 Mtpa of low-carbon hydrogen by 2030.
		UAE	CCS corporate target	In force	ADNOC revised CCS target to 10 Mtpa of CO_2 (ADNOC, 2023b).
		Oman	CCS national target	In force	Target of 15% of carbon abatement from CCS by 2050 (The Sultanate of Oman, 2023)
		Saudi Arabia	CCS national target	In force	Saudi Arabia has set an ambition to capture, utilise and store 44 Mtpa of CO_2 by 2035 (Climate Tracker, 2024).
		Saudi Arabia	CCS corporate target	In force	Aramco has a target of capturing up to 14 Mtpa of CO_2 by 2035 (Global CCS Institute, 2024f).
		South Africa	GHG emission target and carbon budget	In force	The Climate Change Act requires the Department of Forestry, Fisheries and the Environment to publish sectors with GHG emission targets and assign carbon budgets.
	Knowledge sharing	Qatar	CCS Research Partnership	Completed	The Qatar Carbonates and Carbon Storage Research Centre is the result of a 10-year, US$70 million strategic collaboration between Imperial College London, Qatar Petroleum, Shell and the Qatar Science and Technology Park, part of Qatar Foundation (The Peninsula, 2012)
		Nigeria	CCUS Centre of Excellence	In development	The federal government, through its Geological Survey Agency is preparing to unveil a CCUS Centre of Excellence that will collaborate with stakeholders across the value chain to formulate a legal and regulatory framework for this technology.
		South Africa	CCUS Research Centre	Operational	In September 2024, the Minister of Mineral Resources and Petroleum officially unveiled the research site in Leandra, Mpumalanga. This development follows the completion of a geological characterisation study (Council for Geoscience, 2024).
		Saudi Arabia	King Abdullah Petroleum Studies and Research Center (KAPSARC)	Operational	The KAPSARC in Saudi Arabia engages in various activities related to CCS including research and development of CCS technologies, policy analysis, economic studies, technology assessment, capacity building, and international collaboration (KAPSARC, 2024).
	Storage development	South Africa	Publication of geological atlas	Published	The Council for Geoscience has produced an atlas on the geological storage of CO_2 in South Africa (Council for Geoscience, no date).
		Botswana	Funding to support storage exploration	Completed	The World Bank CCS Trust Fund made US$1.4 million in funding available to Botswana.
		Egypt	Study for CO_2 storage	Completed	The Oil and Gas Climate Initiative (OGCI) and the Global CCS Institute have studied Egypt's potential for CCS projects. The report notes that Egypt has significant onshore storage capacity in saline aquifers, which could be used for CO_2 storage (OGCI, 2023).
Supportive policies and programs	Storage development	Oman	Support for project development	In development	In September 2023, Shell Development Oman (SDO) received support from Oman's MEM for the 'Blue Horizons' initiative, a project exploring the production of low-carbon hydrogen and ammonia. PDO would be responsible for storing the captured CO_2 (Ministry of Energy and Minerals, 2023).
	Direct funding	South Africa	World Bank Fund	Completed	The US$23 million CCS pilot project was developed by the Council for Geoscience at a site in Leandra (World Bank, 2024)

TYPE OF POLICY INSTRUMENT		JURISDICTION	INSTRUMENT NAME	STATUS	DETAILS
Legal and regulatory governance	CCS regulation	Qatar	Basic GHG regulatory framework	In force	Qatar has a basic regulatory framework through Law 30 of 2002: Environmental Protection. This law aims to counter various forms of pollution and prevent environmental damage resulting from construction, industrial, agricultural, and economic activities.
		Oman	CCUS regulatory framework development	In development	In November 2023, the MEM signed a Terms of Reference with PDO, SDO, OQGN, and Occidental Oman to establish the CCUS and Blue Hydrogen Framework.
	Permitting/ approvals	Egypt	Amendment to Investment Law	In force	In August 2022, the government amended the Investment Law to offer a pathway for CCUS projects to fall under a unified approval system, provided they meet specified criteria.
	Other climate law	UAE	Federal Decree-Law No. (11) of 2024 'On the Reduction of Climate Change Effect	Comes into force 2025	The climate law is a direct legal mechanism supporting the UAE's Net Zero 2050 strategy, which commits the country to achieving net-zero carbon emissions. Under the climate law, the UAE Ministry of Climate Change and Environment will have the authority to issue climate-related resolutions applicable to public and private entities (BDO, 2024).

Table 7 - Main CCS policy, legal and regulatory instruments in selected countries in the MEA region

Saudi Arabia

- In November 2020, Saudi Arabia adopted a Circular Carbon Economy approach to systematically address greenhouse gas emissions. This approach includes a 'remove' principle, which can be achieved through CCUS (Carbon Circular Economy, 2020)
- In October 2023, Saudi Arabia launched a domestic carbon crediting mechanism, the Greenhouse Gas Crediting and Offsetting Mechanism (Saudi Arabia Ministry of Energy, 2023b). (The National News, 2023).

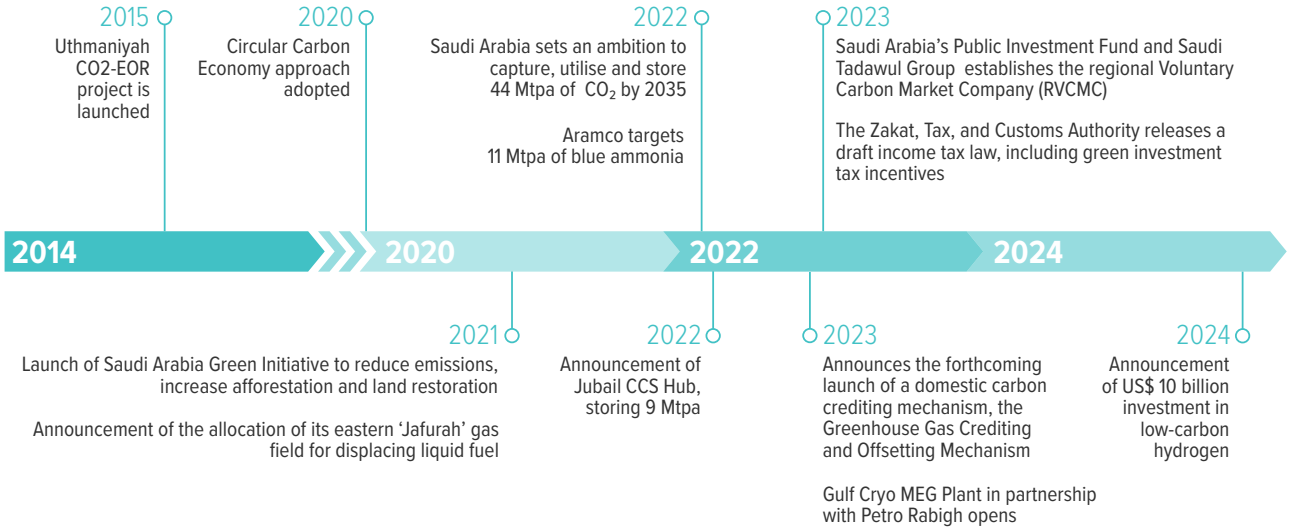


Figure 13 - Main CCS policy, legal and regulatory developments in Saudi Arabia

UAE

- In January 2024, the UAE Cabinet submitted its inaugural long-term net-zero strategy by 2050 to the UNFCCC. This document delves into CCS policy frameworks designed to encourage deployment (UAEnited Arab Emirates Ministry of Climate Change and Environment, 2023)
- In 2022, The Environment Agency-Abu Dhabi called for proposals to establish a MRV system for GHG emissions, laying the groundwork for a potential cap-and-trade scheme (Ministry of Economic Affairs, 2023)

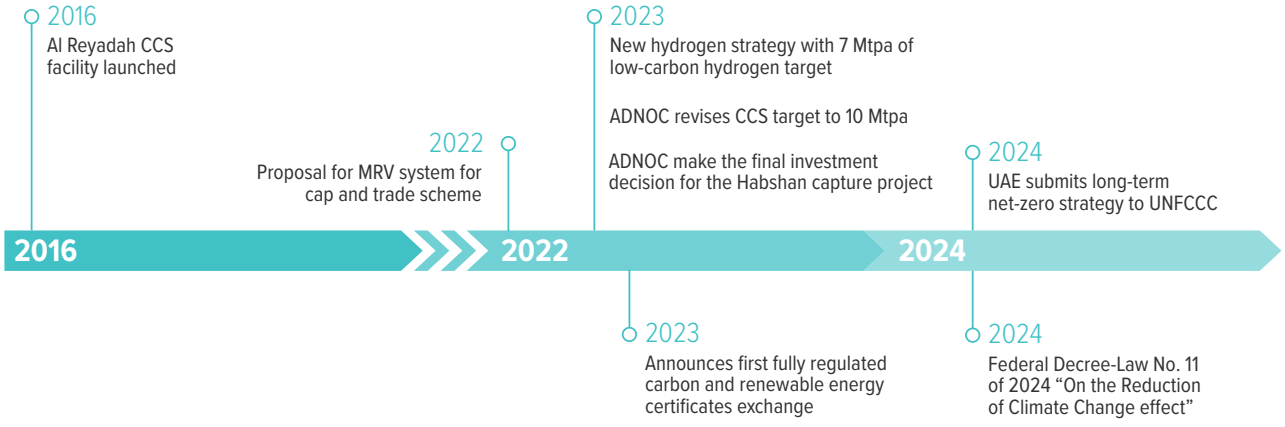


Figure 14 - Main CCS policy, legal and regulatory developments in the UAE

Oman

- In November 2023, the MEM signed a Terms of Reference with PDO, SDO, OQGN, and Occidental Oman to establish the CCUS and Blue Hydrogen Framework (Oman Daily Observer, 2023).
- As part of launching the framework, PDO partnered with the Global CCS Institute to focus on providing guidance for developing a legal and regulatory framework for CCS. Their joint efforts aim to facilitate the implementation of CCS technology within Oman (Global CCS Institute, 2023e).

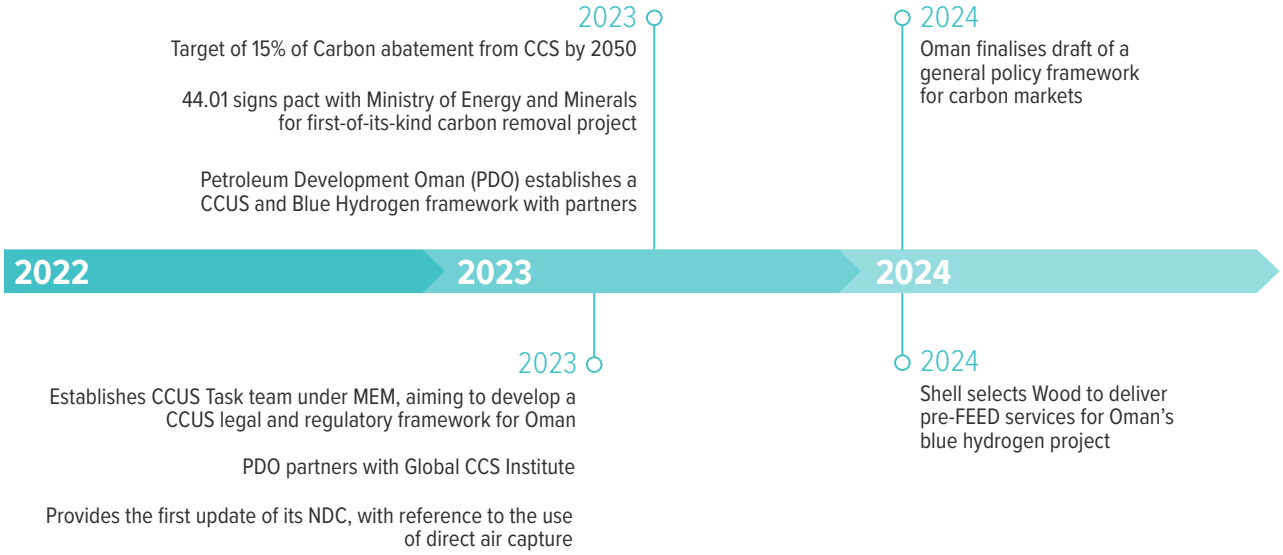


Figure 15 - Main CCS policy, legal and regulatory developments in Oman

Qatar

- In 2022, QatarEnergy LNG set a target to store over 11 Mtpa of CO_2 by 2035 (Global CCS Institute, 2023f).
- Qatar established a basic GHG regulatory framework through Law 30 of 2002: Environmental Protection, in 2022. This law aims to counter various forms of pollution and prevent environmental damage resulting from construction, industrial, agricultural, and economic activities. Qatari efforts to mitigate greenhouse gas emissions with technologies such as CCS fall under the purview of this legislation (Brookings, 2016).

Bahrain

- Bahrain's 2021 NDC supported CCU and DAC under the Technology Innovation and Deployment sections (Supreme Council for Environment, 2021).

Kuwait

- Kuwait's 2021 NDC includes a number of pillars for a circular carbon economy, and a net-zero target by 2060 (gas sector by 2050). CCS is included under the carbon re-use pillar (State of Kuwait, 2021).

Africa

South Africa

- After years of planning, consultations, and legislative processes, South Africa introduced a carbon tax in June 2019, initially setting it at ZAR190 (approximately US$15) per tonne of CO_2-e emissions above specified thresholds. Although the government initially planned to start the second phase of this tax in January 2023, it has delayed the start until January 2026. The government also announced planned increases in the carbon tax rate from ZAR159 in 2023 to ZAR462 by 2030 (GIZ, 2024).
- In July 2024, the President signed the Climate Change Act into law, and it will take effect on a future date determined by proclamation. This Act requires the Department of Forestry, Fisheries, and the Environment to publish sectors subject to GHG emission targets and assign carbon budgets. Businesses must submit GHG mitigation plans and provide annual progress reports (South African Government, 2024).

Egypt

- The government is currently exploring the deployment of CCUS hubs to reduce industrial CO_2 emissions (UNFCCC, 2023).
- In August 2022, the government amended the Investment Law to offer a pathway for CCUS projects to fall under a unified approval system, provided they meet specified criteria. This amendment allows the Cabinet of Ministers to grant a single approval for companies undertaking national or strategic projects, covering the entire project lifecycle (Investment Policy Hub, 2022).

Morocco

- Morocco aims to become a leading Power to X producer, and it plans to use DAC or BECCS to produce synthetic fuels from captured CO_2 ¬(GIZ, 2021).
- In August 2021, the government passed a Framework Law (Loi Cadre) on Fiscal Reform that includes several potential new fiscal measures, including the introduction of a carbon tax (Royaume du Maroc, 2024).

Nigeria

- The federal government, through its Geological Survey Agency, is preparing to unveil a CCUS Centre of Excellence that will collaborate with stakeholders across the value chain to formulate a legal and regulatory framework for this technology (The Sun, 2024).
- Supported by the Africa Carbon Market Initiative, the Nigerian government is spearheading efforts to implement a co-created blueprint that aims to establish frameworks and policies for an efficient and sustainable carbon market ecosystem valued at US$2.5 billion.

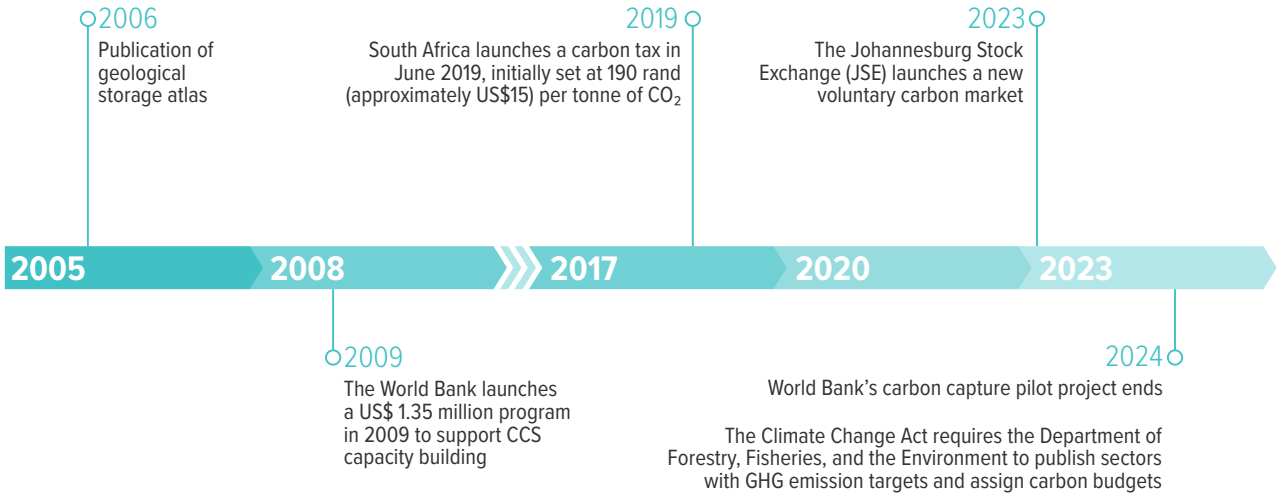


Figure 16 - Main CCS policy, legal and regulatory developments in South Africa

Botswana

- The CCS Trust Fund allocated US$1.4 million to Botswana to identify potential CO_2 storage sites, evaluate and strengthen the country's institutional and regulatory framework for CCS, and provide training and capacity building, including a study tour for key stakeholders (World Bank Group, 2017).

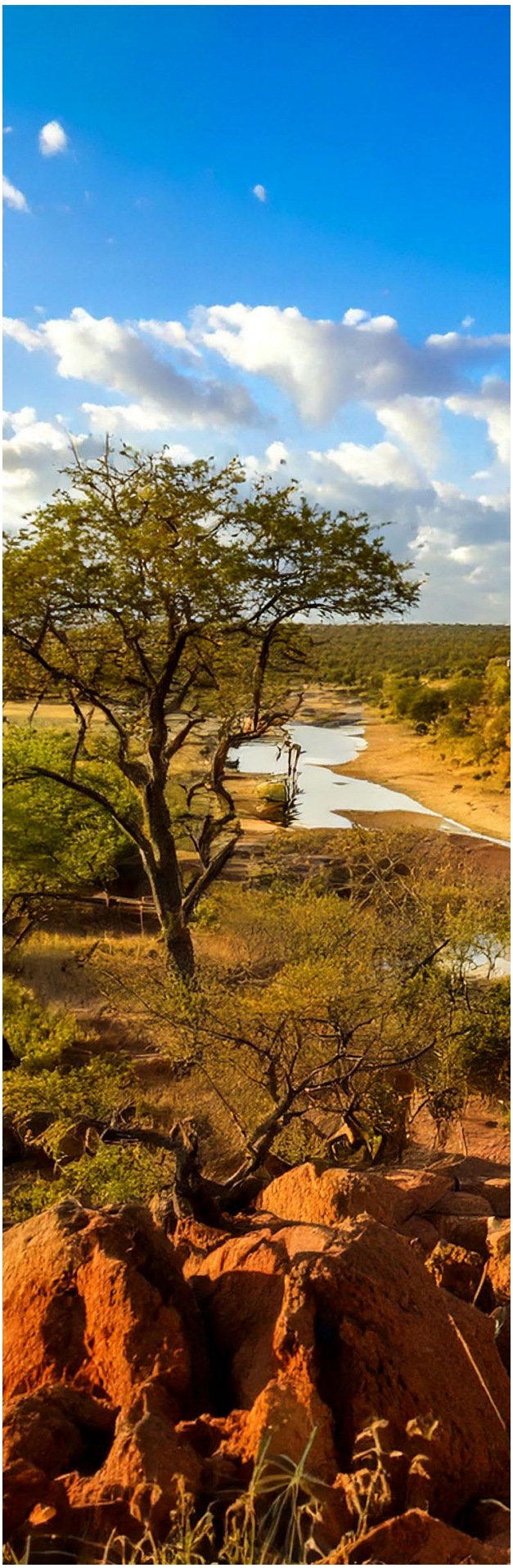
Kenya

- Kenya has introduced the Climate Change Regulations 2024 to provide a legal framework for carbon projects and markets. The Regulations provide clarity on the roles and responsibilities of the institutions that will oversee carbon market activities in Kenya. In addition to addressing governance concerns, the Regulations make provision for the operations and functions of the National Carbon Registry, the standards and approval processes for carbon projects, and the prescribed methods for benefit sharing.

- Octavia Carbon is demonstrating DAC technology and MRV tools with a pilot project that has an initial removal capacity of 250 tonnes of CO_2, scaling up to 1,000 tpa (Global CCS Institute, 2024d)

Algeria

- The In Salah CCS project in central Algeria was a pioneering onshore CCS project. Since the start of CO_2 injection in 2004, the project has been completed and successfully stored over 3.8 million tonnes of CO_2 in the subsurface. (MIT, 2016).



5.0 REFERENCES

ACX (2024) The world's first regulated carbon exchange and clearing house.

Adjei, A., Mageau, J. and Piggott, F. (2023) CCUS: 5 things to look for in 2024. Available at: https://www.woodmac.com/news/opinion/ccus-2024-outlook/ (Accessed: 25 August 2024).

ADNOC (2023a) ADNOC Announces World First Fully Sequestered CO_2 Injection Project.

ADNOC (2023b) ADNOC Takes FID on World's First Project That Aims to Operate with Net Zero Emissions. Available at: https://www.adnoc.ae/en/news-and-media/press-releases/2023/adnoc-takes-fid-on-worlds-first-project-that-aims-to-operate-with-net-zero-emissions (Accessed: 1 October 2024).

Ammonia Energy Association (2022) Aramco targets 11 million tonnes of low-carbon ammonia production by 2030. Available at: https://ammoniaenergy.org/articles/aramco-targets-11-million-tonnes-of-low-carbon-ammonia-production-by-2030/ (Accessed: 16 October 2024).

Aramis (2024) Aramis, a large-scale CO_2 transport and storage service. Available at: https://www.aramis-ccs.com/ (Accessed: 29 August 2024).

Australia-Korea Business Council (2024) Korea and Australia Advancing Cross-Border CO_2 Transport, Facilitating CCS. Available at: https://www.akbc.com.au/news/korea-and-australia-advancing-cross-border-CO_2-transport-facilitating-ccs (Accessed: 26 August 2024).

Australian Government (2024a) Budget Paper No.2 - Budget 2024-25. Available at: www.pmc.gov.au/ (Accessed: 26 August 2024).

Australian Government (2024b) Future Gas Strategy.

Australian Government Department of Foreign Affairs and Trade (2022) Singapore-Australia Green Economy Agreement. Available at: https://www.dfat.gov.au/geo/singapore/singapore-australia-green-economy-agreement (Accessed: 26 August 2024).

Austrian Federal Finance Ministry (2023) Brunner startet nationale Carbon Management Strategie. Available at: https://www.bmf.gv.at/presse/pressemeldungen/2023/september/carbon-management-strategie.html (Accessed: 28 August 2024).

Austrian Federal Ministry for Climate Action, E.E.M.I. and T. (2024) Federal government adopts carbon management strategy as a contribution to achieving climate neutrality. Available at: https://www.bmk.gv.at/service/presse/gewessler/2024/0627_carbonmanagement.html (Accessed: 18 July 2024).

Baker McKenzie InsightPlus (2024) Egypt: Unlocking opportunities - Navigating Egypt's new carbon trading regulations. Available at: https://insightplus.bakermckenzie.com/bm/banking-finance_1/egypt-unlocking-opportunities-navigating-egypts-new-carbon-trading-regulations (Accessed: 20 October 2024).

BDO (2024) Announcing the Federal Decree-Law No. (11) of 2024 on the reduction of climate change effects. Available at: https://www.bdo.ae/en-gb/news/news/announcing-the-federal-decree-law-no-(11)-of-2024-on-the-reduction-of-climate-change-effects (Accessed: 20 October 2024).

Belgian Official Gazette (2024a) Decree on the transport of carbon dioxide by pipeline (Flemish Region). Available at: www.moniteur.be.

Belgian Official Gazette (2024b) Decree on the transport of carbon dioxide by pipeline (Walloon Region). Available at: https://www.ejustice.just.fgov.be/mopdf/2024/07/12_1.pdf#page=603 (Accessed: 15 July 2024).

Bowmans (2022) South Africa: Embracing green and blue hydrogen.

Brazilian National Agency of Petroleum, N.G. and B. (2024) 'Future Fuel Law is sanctioned by the government', Press Release, 9 October. Available at: https://www.gov.br/anp/pt-br/canais_atendimento/imprensa/noticias-comunicados/lei-do-combustivel-do-futuro-e-sancionada-pelo-governo (Accessed: 8 October 2024).

Brookings (2016) Low carbon energy transitions.

BSCSP (2022) 'Big Sky Carbon Sequestration Partnership (BSCSP)', Big Sky Carbon Sequestration Partnership (BSCSP) [Preprint]. Available at: https://www.bigskyCO_2.org/ (Accessed: 19 October 2022).

Bursa Malaysia (2022) Bursa Malaysia Launches a Voluntary Carbon Exchange. Available at: https://www.bursamalaysia.com/bm/about_bursa/media_centre/bursa-malaysia-launches-a-voluntary-carbon-market-exchange (Accessed: 1 October 2024).

Business Australia (2023) Carbon Capture Use and Storage Development Fund. Available at: https://business.gov.au/grants-and-programs/carbon-capture-use-and-storage-development-fund (Accessed: 15 February 2024).

Carbon Circular Economy (2020) Circular Carbon Economy National Program.

Carbon Herald (2024a) ADNOC Sets Aside $23B Budget For Big Decarbonization Agenda. Available at: https://carbonherald.com/adnoc-sets-aside-23b-budget-for-big-decarbonization-agenda/ (Accessed: 21 October 2024).

Carbon Herald (2024b) Nigeria Initiates 'National Carbon Market Activation Plan' To Tap Into $2.5 Billion Opportunity. Available at: https://carbonherald.com/nigeria-initiates-national-carbon-market-activation-plan-to-tap-into-2-5-billion-opportunity/ (Accessed: 21 October 2024).

Carbon Herald (2024c) Oman Finalizes General Policy Framework For Carbon Markets. Available at: https://carbonherald.com/oman-finalizes-general-policy-framework-for-carbon-markets/ (Accessed: 1 October 2024).

Carbon Management Challenge (2024) Carbon Management Challenge - Frequently Asked Questions, Website. Available at: https://www.carbonmanagementchallenge.org/cmc/participants (Accessed: 17 September 2024).

CCS Europe (2024) Roadshow in Poland with CCS Europe. Available at: https://www.ccs-europe.eu/roadshow_in_poland_with_ccs_europe (Accessed: 28 August 2024).

Center for Strategic and International Studies, Nikos Tsafos and Stephen Naimoli (2022) Canada's Carbon Capture Industrial Strategy, Commentary. Available at: https://www.csis.org/analysis/canadas-carbon-capture-industrial-strategy (Accessed: 19 September 2024).

Central Government of Indonesia (2024) Presidential Regulation (PERPRES) Number 14 of 2024: Implementation of Carbon Capture and Storage Activities. Available at: https://peraturan.bpk.go.id/Details/276843/perpres-no-14-tahun-2024 (Accessed: 26 August 2024).

Climate Tracker (2024) Climate Tracker - Saudi Arabia.

Climeworks (2024) Climeworks switches on world's largest direct air capture plant. Available at: https://climeworks.com/press-release/climeworks-switches-on-worlds-largest-direct-air-capture-plant-mammoth (Accessed: 18 July 2024).

CMS Law-Now (2023) The Future of Blue Hydrogen in the Middle East.

CMS Law-Now (2024) Poland enacts regulations to accelerate development of carbon dioxide capture, utilisation and storage technology (CCUS). Available at: https://cms-lawnow.com/en/ealerts/2024/02/poland-enacts-regulations-to-accelerate-development-of-carbon-dioxide-capture-utilisation-and-storage-technology-ccus#:~:text=In%20October%202023%2C%20Poland%20enacted,of%20CCUS%20in%20the%20country. (Accessed: 28 August 2024).

Council for Geoscience (2016) 'New Carbon Capture And Storage Project', https://www.geoscience.org.za/ [Preprint]. Available at: https://www.geoscience.org.za/media/news/new-carbon-capture-and-storage-project/ (Accessed: 1 October 2024).

Council for Geoscience (2024) 'MINISTER GWEDE MANTASHE INAUGURATES SOUTH AFRICA'S FIRST PILOT CCUS RESEARCH SITE IN MPUMALANGA', https://www.geoscience.org.za/ [Preprint]. Available at: https://www.geoscience.org.za/media/news/minister-gwede-mantashe-inaugurates-south-africas-first-pilot-ccus-research-site-in-mpumalanga/ (Accessed: 16 October 2024).

Council of Environmental Quality and The White House (2021) Council on Environmental Quality Report to Congress on Carbon Capture, Utilization, and Sequestration. Washington, DC, USA. Available at: https://www.whitehouse.gov/wp-content/uploads/2021/06/CEQ-CCUS-Permitting-Report.pdf (Accessed: 19 September 2024).

Danish Energy Agency (2024a) Danish Energy Agency presses the start button for billion-dollar tendering procedure for carbon capture and storage. Available at: https://ens.dk/en/press/danish-energy-agency-presses-start-button-billion-dollar-tendering-procedure-carbon-capture (Accessed: 17 October 2024).

Danish Energy Agency (2024b) First licenses in Danish history to explore onshore CO_2 storage potentials awarded. Available at: https://ens.dk/en/press/first-licenses-danish-history-explore-onshore-CO_2-storage-potentials-awarded (Accessed: 25 June 2024).

Danish Energy Agency (2024c) Three new CCS projects have been pledged support to capture and store biogenic CO_2. Available at: https://ens.dk/en/press/three-new-ccs-projects-have-been-pledged-support-capture-and-store-biogenic-CO_2 (Accessed: 25 June 2024).

Danish Government (2021a) A roadmap for capture, transport and storage of CO_2 – Second part of a CCS strategy. Available at: https://www.regeringen.dk/media/10930/delaftale-om-investeringer-i-et-fortsat-groennere-danmark.pdf (Accessed: 29 August 2024).

Danish Government (2021b) A roadmap for CO_2 storage – first part of a CCS strategy. Available at: https://www.kefm.dk/Media/637606718216961589/Principaftale%20om%20CO_2-lagring.pdf (Accessed: 29 August 2024).

Danish Ministry of Climate, E. and U.G.F.M. for E.A. and C.A.M. française de la transition énergétique; D.M. of E.A. and C.P.& G.O. of S. (2023) Aalborg Declaration on enabling cross-border carbon capture utilization and storage (CCUS) in Europe. Aalborg. Available at: https://www.kefm.dk/Media/638366861585598350/EU%20CCUS%20Aalborg%20declaration%20231127%20SEFR.pdf (Accessed: 28 August 2024).

Deloitte (2023) Carbon taxes and incentives from a Middle East perspective.

Department of Climate Change Energy the Environment and Water (2024) Safeguard Mechanism. Available at: https://www.dcceew.gov.au/climate-change/emissions-reporting/national-greenhouse-energy-reporting-scheme/safeguard-mechanism (Accessed: 26 August 2024).

Department of Energy (2024) Notice of Intent: Voluntary Carbon Dioxide Removal Purchase Challenge, Website. Available at: https://www.energy.gov/fecm/notice-intent-voluntary-carbon-dioxide-removal-purchase-challenge (Accessed: 15 September 2024).

Department of Industry Science and Resources (2021) Japan-Australia partnership on decarbonisation through technology. Available at: https://www.minister.industry.gov.au/ministers/taylor/media-releases/japan-australia-partnership-decarbonisation-through-technology (Accessed: 26 August 2024).

Department of Industry Science and Resources (2024) Investments to map Australian resources that will power our future prosperity. Available at: https://www.industry.gov.au/news/investments-map-australian-resources-will-power-our-future-prosperity (Accessed: 26 August 2024).

Department of Industry Science and Resources Australia (2021) Offshore Greenhouse Gas Guideline for Declaration of Identified Greenhouse Gas Storage Formation (including under a Cross-boundary Greenhouse Gas Assessment Permit) and Notification of an Eligible Greenhouse Gas Storage Formation. Available at: www.nopta.gov.au. (Accessed: 26 August 2024).

Department of Industry Science and Resources Australia (2024) Offshore Petroleum and Greenhouse Gas Storage Environmental Management Review. Available at: https://www.industry.gov.au/mining-oil-and-gas/oil-and-gas/offshore-oil-and-gas/offshore-petroleum-and-greenhouse-gas-storage-environmental-management-review (Accessed: 26 August 2024).

Department of Industry Science and Resources, Department of Climate Change Energy the Environment and Water and National Offshore Petroleum Safety and Environmental Management Authority (2023) Offshore Carbon Capture and Storage Regulatory Approvals: In relation to the Offshore Petroleum and Greenhouse Gas Storage Act 2006, the Environment Protection (Sea Dumping) Act 1981, the Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia.

Department Of Science & Technology India (2022) India to have two National Centres of Excellence in Carbon Capture & Utilization at IIT Bombay & at JNCASR, Bengaluru, supported by DST. Available at: https://dst.gov.in/india-have-two-national-centres-excellence-carbon-capture-utilization-iit-bombay-jncasr-bengaluru (Accessed: 1 September 2024).

Drax (2024) Introducing Elimini: New carbon removal leader launches at New York Climate Week.

EFTA Surveillance Authority (2023) Report on the Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide. Available at: https://climate.ec.europa.eu/eu-action/carbon-capture-use-and-.

Emissions Reduction Alberta (2020) Alberta joins world leaders to accelerate CCUS technology development; ERA announces almost $10 million in funding. Available at: https://www.eralberta.ca/media-releases/alberta-joins-world-leaders-to-accelerate-ccus-technology-development-era-announces-almost-10-million-in-funding/ (Accessed: 17 September 2024).

European Commission (2024a) Call for applications: candidate energy infrastructure Projects of Common and Mutual Interest. Available at: https://energy.ec.europa.eu/news/call-applications-candidate-energy-infrastructure-projects-common-and-mutual-interest-2024-09-18_en (Accessed: 17 October 2024).

European Commission (2024b) Commission approves €3 billion Swedish State aid scheme to support the roll-out of biogenic carbon dioxide capture and storage. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_24_3583 (Accessed: 18 July 2024).

European Commission (2024c) Commission opens €4 billion call for proposals for net-zero technologies under the Innovation Fund. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_23_5948 (Accessed: 18 July 2024).

European Commission (2024d) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Securing our future: Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society'. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52024DC0063 (Accessed: 21 March 2024).

European Commission (2024e) 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'.

European Commission (2024f) EU invests €4.8 billion of emissions trading revenues in innovative net-zero projects. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_24_5423 (Accessed: 24 October 2024).

European Commission (2024g) The European Commission publishes revised Guidance Documents to the CCS Directive. Available at: https://climate.ec.europa.eu/news-your-voice/news/european-commission-publishes-revised-guidance-documents-ccs-directive-2024-07-23_en (Accessed: 29 July 2024).

European Parliament (2024) European Parliament legislative resolution of 10 April 2024 on the proposal for a regulation of the European Parliament and of the Council establishing a Union certification framework for carbon removals (COM(2022)0672 – C9-0399/2022 – 2022/0394(COD)). Available at: https://www.europarl.europa.eu/doceo/document/TA-9-2024-0195_EN.pdf (Accessed: 28 August 2024).

EY - Global (2024) Kenya publishes Climate Change (Carbon Markets) Regulations, 2024. Available at: https://www.ey.com/en_gl/technical/tax-alerts/kenya-publishes-climate-change--carbon-markets--regulations--202 (Accessed: 21 October 2024).

French Government (2023) Stratégie CCUS: Capture, stockage, et utilisation du carbone. Available at: https://www.conseil-national-industrie.gouv.fr/files_cni/files/actualite/20230623_consultation_ccus.pdf (Accessed: 15 July 2024).

French Ministry of Economy, F. and I. and D.S. (2024a) État des lieux et perspectives de déploiement du CCUS en France. Available at: https://www.entreprises.gouv.fr/files/files/industrie/etat-des-lieux-et-perspectives-de-deploiement-du-ccus-en-france.pdf (Accessed: 18 July 2024).

French Ministry of Economy, F. and I. and D.S. (2024b) Roland Lescure lance un appel à manifestation d'intérêt pour développer les capacités de capture et stockage de carbone de la France. Available at: https://www.economie.gouv.fr/actualites/appel-manifestation-dinteret-developper-capacites-stockage-carbone#:~:text=Roland%20Lescure%2C%20ministre%20d%C3%A9l%C3%A9gu%C3%A9%20charg%C3%A9,jusqu'au%2026%20juillet%202024. (Accessed: 25 June 2024).

French Ministry of Economy, F. and I. and D.S. (2024c) Simplification des procédures minières pour accélérer la transition énergétique et renforcer la sécurité d'approvisionnement française. Available at: https://presse.economie.gouv.fr/simplification-des-procedures-minieres-pour-accelerer-la-transition-energetique-et-renforcer-la-securite-dapprovisionnement-francaise/ (Accessed: 25 June 2024).

French Ministry of the Economy, F. and I. and D.S. of the F.R. and M. of C.E. and U. of D. (2024a) Memorandum of Understanding on cross border transportation of CO_2 with the purpose of permanent geological storage.

French Ministry of the Economy, F. and I. and D.S. of the F.R. and M. of C.E. and U. of D. (2024b) Memorandum of Understanding on cross border transportation of CO_2 with the purpose of permanent geological storage.

Gazzetta Ufficiale della Repubblica Italiana (2024) Legge 2 febbraio 2024, n. 11. Available at: https://www.gazzettaufficiale.it/eli/id/2024/02/07/24G00022/sg (Accessed: 25 June 2024).

GCCSI (2024) CORE database.

GE Vernova (2022) QatarEnergy and GE to Develop Carbon Capture Roadmap and Low Carbon Solutions for Qatar's Energy Sector.

German Federal Cabinet (2024) Initiative for Growth – new economic dynamism for Germany. Available at: https://www.bundesregierung.de/resource/blob/998440/2298242/b27ba5f4d51b2f9bad3a67d4e7234da8/2024-07-08-wachstumsinitiative-en-data.pdf?download=1 (Accessed: 28 August 2024).

German Federal Ministry for Economic Affairs and Climate Action (2024a) Cabinet clears path for CCS in Germany. Available at: https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2024/05/20240529-cabinet-clears-path-for-ccs-in-germany.html (Accessed: 19 July 2024).

German Federal Ministry for Economic Affairs and Climate Action (2024b) First round of carbon contracts for difference launched. Available at: https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2024/03/20240312-first-round-of-carbon-contracts-for-difference-launched.html (Accessed: 28 August 2024).

German Federal Ministry of Economic Affairs and Climate Action (2024) Minister Habeck intends to make it possible to use CCS: "Without CCS, there is no way we can reach our climate targets." Available at: https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2024/02/20240226-minister-habeck-intends-to-make-it-possible-to-use-ccs.html (Accessed: 28 August 2024).

GIZ (2021) H2 development and sustainability concerns in Morocco.

GIZ (2024) Carbon capture in South Africa.

Global Carbon Council (2023) Draft methodology for project activities involving the capture, transport and geological storage of carbon dioxide .

Global CCS Institute (2023a) 14 CO_2 Storage and Transport Projects Selected Under the EU's Projects of Common Interest and Projects of Mutual Interest . Available at: https://www.globalccsinstitute.com/news-media/latest-news/14-CO_2-storage-and-transport-projects-selected-under-the-eus-projects-of-common-interest-and-projects-of-mutual-interest/ (Accessed: 29 August 2024).

Global CCS Institute (2023b) Global Status of CCS 2023. Melbourne, Australia. Available at: https://www.globalccsinstitute.com/resources/publications-reports-research/global-status-of-ccs-2023-executive-summary/ (Accessed: 6 December 2023).

Global CCS Institute (2023c) Global Status Report 2023.

Global CCS Institute (2023d) India's Carbon Credit Trading Scheme & the Indian Government's CCUS Report.

Global CCS Institute (2023e) The Global CCS Institute to Support Oman's Work Programme to Scale up CCS Climate Technology.

Global CCS Institute (2023f) The Global Status of CCS Report 2023.

Global CCS Institute (2024a) A Gap Analysis of China's Regulatory Framework for CO_2 Geological Storage.

Global CCS Institute (2024b) Belgian Presidency of the Council of the EU Focuses on the Green and Just Transition as a Key Action Area and Will Work to Explore Further the Potential of CCUS. Available at: https://www.globalccsinstitute.com/news-media/latest-news/belgian-presidency-of-the-council-of-the-eu-focuses-on-the-green-and-just-transition-as-a-key-action-area-and-will-work-to-explore-further-the-potential-of-ccus/ (Accessed: 28 August 2024).

Global CCS Institute (2024c) 'Canadian Parliament Passes Bill C-59, Providing CCUS Investment Tax Credit', Latest news, 26 June. Available at: https://www.globalccsinstitute.com/news-media/latest-news/canadian-parliament-passes-bill-c-59-providing-ccus-investment-tax-credit/ (Accessed: 15 September 2024).

Global CCS Institute (2024d) Global Status of CCS Report.

Global CCS Institute (2024e) 'Industry Association Releases New Guidance for Pipeline Public Engagement', Press Release, 1 May. Available at: https://www.globalccsinstitute.com/news-media/latest-news/industry-association-releases-new-guidance-for-pipeline-public-engagement/ (Accessed: 16 October 2024).

Global CCS Institute (2024f) Saudi Arabia steps up efforts to achieve ambitious CCS targets. Available at: https://www.globalccsinstitute.com/news-media/insights/saudiarabiaccsefforts/ (Accessed: 18 October 2024).

Global CCS Institute (2024g) UK Spring Budget 2024 Allocates New Funding to Further Boost CCUS Deployment Across the Country. Available at: https://www.globalccsinstitute.com/news-media/latest-news/uk-spring-budget-2024-allocates-new-funding-to-further-boost-ccus-deployment-across-the-country/ (Accessed: 29 August 2024).

Government of Alberta (2022) Technology Innovation and Emissions Reduction Regulation, Technology Innovation and Emissions Reduction Regulation. Available at: https://www.alberta.ca/technology-innovation-and-emissions-reduction-regulation.aspx (Accessed: 27 May 2022).

Government of Canada (2021) Canada's 2021 Nationally Determined Contribution under the Paris Agreement . Available at: https://unfccc.int/sites/default/files/NDC/2022-06/Canada%27s%20Enhanced%20NDC%20Submission1_FINAL%20EN.pdf (Accessed: 19 September 2024).

Government of Canada (2023) Canada's Carbon Management Strategy. Ottawa, ON, Canada. Available at: https://natural-resources.canada.ca/climate-change/canadas-green-future/capturing-the-opportunity-carbon-management-strategy-for-canada/canadas-carbon-management-strategy/25337 (Accessed: 19 September 2024).

Government of Canada (2024a) Net-zero emissions by 2050, Website. Available at: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html (Accessed: 19 September 2024).

Government of Canada (2024b) What is the CCUS ITC?, Website. Available at: https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/corporations/business-tax-credits/clean-economy-itc/carbon-capture-itc/about-ccus-itc.html (Accessed: 15 September 2024).

Government of Iceland (2020) Iceland's 2020 Climate Action Plan. Available at: https://www.stjornarradid.is/library/01--Frettatengt---myndir-og-skrar/UAR/Tengd-skjol/Climate%20Action%20Plan%20Iceland%202020_Summary.pdf (Accessed: 29 August 2024).

Government of Sarawak Malaysia (2022) 'Land (Carbon Storage) Rules 2022', Sarawak Government Gazette Part II [Preprint].

Government of the Netherlands (2024a) Five northern European countries conclude international arrangements on transport and storage of carbon across borders. Available at: https://www.government.nl/latest/news/2024/04/15/five-northern-european-countries-conclude-international-arrange-ments-on-transport-and-storage-of-carbon-across-borders (Accessed: 18 July 2024).

Government of the Netherlands (2024b) Five northern European countries conclude international arrangements on transport and storage of carbon across borders. Available at: https://www.government.nl/latest/news/2024/04/15/five-northern-european-countries-conclude-international-arrange-ments-on-transport-and-storage-of-carbon-across-borders (Accessed: 18 July 2024).

Government of Timor-Leste (2024) Timor-Leste and Australia strengthen bilateral ties and commit to the joint development of carbon capture and storage projects and the Greater Sunrise initiative. Available at: https://timor-leste.gov.tl/?p=35865&lang=en&n=1 (Accessed: 1 September 2024).

Great Plains Institute (2024) Carbon Management Legislative Tracker - 2024, Interactive website. Available at: https://www.quorum.us/spreadsheet/external/saIsRkyXngxhHVBCSEVu/?mc_cid=10edb9b693&mc_eid=b775c8e215 (Accessed: 17 September 2024).

Great Plains Institute (GPI) (2023) Great Plains Institute State Legislative Tracker 2023, Tracker website. Available at: https://www.quorum.us/spreadsheet/external/fVOjsTvwyeWkIqVINmoq/?mc_cid=d8eb167dbf&mc_eid=b775c8e215 (Accessed: 17 July 2023).

House of Councillors of the National Diet of Japan (2024) Request for approval of the acceptance of the 2009 amendments to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters, 1972 - 213th National Diet Voting Results. Available at: https://www.sangiin.go.jp/japanese/touhyoulist/213/213-0524-v003.htm (Accessed: 26 August 2024).

Ibe, A.P. et al (2024) 'Framework for Carbon-Capture and Storage (CCS) in Nigeria', Society of Petroleum Engineers - SPE Nigeria Annual International Conference and Exhibition, NAIC 2024 [Preprint]. Available at: https://doi.org/10.2118/221616-MS.

Icelandic Supreme National Parliament (2024) Sanitation and Pollution Prevention Act. Available at: https://www.althingi.is/lagas/nuna/1998007.html (Accessed: 25 June 2024).

IEA (2023a) Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach.

IEA (2023b) Section 45Q Credit for Carbon Oxide Sequestration, IEA. Available at: https://www.iea.org/policies/4986-section-45q-credit-for-carbon-oxide-sequestration (Accessed: 25 August 2024).

IEA (no date) CO_2 storage resources and their development - An IEA CCUS Handbook. Available at: www.iea.org (Accessed: 26 September 2024).

Indonesia Stock Exchange (2023) Launching of Indonesia Carbon Exchange (IDXCarbon). Available at: https://www.idx.co.id/en/news/news/b882a251-3e5c-ee11-b808-005056aec3a4 (Accessed: 1 October 2024).

International Carbon Action Partnership (2024a) China National ETS. Available at: https://icapcarbonaction.com/en/ets/china-national-ets (Accessed: 1 October 2024).

International Carbon Action Partnership (2024b) Indonesian Economic Value of Carbon (Nilai Ekonomi Karbon) Trading Scheme. Available at: https://icapcarbonaction.com/en/ets/indonesian-economic-value-carbon-nilai-ekonomi-karbon-trading-scheme (Accessed: 1 October 2024).

International CCS Knowledge Centre (2023) Government of Canada Reaffirms Support for CCS Projects – Statement from the International CCS Knowledge Centre, News article. Available at: https://ccsknowledge.com/news/government-of-canada-enhances-support-for-ccs-projects--statement-from-the-international-ccs-knowledge-centre (Accessed: 19 September 2024).

International Energy Agency (2020) 'China's Emissions Trading: Designing efficient allowance allocation'.

International Energy Agency (2024) 'Enhancing China's ETS for Carbon Neutrality: Introducing Auctioning Lessons from international experience'. Available at: www.iea.org (Accessed: 1 October 2024).

Investment Policy Hub (2022) Prime Minister Decree No. 56 Regarding Investment Enhancing.

IPCC (2005) IPCC Special Report on Carbon Dioxide Capture and Storage. Available at: www.ipcc.ch/site/assets/uploads/2018/03/ srccs_chapter5-1.pdf (Accessed: 26 September 2024).

IPCC (2018) Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Available at: https://doi.org/10.1017/9781009157940.001 (Accessed: 24 August 2024).

IPCC (2022) Summary for Policy Makers. In: Climate Change 2022: Mitigation of Climate Change. Working Group III Contribution of the IPCC Sixth Assessment Report.

IPCC (2023) Summary for Policymakers. In: Climate Change 2023: Synthesis Report.

Italian Ministry of Environment and Energy Security (2024) Energy transition, CCS Committee established. Gava: "A step forward, the only available solution to decarbonize hard to abate". Available at: https://www.mase.gov.it/notizie/transizione-energetica-istituito-il-comitato-ccs-gava-passo-avanti-unica-soluzione (Accessed: 18 July 2024).

JSE (2023) JSE collaborates with Xpansiv to launch voluntary carbon market to advance South Africa's carbon credit capabilities.

KAPSARC (2024) King Abdullah Petroleum Studies and Research Center | Home. Available at: https://www.kapsarc.org/ (Accessed: 20 October 2024).

Malaysian Investment Development Authority (2023) Launch of the New Industrial Master Plan 2030 (NIMP 2030). Available at: https://www.mida.gov.my/launch-of-the-new-industrial-master-plan-2030-nimp-2030/ (Accessed: 26 August 2024).

MGSC (2022) Midwest Geological Sequestration Consortium (MGSC), Midwest Geological Sequestration Consortium (MGSC). Available at: Midwest Geological Sequestration Consortium (MGSC) (Accessed: 19 October 2022).

Ministry of Economic Affairs (2023) Feasibility of Cap-And-Trade Scheme (Phase 2 Preparation and Compliancel MRV System).

Ministry of Economy Malaysia (2023) 'National Energy Transition Roadmap'. Available at: https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf (Accessed: 26 August 2024).

Ministry of Economy Trade and Industry Japan (2023) CCS Long-Term Roadmap.

Ministry of Economy Trade and Industry Japan (2024) Cabinet Approvals on the "Bill for the Act on Promotion of Supply and Utilization of Low-Carbon Hydrogen and its Derivatives for Smooth Transition to a Decarbonized, Growth-Oriented Economic Structure" and the "Bill for the Act on Carbon Dioxide Storage Businesses". Available at: https://www.meti.go.jp/english/press/2024/0213_003.html (Accessed: 26 August 2024).

Ministry of Energy and Infrastructure (2023) National Hydrogen Strategy.

Ministry of Energy and Minerals (2023) Ministry of Energy and Minerals Supports Studies of the Proposed Shell-Led Blue Hydrogen and Ammonia Project, MEM News. Available at: https://mem.gov.om/en-us/Media-Center/News/ArtMID/608/ArticleID/1361/Ministry-of-Energy-and-Minerals-Supports-Studies-of-the-Proposed-Shell-Led-Blue-Hydrogen-and-Ammonia-Project- (Accessed: 21 March 2024).

Ministry of Energy and the Ministry of Climate and Environment of Norway and the Swiss Federal Department of Environment, T.E. and C. on C. (2024a) Declaration of Intent between the Ministry of Energy and the Ministry of Climate and Environment of Norway and the Swiss Federal Department of Environment, Transport, Energy and Communications on Cooperation on Carbon Capture Storage and Carbon Dioxide Removals, 202. Available at: https://www.regjeringen.no/contentassets/5e31163d7fb44e759d92beacfaef528e/decleration-of-intent.pdf.

Ministry of Energy and the Ministry of Climate and Environment of Norway and the Swiss Federal Department of Environment, T.E. and C. on C. (2024b) Declaration of Intent between the Ministry of Energy and the Ministry of Climate and Environment of Norway and the Swiss Federal Department of Environment, Transport, Energy and Communications on Cooperation on Carbon Capture Storage and Carbon Dioxide Removals, 202. Available at: https://www.regjeringen.no/contentassets/5e31163d7fb44e759d92beacfaef528e/decleration-of-intent.pdf.

Ministry of Environment (2022) Egypt National Climate Change Strategy 2050.

Ministry of Environment, F. and C.C. (2024) Revised List of Activities under bilateral/cooperative approaches in India under Article 6.2 Mechanism of the Paris Agreement.

Ministry of Finance Malaysia (2023) Appendix II Tax Measures - Budget 2023: Building Malaysia MADANI. Available at: https://belanjawan.mof.gov.my/pdf/belanjawan2023/ucapan/tax-measure.pdf (Accessed: 26 August 2024).

Ministry of Law and Justice - Legislative Department (2022) The Energy Conservation (Amendment) Act 2022.

Ministry of Trade and Industry Singapore (2024) Singapore and Indonesia sign Letter of Intent to collaborate on carbon capture and storage (CCS). Available at: https://www.mti.gov.sg/Newsroom/Press-Releases/2024/02/Singapore-and-Indonesia-sign-Letter-of-Intent-to-collaborate-on-carbon-capture-and-storage (Accessed: 29 August 2024).

Ministry of Trade Industry and Energy South Korea (2024) Act on the Capture, Transportation, Storage and Utilisation of Carbon Dioxide.

MIT (2016) Carbon Capture and Sequestration Technologies. Available at: https://sequestration.mit.edu/tools/projects/in_salah.html (Accessed: 18 October 2024).

MRCSP (2022) Midwest Regional Carbon Sequestration Partnership (MRCSP), Midwest Regional Carbon Sequestration Partnership (MRCSP). Available at: https://netl.doe.gov/coal/carbon-storage/atlas/mrcsp (Accessed: 19 October 2022).

National Climate Change Secretariat Singapore (2024a) Carbon Tax. Available at: https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/carbontax/ (Accessed: 4 May 2023).

National Climate Change Secretariat Singapore (2024b) International Collaboration. Available at: https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/internationalcollaboration/ (Accessed: 1 October 2024).

National Development and Reform Commission China (2023) China to implement demonstration projects featuring green, low-carbon technologies. Available at: https://english.www.gov.cn/news/202308/22/content_WS64e4aae9c6d0868f4e8dec1d.html (Accessed: 2 September 2024).

National Development and Reform Commission China (2024a) Notice of the General Office of the National Development and Reform Commission on Issuing the List of Green and Low-Carbon Advanced Technology Demonstration Projects (First Batch). Available at: https://www.gov.cn/zhengce/zhengceku/202404/content_6945545.htm (Accessed: 1 October 2024).

National Development and Reform Commission China (2024b) Notice on Issuing the Action Plan for Low-Carbon Transformation of Coal-fired Power (2024-2027). Available at: https://www.ndrc.gov.cn/xxgk/zcfb/tz/202407/t20240715_1391663.html (Accessed: 2 September 2024).

National Petroleum Council (NPC) (2019) Meeting the Dual Challenge A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage. Washington, DC. Available at: https://dualchallenge.npc.org/ (Accessed: 24 September 2024).

Netherlands Enterprise Agency (2023) Stimulation of sustainable energy production and climate transition (SDE++). Available at: https://english.rvo.nl/subsidies-financiering/sde (Accessed: 29 August 2024).

NITI Aayog (2022) Carbon Capture, Utilisation and Storage (CCUS) - Policy Framework and its Deployment Mechanism in India. Available at: www.niti.gov.in (Accessed: 1 September 2024).

NITI Aayog, Government of India and M. N. Dastur and Company (P) Ltd. (2022) Carbon Capture, Utilization and Storage (CCUS) - Policy Framework and its Deployment Mechanism in India. New Delhi. Available at: https://www.niti.gov.in/sites/default/files/2022-12/CCUS-Report.pdf (Accessed: 10 May 2023).

Northern Lights (2024a) About the Longship project. Available at: https://norlights.com/about-the-longship-project/ (Accessed: 29 August 2024).

Northern Lights (2024b) Northern Lights EU funding approved. Available at: https://norlights.com/about-the-longship-project/ (Accessed: 29 August 2024).

Norton Rose Fulbright (2023) Global carbon capture and storage regulations: A driver or barrier to CCS project development? Available at: https://www.nortonrosefulbright.com/en-th/knowledge/publications/3f25baee/global-carbon-capture-and-storage-regulations-a-driver-or-barrier-to-ccs-project-development#section9 (Accessed: 1 September 2024).

Norwegian Government (2024a) France and Norway sign a strategic partnership on green industrial transformation. Available at: https://www.regjeringen.no/no/aktuelt/dep/nfd/nyheter/2024/france-and-norway-sign-a-strategic-partnership-on-green-industrial-transformation/id3022184/ (Accessed: 28 August 2024).

Norwegian Government (2024b) France and Norway sign a strategic partnership on green industrial transformation. Available at: https://www.regjeringen.no/no/aktuelt/dep/nfd/nyheter/2024/france-and-norway-sign-a-strategic-partnership-on-green-industrial-transformation/id3022184/ (Accessed: 28 August 2024).

Norwegian Offshore Directorate (2024a) Announcement 2024, round 1. Available at: https://www.sodir.no/en/facts/carbon-storage/licences-for-carbon-storage/announcement-2024-round-1/ (Accessed: 29 August 2024).

Norwegian Offshore Directorate (2024b) Announcement 2024, round 2. Available at: https://www.sodir.no/en/facts/carbon-storage/licences-for-carbon-storage/announcement-2024-round-2/ (Accessed: 29 August 2024).

Office of Clean Energy Demonstrations (OCED) and US Department of Energy (DOE) (2024a) Carbon Capture Demonstration Projects Program Front-End Engineering Design (FEED) Studies Selections for Award Negotiations, Website. Available at: https://www.energy.gov/oced/carbon-capture-demonstration-projects-program-front-end-engineering-design-feed-studies (Accessed: 20 August 2024).

Office of Clean Energy Demonstrations (OCED) and US Department of Energy (DOE) (2024b) Carbon Capture Demonstrations Projects Selected and Awarded Projects, Website. Available at: https://www.energy.gov/oced/carbon-capture-demonstrations-projects-selected-and-awarded-projects (Accessed: 20 August 2024).

Official Journal of the EU (2009) Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 (Text with EEA relevance), OJ L 140/114.

Official Journal of the EU (2021) Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119 (Accessed: 29 August 2024).

Official Journal of the EU (2023) Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system (Text with EEA relevance). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023L0959 (Accessed: 21 March 2024).

Official Journal of the EU (2024a) Commission Implementing Regulation (EU) 2024/2493 of 23 September 2024 amending Implementing Regulation (EU) 2018/2066 as regards updating the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. Available at: http://data.europa.eu/eli/reg_impl/2024/2493/oj.

Official Journal of the EU (2024b) Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets for renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC (recast) (Text with EEA relevance). Available at: http://data.europa.eu/eli/dir/2023/2413/oj.

Official Journal of the EU (2024c) Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem and amending Regulation (EU) 2018/1724 (Text with EEA relevance). Available at: http://data.europa.eu/eli/reg/2024/1735/oj.

OGCI (2023) Removing carbon dioxide - Carbon capture, utilization and storage (CCUS). Available at: https://www.ogci.com/ccus (Accessed: 20 October 2024).

Oman Daily Observer (2023) Oman to establish Carbon Capture, Blue Hydrogen regulatory framework. .

Ørsted (2023) Ørsted begins construction of Denmark's first carbon capture project. Available at: https://orsted.com/en/media/news/2023/12/oersted-begins-construction-of-denmarks-first-carb-13757543 (Accessed: 29 August 2024).

Parliament of Australia (2020) Offshore Petroleum and Greenhouse Gas Storage Amendment (Cross-boundary Greenhouse Gas Titles and Other Measures) Bill 2019 [and] Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Amendment (Miscellaneous Measures) Bill 2019. Available at: https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/bd/bd1920a/20bd082 (Accessed: 26 August 2024).

Parliament of Australia (2023) Environment Protection (Sea Dumping) Amendment (Using New Technologies to Fight Climate Change) Bill 2023. Available at: https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r7052 (Accessed: 26 August 2024).

PCOR (2022) Plains CO_2 Reduction (PCOR) Partnership, Plains CO_2 Reduction (PCOR) Partnership. Available at: https://netl.doe.gov/coal/carbon-storage/atlas/pcor (Accessed: 19 October 2022).

People's Bank of China (2021) The People's Bank of China Launches the Carbon Emission Reduction Facility. Available at: http://www.pbc.gov.cn/en/3688110/3688172/4157443/4385345/index.html (Accessed: 1 September 2024).

People's Bank of China (2023) China Monetary Policy Report Q1 2023.

Porthos (2024) First drilling under seawall. Available at: https://www.porthosCO_2.nl/en/first-drilling-under-seawall/ (Accessed: 28 June 2024).

Presidential Committee on Carbon Neutrality and Green Growth 2050 Korea (no date) Basic Plan for Carbon Neutrality and Green Growth.

Royaume du Maroc (2024) The Head of Government issues the circular implementing the "Morocco Offer" for the development of the green hydrogen sector.

Saudi & Middle East Green Initiatives (2021) SGI target: protecting 30% of Saudi Arabia's land and sea.

Saudi and Middle East Green Initiative (2024) Initiatives Under The Middle East Green Initiative. Available at: https://www.greeninitiatives.gov.sa/mgi-initiatives/ (Accessed: 20 October 2024).

Saudi Arabia Ministry of Energy (2023a) Saudi Arabia Launches Groundbreaking Greenhouse Gas Crediting and Offsetting Mechanism to Advance Global Climate Goals. Available at: https://moenergy.gov.sa/en/MediaCenter/ClimateWeek/Pages/KSA-Launches-GHG-Crediting-and-Offsetting-Mechanism-GCOM.aspx (Accessed: 27 October 2024).

Saudi Arabia Ministry of Energy (2023b) Saudi Arabia Launches Groundbreaking Greenhouse Gas Crediting and Offsetting Mechanism to Advance Global Climate Goals. Available at: https://moenergy.gov.sa/en/MediaCenter/ClimateWeek/Pages/KSA-Launches-GHG-Crediting-and-Offsetting-Mechanism-GCOM.aspx (Accessed: 27 October 2024).

Saudi Arabia Press Agency (2023) PIF Announces the Establishment of the Regional Voluntary Carbon Market Company. Available at: https://www.spa.gov.sa/2395130 (Accessed: 1 October 2024).

SECARB (2022) Southeast Regional Carbon Sequestration Partnership (SECARB), Southeast Regional Carbon Sequestration Partnership (SECARB). Available at: https://www.sseb.org/programs/secarb/ (Accessed: 19 October 2022).

Shell Singapore (2022) Shell to explore carbon transport and storage in Brunei and Singapore. Available at: https://www.shell.com.sg/media/2022-media-releases/shell-to-explore-carbon-transport-and-storage-in-brunei-and-singapore.html (Accessed: 4 May 2023).

Shepherd CCS (2024) Shepherd CCS Summit 2024. Available at: https://shepherdccs.com/ (Accessed: 1 September 2024).

South African Government (2024) Climate Change Act 22 of 2024.

Southwest Partnership (SWP) (2022) Southwest Regional Partnership on Carbon Sequestration (SWP), Southwest Regional Partnership on Carbon Sequestration (SWP).

State of Kuwait (2021) Kuwait's NDC.

Supreme Council for Environment (2021) Nationally Determined Contribution of Kingdom of Bahrain under UNFCCC 2021.

Swedish Energy Agency & Federal Department of the Environment, T.E. and C. of the S.C. (2023) Memorandum of Understanding between the Swedish Energy Agency and the Federal Department of the Environment, Transport, Energy and Communications of the Swiss Confederation on a Cooperation for International Transfer of Industrial Carbon Removals. Available at: https://www.energimyndigheten.se/4aebc0/globalassets/webb-en/cooperation/international-climate-cooperation/mou-on-bilateral-cooperation-under-article-6-of-the-paris-agreement---sweden-and-switzerland.pdf (Accessed: 28 August 2024).

Swiss Confederation (2023) Federal Council lays groundwork for export of CO_2 for sub-seabed storage. Available at: https://www.eda.admin.ch/countries/lebanon/en/home/news/news.html/content/eda/en/meta/news/2023/11/22/98800 (Accessed: 18 July 2024).

Thailand Board of Investment (2023) 'Investment Promotion Guide 2023'. Available at: www.facebook.com/boinews (Accessed: 1 September 2024).

The Government of Japan (2024) AZEC: Asia's Various Pathways to Net Zero Co-Created by Japan. Available at: https://www.japan.go.jp/kizuna/2024/02/asias_various_pathways_to_net_zero.html (Accessed: 2 September 2024).

The Government of Public Relations Department Thailand (2024) Thailand to Implement Carbon Tax by 2025. Available at: https://thailand.prd.go.th/en/content/category/detail/id/2078/iid/302332 (Accessed: 1 September 2024).

The Government of Singapore (2021) Singapore Green Plan 2030. Available at: https://www.greenplan.gov.sg/ (Accessed: 4 May 2023).

The Mail & Guardian (no date) Mpumalanga carbon capture pilot project completed. Available at: https://mg.co.za/the-green-guardian/2024-04-24-mpumalanga-carbon-capture-pilot-project-completed/ (Accessed: 1 October 2024).

The Official Portal of the UAE Government (2024) National Hydrogen Strategy. Available at: https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/environment-and-energy/national-hydrogen-strategy (Accessed: 18 October 2024).

The Peninsula (2012) 'Qatar provides $70m funding for research on carbon storage'. Available at: https://thepeninsulaqatar.com/article/02/12/2012/qatar-provides-70m-funding-for-research-on-carbon-storage (Accessed: 20 October 2024).

The Sultanate of Oman (2023) The Sultanate of Oman's National Strategy for an Orderly Transition to Net Zero.

The Sun (2024) FG to unveil CCUS centre in Abuja.

The White House (2024) Voluntary Carbon Markets Joint Policy Statement and Principles. Washington, DC, USA. Available at: https://www.whitehouse.gov/wp-content/uploads/2024/05/VCM-Joint-Policy-Statement-and-Principles.pdf (Accessed: 15 September 2024).

Times of India (2024) Government to devise policy framework for carbon capture, utilisation and storage. Available at: https://timesofindia.indiatimes.com/india/government-to-devise-policy-framework-for-carbon-capture-utilisation-and-storage/articleshow/111696694.cms (Accessed: 1 September 2024).

Tossou, R.K., Nahornick, N. and Scholz, T. (2024) Investment Tax Credit for Carbon Capture, Utilization and Storage, Office of the Parliamentary Budget Officer. Available at: https://www.pbo-dpb.ca/en/publications/LEG-2324-022-S--investment-tax-credit-carbon-capture-utilization-storage--credit-impot-investissement-captage-utilisation-stockage-carbone (Accessed: 25 August 2024).

UK Department for Energy Security & Net Zero (2023a) Carbon Capture, Usage and Storage: a vision to establish a competitive market. Available at: https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-a-vision-to-establish-a-competitive-market/carbon-capture-usage-and-storage-a-vision-to-establish-a-competitive-market#fn:1 (Accessed: 15 July 2024).

UK Department for Energy Security & Net Zero (2023b) Carbon Capture, Usage and Storage: a vision to establish a competitive market. Available at: https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-a-vision-to-establish-a-competitive-market/carbon-capture-usage-and-storage-a-vision-to-establish-a-competitive-market#fn:1 (Accessed: 15 July 2024).

UK Department for Energy Security and Net Zero (2024a) CCUS: Industrial Carbon Capture business models Update for Track-1 Expansion and Track-2. Available at: https://assets.publishing.service.gov.uk/media/661530cdc4c84d6602346a13/ccus-iccc-business-models-update-april-2024.pdf (Accessed: 29 August 2024).

UK Department for Energy Security and Net Zero (2024b) CCUS: non-pipeline transport and cross-border CO_2 networks - call for evidence. Available at: https://www.gov.uk/government/calls-for-evidence/carbon-capture-usage-and-storage-ccus-non-pipeline-transport-and-cross-border-CO_2-networks/ccus-non-pipeline-transport-and-cross-border-CO_2-networks-call-for-evidence (Accessed: 29 August 2024).

UK Department for Energy Security and Net Zero (2024c) Integrating greenhouse gas removals in the UK Emissions Trading Scheme. Available at: https://www.gov.uk/government/consultations/integrating-greenhouse-gas-removals-in-the-uk-emissions-trading-scheme (Accessed: 29 August 2024).

UK Government (2024) Government reignites industrial heartlands 10 days out from the International Investment Summit. Available at: https://www.gov.uk/government/news/government-reignites-industrial-heartlands-10-days-out-from-the-international-investment-summit (Accessed: 17 October 2024).

UNFCCC (2023) Egypt's Second Updated Nationally Determined Contributions.

United Arab Emirates Ministry of Climate Change and Environment (2023) The United Arab Emirates First Long-Term Strategy (LTS).

United Arab Emirates Ministry of Climate Change and Environment (no date) The United Arab Emirates First Long-Term Strategy (LTS).

United States Department of Energy and National Energy Technology Laboratory (2022a) CarbonSAFE Initiative, CarbonSAFE Initiative. Available at: https://netl.doe.gov/carbon-management/carbon-storage/carbonsafe (Accessed: 19 October 2022).

United States Department of Energy and National Energy Technology Laboratory (2022b) History of the NETL, History of the NETL. Available at: https://netl.doe.gov/about/history (Accessed: 19 October 2022).

United States Department of Energy and National Energy Technology Laboratory (2022c) Regional Carbon Sequestration Partnerships, Regional Carbon Sequestration Partnerships. Available at: https://netl.doe.gov/carbon-management/carbon-storage/RCSP (Accessed: 19 October 2022).

United States Department of Energy and National Energy Technology Laboratory (2022d) RSCP Phases and Accomplishments, RSCP Phases and Accomplishments. Available at: https://netl.doe.gov/sites/default/files/2022-05/RCSP%20Infographic_20220512.pdf (Accessed: 19 October 2022).

US EPA (2024) Public Notice: UIC Class VI Permit Intent to Issue - Oxy Low Carbon Ventures, LLC.

WESTCARB (2022) 'West Coast Regional Carbon Sequestration Partnership (WESTCARB)', West Coast Regional Carbon Sequestration Partnership (WESTCARB) [Preprint]. Available at: https://westcarb.org/ (Accessed: 19 October 2022).

Western Australian Government (2024) Carbon capture and storage Bill passes WA Parliament. Available at: https://www.wa.gov.au/government/media-statements/Cook-Labor-Government/Carbon-capture-and-storage-Bill-passes-WA-Parliament-20240508 (Accessed: 26 August 2024).

World Bank Group (2017) World Bank CCS program activities in Botswana : results and lessons learned.

World Economic Forum (2023) How state-owned companies can accelerate sustainability in the Middle East and North Africa.

6.0 APPENDICES

6.1 Overview of CCS developments in other European countries

Beyond the EU, Denmark, the Netherlands, Iceland, Norway and the UK, several other European countries have made significant strides in advancing their CCS policy, legislative and regulatory frameworks in 2024. These developments include:

Austria

In 2024, Austria joined the list of European countries supportive of CCS. This comes after Austria's Finance Minister Magnus Brunner in September 2023 initiated a stakeholder dialogue to craft a national carbon management roadmap (Austrian Federal Finance Ministry, 2023).

Following this groundwork, on 26 June 2024, the Austrian government adopted this comprehensive strategy, developed by its Federal Ministry of Finance and Federal Ministry for Climate Action, with stakeholder and international advisory input (Austrian Federal Ministry for Climate Action, 2024). The strategy outlines a two-phase approach: the first establishes the current landscape and sets the groundwork for managing hard-to-abate emissions, while the second focuses on detailed planning and implementation of the proposed measures. Key recommendations include lifting the current CO_2 geological storage restrictions, aligning with the EU CCS Directive, and updating CO_2 transport regulations.

Belgium

From January to June 2024, Belgium held the rotating presidency of the Council of the EU, one of the EU's two co-legislating institutions. During this period, Belgium prioritised several CCS-related issues. These included evaluating the effectiveness of the current European framework for planning, constructing, and funding CO_2 infrastructure, as well as supporting discussions on the future European Commission's 2040 climate target and the Industrial Carbon Management communications (Global CCS Institute, 2024b). In April 2024, Belgium signed a memorandum of understanding with Norway to facilitate the cross-border transport of CO_2 for offshore geological storage (Government of the Netherlands, 2024b).

At the regional level, in March 2024, the parliaments of Wallonia and Flanders enacted CO_2 pipeline decrees. These decrees address the limited scope of the EU CCS Directive concerning CO_2 transport infrastructure (Belgian Official Gazette, 2024a, 2024b).

France

Since releasing its draft national CCUS strategy in June 2023 (French Government, 2023), France has made significant strides in advancing CCS technologies. The momentum from the November 2023 Aalborg Declaration signed with Denmark, Germany, the Netherlands, and Sweden to support CCUS and a European CO_2 market continued with notable international collaborations (Danish Ministry of Climate, 2023). In January 2024, France and Norway established a partnership focused on green industrial transformation, emphasising CCS (Norwegian Government, 2024b). This was followed by a March 2024 agreement with Denmark on cross-border CO_2 transport and storage, adhering to the London Protocol's requirements (French Ministry of the Economy, 2024b). Despite these promising initiatives, France has not yet ratified the 2009 amendment to the London Protocol.

In April 2024, Roland Lescure, France's incumbent Minister Delegate for Industry, launched a call for expressions of interest to identify key players in the future CCS chain (French Ministry of Economy, 2024b). Additionally, a bill was submitted to the French Senate aimed at 'simplifying economic life', which includes provisions designed to streamline CCS permitting processes (French Ministry of Economy, 2024c). These efforts culminated in July 2024 with the update of France's national CCUS Strategy, despite political uncertainty from recent snap elections (French Ministry of Economy, 2024a).

In September 2024, the French regulatory authority for energy published its recommendations for a regulatory framework for CO_2 and hydrogen infrastructure.

Germany

Germany is committed to achieving climate neutrality by 2045, five years ahead of the EU's 2050 target. This ambitious goal underscores the critical role of CCS in the country's climate strategy. In February 2024, Germany's Federal Minister for Economic Affairs and Climate Action outlined the key considerations of Germany's national

Carbon Management Strategy, which includes CCS as a cornerstone for reducing the country's residual emissions (German Federal Ministry of Economic Affairs and Climate Action, 2024).

To support this strategy, the government proposed a draft bill to amend the Carbon Dioxide Storage Act, which previously imposed limitations on CCS activities. In May 2024, the Federal Cabinet adopted the principles of the revised Carbon Management Strategy and the updated Carbon Storage Act, which now await approval by the Bundestag and Bundesrat, the two federal legislative chambers (German Federal Ministry for Economic Affairs and Climate Action, 2024a). Emphasising the urgency, the Federal Government, as part of its growth initiative in July 2024, called for the swift completion of this legislative process (German Federal Cabinet, 2024). In late September, the Bundestag held a first reading of the draft bill, which has now been referred to the Committee for further review.

Further demonstrating its commitment to CCS, in March 2024, Germany launched its first CCfD pilot program, announced in July 2023, to help heavy industries to decarbonise (German Federal Ministry for Economic Affairs and Climate Action, 2024b).

Italy

In 2024, Italy made significant progress in CCS with the adoption of the Energy Decree in February 2024, addressing regulatory gaps in CO_2 storage licenses and authorisations (Gazzetta Ufficiale della Repubblica Italiana, 2024). This was followed by the adoption of the Infrastructure Decree in June 2024, which established a CCS Committee to identify suitable CO_2 storage sites and review exploration applications (Italian Ministry of Environment and Energy Security, 2024).

Poland

Poland enacted significant CCS-related regulatory changes in October 2023 by amending the Geological and Mining Law and the Energy Law (CMS Law-Now, 2024). These updates lifted previous restrictions on CCS, allowing onshore CO_2 storage within Poland and exempting small-scale projects (under 100 kt CO_2 capacity) from licensing requirements.

In April 2024, Poland announced plans to develop a comprehensive national CCS implementation strategy to further integrate and expand CCS technologies (CCS Europe, 2024).

Sweden

In 2024, Sweden made notable strides in CCS. In April, it signed memoranda of understanding respectively with Norway and Denmark for cross-border CO_2 transport to offshore geological storage (Government of the Netherlands, 2024b).

Additionally, the Swedish Government submitted a €3 billion state aid notification to the European Commission in April 2024 to support CCS projects focused on reducing biogenic CO_2 emitted during the combustion or processing of biomass (European Commission, 2024b). Approved in July, this scheme will provide grants for each tonne of biogenic CO_2 stored, with adjustments based on potential revenues from carbon removal certificates and other public support. It will run until December 2028.

Switzerland

In 2024, Switzerland significantly advanced its CCS and CDR strategies, aiming for climate neutrality by 2050. After setting this target in August 2019, the Swiss Federal Council introduced a roadmap in May 2022 to scale CCS and CDR technologies.

In November 2023, Switzerland expressed interest in ratifying the 2009 amendment to the London Protocol (Swiss Confederation, 2023). The country also signed a memorandum of understanding with Sweden in December 2023 for cooperation on the international transfer of industrial carbon removals and a declaration of intent with Norway in May 2024 to strengthen CCS and CDR cooperation (Swedish Energy Agency & Federal Department of the Environment, 2023; Ministry of Energy and the Ministry of Climate and Environment of Norway and the Swiss Federal Department of Environment, 2024b). These developments complement the pioneering efforts of Swiss companies like Climeworks which launched the world's largest direct air capture facility, Mammoth, in May 2024 (Climeworks, 2024).

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