2024 THOUGHT LEADERSHIP

CARBON MANAGEMENT IN NDCs: COLLATION, ASSESSMENT AND A PATH FORWARD

DECEMBER 2024

GLOBAL CCS INSTITUTE

NOORA AL AMER
Senior International Climate Change Policy Lead

CONTENTS

AS THE WORLD REACHES THE HALFWAY POINT OF THIS CRITICAL DECADE FOR ACTION ON CLIMATE CHANGE, CARBON MANAGEMENT HAS BEEN GLOBALLY RECOGNISED AS AN INTEGRAL PIECE OF THE CLIMATE MITIGATION TECHNOLOGY TOOLBOX.

1.0 CONTEXT

The Paris Agreement established a framework for countries to set and achieve nationally determined contributions (NDCs) in an effort to limit the world's average surface temperature increase to no more than 1.5°C by 2100.

NDCs describe each country's efforts to reduce their emissions and adapt to the impacts of climate change. Countries are required to submit them in five-year intervals to the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, with the third generation of NDCs (NDC 3.0) due in February 2025, although they may adjust their existing NDC at any time in the interest of reflecting their highest possible ambition.

Carbon management

Carbon management refers to carbon capture, engineered removal, use and storage of CO_2. All methods contribute to the stabilisation of CO_2 in the atmosphere. Carbon can be captured from industrial point sources or removed from the air and then permanently stored in products or in geologic formations underground.

As the world reaches the halfway point of this critical decade for action on climate change, carbon management has been globally recognised as an integral piece of the climate mitigation technology toolbox, requiring coordinated efforts, innovative solutions and a commitment to sustainable development. In its latest assessment report on climate mitigation, the Intergovernmental Panel on Climate Change (IPCC) indicates that global rates of carbon capture and storage (CCS) deployment are far below what would be needed to limit global warming to 1.5°C, and the deployment of carbon dioxide removal (CDR) to counterbalance hard-to-abate residual emissions is unavoidable if net zero emissions are to be achieved[1].

Nature-based CDR (bio-sequestration), which is important to consider in the broader context of removals, is not included in the abovementioned definition of carbon management and was not analysed in this report.

Global consensus

The Paris Agreement's Global Stocktake established a process that ultimately assesses progress and informs the next generation of NDCs, calling on countries to align NDCs with 1.5°C. At the first Global Stocktake in COP28, designed to inform NDCs in 2025, countries were called to accelerate carbon capture utilisation and storage (CCUS), particularly in hard-to-abate sectors[2]. In the cement industry in particular, a large share of emissions is not energy related but due to the specific chemistry of cement making. Carbon management technologies are therefore a crucial part of sector-wide decarbonisation, accounting for 36% of needed reductions by 2050, which amounts to over 1.3 gigatonnes of CO_2[3]. To meet mitigation goals in the industrial sector broadly, the United Nations Environment Programme has stated that the industrial sector will require between US$0.9 trillion and US$1.2 trillion annually by 2035, with carbon capture identified as a key investment area[4].

[1] *AR6 Climate Change 2022: Mitigation of Climate Change — IPCC*
[2] *Outcome of the first global stocktake. Draft decision -/CMA.5. Proposal by the President | UNFCCC*
[3] *GCCA-Concrete-Future-Roadmap-Document-AW-2022.pdf*
[4] *Emissions Gap Report 2024 | UNEP - UN Environment Programme*

The advantage

The advantage of carbon management in international climate change mitigation is the versality of the technologies, ranging from point source capture across a variety of industries to CDR technologies such as Direct Air Capture (DAC). Countries may choose how to employ them according to their environmental, social and economic needs. Along with strengthened international coordination multilaterally and bilaterally, national governments have continued to enhance and expand their domestic commitments towards the deployment of carbon management technologies, with strengthened policy frameworks, the launch of new initiatives, and a record number of projects in the pipeline[5].

The driving force

Limiting global warming to below 1.5°C will significantly reduce the adverse impacts of climate change, including the triggering of multiple climate tipping points – such as breakdowns of major ocean circulation systems, abrupt thawing of boreal permafrost, and collapse of tropical coral reef systems[6].

Failing to limit temperatures will lead to increasingly frequent and dangerous extreme weather events including heatwaves, droughts, wildfires, and heavy precipitation and flooding[7]. Every 0.1°C of global warming causes clearly discernible increases in the intensity and frequency of temperature and precipitation extremes, as well as agricultural and ecological droughts[8].

The global average temperature for the most recent 10-year period, from 2014 to 2023, is estimated to be the warmest 10-year period on record, at around 1.2°C above the 1850-1900 average[9].

Why this report

This study collates, assesses, and explores the current status of carbon management in NDCs, offering recommendations to enhance future country reporting. By utilising the diverse and evolving reporting tools within the UNFCCC, clearer communication of carbon management strategies can signal political intent, encourage investment, and track progress.

[5] *Global Status Report 2024 - Global CCS Institute*
[6] *Exceeding 1.5°C global warming could trigger multiple climate tipping points | Science*
[7] *SR15_Headline-statements.pdf*
[8] *IPCC_AR6_WGI_SPM_final.pdf*
[9] *Climate change indicators reached record levels in 2023: WMO*

2.0 STATE OF PLAY

International climate policy landscape

Carbon management has received increasing attention in the multilateral space over the past few years (Figure 1). Notably, a methodological report on CDR, CCS and CCUS was decided to be released by the end of 2027[10], while the Carbon Management Challenge (CMC), which currently includes 22 country participants plus the European Commission, was launched at Major Economies Forum (MEF) in April 2023. Recognition and promising momentum for carbon management deployment is supported by the enhanced involvement of the Group of 7 (G7), the Group of 20 (G20), the Clean Energy Ministerial (CEM) and Mission Innovation (MI), with several political declarations and ministerial events.

Gaps remain for direct support to developing countries for carbon management projects. At this critical juncture in climate finance, the Green Climate Fund (GCF), the world's largest climate fund and critical element in supporting developing countries' NDCs, recently funded its first CCS-related activity in Trinidad & Tobago[11], while the World Bank (WB) CCS Trust Fund closed in August 2024, with new support currently under discussion. Ongoing dialog remains between the WB and countries globally on carbon management, including Cambodia, Indonesia, Laos, Malaysia, Papua New Guinea, the Philippines, Timor-Leste, Vietnam, Türkiye, Brazil, Colombia, Egypt*, India*, Nigeria* and South Africa*.

*Countries where the CCS Trust Fund is currently supporting activities.

[10] *IPCC-60_decisions_adopted_by_the_Panel.pdf*
[11] *Trinidad and Tobago secures funding for CCS - UNEP-CCC*

APRIL 2023

Carbon Management Challenge Launch: Announcement by US President Joe Biden at the MEF with first joiners Australia, Canada, Egypt, the European Union, Japan, Saudi Arabia, the UAE and the US, as well as Norway and Denmark.

READ MORE

Chair's Summary of the Major Economies Forum on Energy and Climate Held by President Joe Biden | The White House

MAY 2023

G7 Hiroshima Leaders' Communique: "We acknowledge that CCUS/carbon recycling technologies can be an important part of a broad portfolio of decarbonisation solutions."

READ MORE

G7 Hiroshima Leaders' Communiqué | The White House

SEPTEMBER 2023

G20 New Delhi Leaders Declaration: "Will pursue and encourage efforts to triple renewable energy capacity globally through existing targets and policies, as well as demonstrate similar ambition with respect to other zero- and low-emission technologies, including abatement and removal technologies, in line with national circumstances by 2030."

READ MORE

g20.in/content/dam/gtwenty/gtwenty_new/document/G20-New-Delhi-Leaders-Declaration.pdf

DECEMBER 2023

2023 The UAE Consensus: "Accelerating zero- and low-emission technologies, including inter alia, renewables, nuclear, abatement and removal technologies such as carbon capture utilisation and storage, particularly in hard- to-abate sectors, and low-carbon hydrogen production."

READ MORE

Outcome of the first global stocktake. Draft decision -/CMA.5. Proposal by the President | UNFCCC)

JANUARY 2024

IPCC 60th Session, Istanbul: The IPCC decides that the Task Force on National Greenhouse Gas Inventories (TFI) should hold an Expert Meeting and produce a Methodology Report on Carbon Dioxide Removal Technologies and Carbon Capture, Utilisation and Storage.

READ MORE

IPCC agrees on the set of scientific reports for the seventh assessment cycle — IPCC

APRIL 2024

G7 Ministers' Meeting on Climate, Energy and Environment: "Noting the work of those Parties participating in the Carbon Management Challenge to support a global goal of advancing carbon management projects that would reach gigatonne-scale by 2030."

READ MORE

G7-Climate-Energy-Environment-Ministerial-Communique_Final.pdf

MAY 2024

The GCF funds its first CCS-related activity in Trinidad and Tobago: Funding will go towards assessing the islands' storage potential to produce a national storage atlas as part of a GCF project with Suriname.

READ MORE

Trinidad and Tobago secures funding for CCS - UNEP-CCC

OCTOBER 2024

Launch of the CEM-MI "Gt by 2030" Campaign: First joint CEM MI campaign centred around carbon management, to elevate it to the ministerial stage and act as a coordinating platform.

READ MORE

gtby2030_launchdocument_3oct2024.pdf

Figure 1 - Recent international momentum on carbon management

3.0 ASSESSMENT

Carbon management in current NDCs

A total of 90% of countries have updated or replaced their initial NDCs since the adoption of the Paris Agreement, although most improvements came in the lead-up to COP26 in 2021. Despite requests from the last three COPs to further strengthen 2030 targets, only one country has strengthened its target since COP28[12].

The dataset of carbon management currently included in NDCs is found in Table 1, highlighting a global movement towards these technologies, with significant variation in strategies, policies and commitments. Application of carbon management technologies tends largely towards industry and power, followed by CDR and low carbon hydrogen.

Mitigation technologies play a vital role in NDCs, providing the tools and strategies necessary to achieve emissions reduction targets. NDCs often highlight specific sectors like transportation, industry, and agriculture, where mitigation technologies can be applied to achieve substantial reductions.

Four G7 countries, and eight G20 countries, representing roughly half of worldwide CO_2 emissions, included carbon management in their NDCs, with varying levels of detail and relatively low levels of ambition compared with the needs reflected by the IPCC and current industry commitments. On a political level, the G20 is expected to show enhanced ambition, given their responsibility for 80% of global emissions[13]. For countries that traditionally lead on carbon management, such as the United States, Japan and the United Kingdom, the level of their respective domestic, political and financial commitments[14] is under-represented in current NDCs. Emerging G20 economies like China and Saudi Arabia as well as the United Arab Emirates, a country invited to G20 meetings, are communicating active development of carbon management technologies as part of overall industrial and energy strategies within their respective NDCs, suggesting a dual focus on environmental and economic sustainability. This is also relevant for Australia, which is highlighting economic stretch goals such as cost targets for CCS deployment and clean hydrogen production.

Developed countries such as Canada and Norway tend to mention detailed plans and funding mechanisms for carbon management. Developing countries such as Malawi and Togo instead focus on capacity building and seeking external support and investment. Many countries are also prioritising research and development, reflecting the need for innovation to make carbon management solutions commercially viable.

There are varying approaches to the inclusion and coverage of carbon management in the NDCs of countries with the following characteristics:

- Strengthened national carbon management policies
- Planned or ongoing carbon management projects
- Documented international or bilateral cooperation on carbon management
- Communication with the World Bank on matters related to the CCS Trust Fund

Such gaps may indicate premature strategies at the time of publication of their NDCs or an early state in their carbon management development. Countries include G20 members Brazil[15], India, Indonesia and South Korea, in addition to Cambodia, Egypt, Kenya, Laos, Malaysia, Mexico, Nigeria, Oman, Papua New Guinea, the Philippines, Trinidad & Tobago and Timor-Leste. Mozambique includes references to carbon management in the NDC bibliography with no obvious reference in the main text.

[12] *Emissions Gap Report 2024 | UNEP - UN Environment Programme*
[13] *240426-pcd-co-chairs-summary-data.pdf*
[14] As found in in the Institute's *Global Status Report*
[15] Brazil has since submitted its third-generation NDC at COP29, which now includes references to CCS. Further details are provided in the next chapter.

Table 1 - Collation of carbon management in current NDCs

● G20 COUNTRIES ● G7 COUNTRIES

COUNTRY	NDC YEAR	REDUCTION TARGET	CARBON MANAGEMENT CONTEXT
Australia ●	2022	26-28% reduction below 2005 levels by 2030	Makes CCS one of its six priority technologies, setting ambitious goals to reduce costs and deploy CCS by 2025-2030, along with a target for clean hydrogen production.
Canada ● ●	2022	40-45% reduction below 2005 levels by 2030	Focuses on investment tax credits for CCUS and plans significant funding for research and demonstration projects, with a target to reduce emissions by 15 Mtpa through CCS.
China ●	2021	Peak emissions before 2030 and achieve carbon neutrality by 2060	Prioritises CCS going forward, with pilot projects, particularly in coal sectors, while curbing further coal-powered development.
Japan ● ●	2021	46% below 2013 levels by 2030, with a long-term goal of achieving carbon neutrality by 2050	Includes CO_2 transport and storage in its emissions reduction measures, recognising their role in decarbonisation.
Saudi Arabia ●	2021	Net zero by 2060, with 50% reduction by 2030	Details the National Circular Carbon Economy (CCE) Program, which includes CCS and DAC as key pillars, with ambitious plans for carbon hubs and blue hydrogen production.
Türkiye ●	2023	21% reduction by 2030 relative to business-as-usual	Develops a roadmap for CCUS implementation, highlighting its commitment to these technologies.
United Kingdom ● ●	2022	68% reduction by 2030, relative to 1990 levels	Includes CCS but acknowledges its uncertain future, with public consultations on its viability.
United States ● ●	2021	50-52% reduction by 2030 relative to 2005 levels	Plans to incentivise carbon capture for power plants through retrofits and other policy measures.
Bahamas	2022	30% reduction by 2030	Includes enhancing carbon capture as a component of its greenhouse gas (GHG) reduction target.
Bahrain	2021	30% reduction by 2035 relative to business-as-usual	Supports CCS and DAC as essential for decarbonising hard-to-abate sectors.
El Salvador	2022	30% by 2030 relative to business-as-usual	Plans a 100 MW CCS facility by 2030, with significant GHG reductions tied to its success.
Iceland	2021	55% reduction by 2030 relative to 2005	Includes CCS and mineralisation in its goal for carbon neutrality by 2040, with a focus on Carbfix technology.
Iran	2015	12% reduction by 2030 relative to business-as-usual	Integrates CCS into its broader energy transition, alongside renewable and alternative energy initiatives.
Iraq	2021	2.3% reduction by 2030 relative to business-as-usual	Identifies CCS or CCUS to mitigate industrial emissions.
Kuwait	2021	7.4% reduction by 2035 relative to business-as-usual	Continues to support carbon reuse, including CCS projects initiated in 2015 and another beginning operations in 2022.
Lesotho	2018	15% by 2030 relative to business-as-usual	Calls for widespread CCS deployment and streamlined permitting to support large-scale projects.
Malawi	2020	10% reduction by 2030, relative to business-as-usual	Strives for CCS deployment on subcritical power stations between 2030 and 2040; supports companies assessing/developing/implementing CCUS and calls for US$4.8 billion of investment and less than US$1 million investment respectively for these goals.
Mongolia	2020	14% reduction by 2030 relative to business-as-usual	Notes that if CCS becomes feasible by 2030 projects can achieve deeper emissions cuts relative to business-as-usual, (27.2% cut vs. 22.7% drop by 2030).
Norway	2022	50-50% reduction by 2030, relative to 1990 levels	Mentions the Climate Status and Plan, released in October 2022, which identifies financial support for the development of new technologies such as CCS.

COUNTRY	NDC YEAR	REDUCTION TARGET	CARBON MANAGEMENT CONTEXT
Pakistan	2021	20-25% reduction by 2030, relative to business-as-usual	Plans for researching and developing carbon capture and sequestration technologies.
Qatar	2021	25% by 2030, relative to business as usual	Incorporates CCS into new LNG projects and existing facilities when economically and environmentally feasible.
Singapore	2020	36% reduction per unit of GDP by 2030	Mentions potential for carbon storage but has not detailed a full-scale strategy.
Togo	2021	20% reduction by 2030 relative to business-as-usual	Explores the development of CO_2 capture and storage infrastructure.
Tunisia	2021	13.5% by 2030 relative to business-as-usual	Invests in CCS technologies as part of its broader hydrogen and CCUS roadmap.
Thailand	2022	20-25% reduction by 2030 relative to business-as-usual	Focuses on research and deployment of CCS, CCUS, BECCS, DAC, and hydrogen technologies.
United Arab Emirates	2023	23% reduction by 2030 relative to business as usual	Views CCS as critical for decarbonising heavy industries like cement and plans extensive CCS and DAC development, including carbon contracts for difference (CCfDs) to incentivise adoption.
Vietnam	2022	9% by 2030 relative to business-as-usual, with conditional targets of up to 27%	Promotes international collaboration on CCS and CCUS, with a focus on reducing coal dependency in the power sector.

4.0 PATH FORWARD

Building carbon management into NDCs 3.0

While carbon management technologies are increasingly recognised as crucial tools for the mitigation of climate change, their widespread adoption and effectiveness remain hindered by insufficient emphasis and commitment in NDCs. Many NDCs still lack clear, robust targets for the deployment of carbon management technologies. For these technologies to have a meaningful impact, governments must not only integrate them more prominently into their climate action plans but also commit to substantial investments in research, infrastructure, and regulatory frameworks that enable their scaling.

With the advantage of drawing on several years of experience in NDC formulation and implementation, the next round of NDCs offers countries an opportunity to strengthen reporting, informed by the outcomes of the first global stocktake. NDCs can articulate high-level commitments to carbon management strategies, integrating them as part of a comprehensive decarbonisation portfolio. These contributions not only outline broad national goals but also shape the political and financial framework needed for effective action.

By pairing these commitments with detailed submissions known as Information to facilitate Clarity, Transparency, and Understanding (ICTU), countries provide a deeper layer of transparency. ICTU ensures that key elements such as baseline scenarios, timelines, methodologies, and progress indicators are clearly defined, which strengthens accountability and fosters international confidence in the country's climate plans.

This dual structure – NDCs for high-level commitments and ICTU for detailed reporting – encourages transparency, better tracking of progress, and more effective policy implementation. It helps countries prioritise key technologies and integrate them into their broader decarbonisation strategies. Furthermore, this integrated approach enables the global climate community to better understand each nation's efforts, creating stronger political and financial ecosystems for the deployment of decarbonisation technologies. This approach is exemplified by the United Kingdom's recent 2035 NDC announcement, which will be underpinned by an ICTU.[16]

Enhancing transparency

Country Biennial Transparency Reports (BTRs), due for the first time in December 2024[17], are set to provide data summarising progress made towards achieving a country's NDC commitments. BTRs must include updates on national inventory reports (NIR), progress towards NDCs, policies and measures, climate change impacts and levels of financial, technology development, transfer and capacity-building support needed and received.

As NDCs outline a country's emissions reduction targets and climate action plans, BTRs provide detailed updates that ensures transparency and accountability. This connection may allow for the tracking of carbon management efforts, enabling countries to assess their progress, adjust strategies as needed, and strengthen their climate commitments over time, fostering a global system of transparency and continuous improvement in emissions reductions.

The Enhanced Transparency Framework (ETF), which includes BTRs, applies to both developed and developing countries, marking a shift from previous reporting mechanisms like Biennial Reports (BRs) and Biennial Update Reports (BURs) that had different requirements for developed and developing countries under the UNFCCC.

[16] *Written statements - Written questions, answers and statements - UK Parliament*
[17] *First Biennial Transparency Reports | UNFCCC*

Advancing climate finance

NDCs can be a useful tool for investors looking to identify a country's technological and sectoral opportunities and learn about the policy landscape. Politically, such as in this year's Petersburg Climate Dialogue, an annual forum held before COP and an important milestone for the climate negotiations at COP29 Baku, there was growing interest ensuring upcoming NDCs "safeguard investments in green technologies" and are "investable"[18].

A key challenge to deploying carbon management technologies in developing countries is securing sufficient project financing. Broader and more transparent reporting mechanisms can help overcome these barriers by enhancing clarity around carbon management strategies.

In developing countries, technology needs assessments (TNA) and technology action plans (TAPs) can further help unlock support and streamline investment within the UNFCCC financial mechanism. So far, almost 100 developing countries have undertaken TNAs, however only two identify carbon management technologies: Thailand and Trinidad and Tobago, with the latter country recently receiving GCF funding towards carbon management, even though carbon management technologies are not in their NDC.

An analysis by the Technology Executive Committee (TEC), the policy arm in the UNFCCC focused on the development and transfer of low-emission and climate-resilient technologies, found that there is consistency between TNA and NDC processes in terms of setting national priorities and defining the sectoral scope[19]. Out of the 98 developing countries with completed TNAs[20], at least 20 may consider including carbon management in updated assessments, based on our review[21]. Currently 17 countries are either publishing their first TNA, or updating previous ones[22], including Bahrain and Senegal, both potential candidates for climate finance for carbon management projects.

TNAs and their associated TAPs can play a key role in mapping out a country's long-term development, climate priorities and technologies. The actions in a TAP can, for example, lead to a technology demonstration project or a programme to train local engineers, aiming to overcome barriers to technology uptake or diffusion.

[18] *240426-pcd-co-chairs-summary-data.pdf*

[19] *de6da9e857d145fdbd5b8c2be66fcd26.pdf*

[20] *TNA Country Reports*

[21] Based on current NDC, strengthened national carbon management policies, planned or ongoing carbon management projects, documented international/bilateral cooperation with other countries on carbon management, and/or communication with the World Bank on matters related to the CCS Trust Fund.

[22] *New round of TNAs - Technology Needs Assessment*

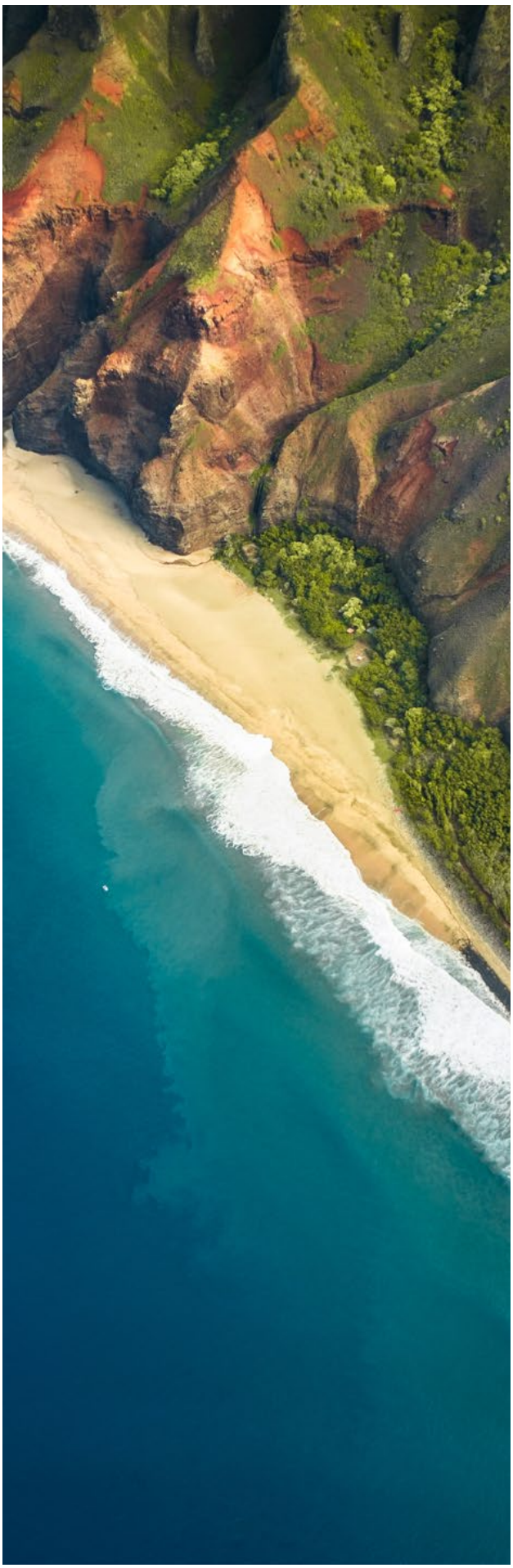
Towards a holistic carbon management portfolio

With decarbonisation as the most urgent common goal, countries need to employ and optimise all pathways to ensure effective, efficient and complete action is taken. In this light, CDR is important. Nature-based solutions (i.e. biosequestation) are mentioned widely throughout NDCs. The process of capturing and storing CO_2 in natural ecosystems, such as forests, grasslands, soil, oceans and other bodies of water[23], is the largest form of CDR today[24] with inextricable links to societal and ecological wellbeing.

A concerted effort on CDR that combines the potential of both methods, the natural and the technological, may emerge as a trend to ensure a holistic approach to mitigation action in upcoming NDCs. In doing so, policies and their associated regulatory frameworks could also be designed in ways that ensure the environmental safety and durability of projects, prioritising meaningful public participation throughout, and maximising co-benefits for surrounding communities.

Road to Belém - Early submission from Brazil

In the run-up to its COP30 Presidency, Brazil submitted its third-generation NDC at COP29, four months earlier than the February 2025 due date. The NDC mentions the National Climate Plan that supports the expansion of biofuel production associated with CCS to meet the demand for negative emissions. The NDC also mentions the possibility of raising the ambition of its national mitigation actions beyond the base level of 59% below 2005 levels by 2035, or 1.05 $GtCO_2e$, through Article 6. This estimate is attributed to attracting timely and large-scale investments in activities and new technologies with significant abatement opportunity costs, while also enabling the country to accelerate its trajectory towards net-zero emissions.



[23] *IPCC_AR6_WGIII_Factsheet_CDR.pdf*
[24] *Nature-based solutions can help cool the planet — if we act now*

GET IN TOUCH

To find out more about the Global CCS Institute including Membership and our Consultancy services, visit globalccsinstitute.com or contact us.

AMERICAS

Washington DC, United States

americasoffice@globalccsinstitute.com

AUSTRALIA

Melbourne, Australia

info@globalccsinstitute.com

CHINA

Beijing, China

chinaoffice@globalccsinstitute.com

EUROPE

Brussels, Belgium

europeoffice@globalccsinstitute.com

MIDDLE EAST AND NORTH AFRICA

Abu Dhabi, United Arab Emirates

menaregion@globalccsinstitute.com

UNITED KINGDOM

London, United Kingdom

ukoffice@globalccsinstitute.com

JAPAN

Tokyo, Japan

japanoffice@globalccsinstitute.com