



Decarbonising The Future: CCUS Policy Framework In USA, China And India

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Abstract:

Greenhouse gases, especially carbon dioxide (CO₂) emissions are one of the major contributors of climate change. With population proliferation and the expeditious industrial and economic growth, it becomes imperative for the governments to develop strategies and policies to combat carbon emissions and greenhouse gases. Carbon Capture, Utilisation and Storage (CCUS) is one of the effective mechanisms to ensure decarbonisation and to tackle the impacts of climate change. This paper focuses on the CCUS Policy Frameworks of USA, China and India, intending to give a perspective to the efforts of the three nations in mitigating climate change impacts and contributing towards the sustainable development goals; ultimately ensuring a decarbonised future.

Keywords:

Carbon Capture, Utilisation and Storage (CCUS); Carbon Emission; Decarbonisation; USA; China; India.

For Citation:

Ananya R & Devika Santosh, 'Decarbonising The Future: CCUS Policy Framework In USA, China And India', (2024) Special Issue on SDGs, JSS Journal for Legal Studies and Research, 92-106, Available at <https://www.jsslawcollege.in/jsslc-online-journal/>

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I. INTRODUCTION:

The global average temperature of the Earth has increased by an average of 0.06°C per decade since 1850 and since 1982, the rate of warming has increased more than three times at over 0.20°C per decade¹. In the past decade (2014 to 2023), the warmest years have been recorded, with 2023 being the warmest – approximately 1.36°C warmer in comparison to the preindustrial average during the late 19th Century (1850-1900)².

Over 75% of the global greenhouse gas (GHG) emissions can be attributed to fossil fuels, making them the largest contributor to climate change. Approximately 90% of the GHG emissions are carbon dioxide (CO₂) emissions³.

Sustainable development and decarbonisation mechanisms become highly crucial to mitigate these detrimental impacts of global warming and climate change. Reduction and removal of carbon emissions become imperative to limit climate change.

Carbon Capture, Utilisation and Storage (CCUS) is one of the mechanisms adopted to mitigate CO₂ from large sources, or for the removal of the existing excess CO₂ from the atmosphere. It is expected that CCUS will be essential in achieving global climate goals.

II. CARBON CAPTURE, UTILISATION AND STORAGE (CCUS):

Also referred to as ‘Carbon Capture, Use and Storage’, Carbon Capture, Utilisation and Storage (CCUS) is the process of capturing CO₂ emissions from large-scale emission sources like power generation plants or industries⁴, utilising the same and transporting to be stored (also referred to as “sequestering”) in deep underground geological formations⁵.

The transportation of CO₂ in a compressed liquid form is usually carried out via pipelines or ships to either an onshore or an offshore underground storage facility and pumped into suitable storage formations such as saline aquifers, depleted oil and gas reservoirs⁶.

Industries often utilise the CO₂ captured on-site as a resource in product like synthetic fuels, chemicals, and concrete.⁷

¹ Climate Change: Global Temperature | NOAA Climate.gov, <https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature> (last visited Oct 28, 2024).

² NASA Global Climate Change, *Global Surface Temperature* | *NASA Global Climate Change*, CLIMATE CHANGE: VITAL SIGNS OF THE PLANET, <https://climate.nasa.gov/vital-signs/global-temperature?intent=121> (last visited Oct 28, 2024).

³ United Nations, *Causes and Effects of Climate Change*, UNITED NATIONS, <https://www.un.org/en/climatechange/science/causes-effects-climate-change> (last visited Oct 28, 2024).

⁴ Carbon Capture, Utilisation and Storage - Energy System, IEA, <https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage> (last visited Oct 27, 2024).

⁵ Aaditya Sarin, *Trends in Carbon Capture, Utilization and Storage (CCUS) Technologies and Status in India*, 1 (2022), <https://rgdoi.net/10.13140/RG.2.2.14946.91840> (last visited Oct 27, 2024).

⁶ Matt, *Understanding Carbon Capture Use Storage (CCUS)*, (2021), <https://ccushub.ogci.com/ccus-basics/understanding-ccus/> (last visited Oct 27, 2024).

⁷ Katie Lebling et al., *7 Things to Know About Carbon Capture, Utilization and Sequestration* (2023), <https://www.wri.org/insights/carbon-capture-technology> (last visited Oct 27, 2024).

II. 1. Why Carbon Capture, Utilisation and Storage?

According to the International Energy Agency (IEA), “reaching net-zero will be virtually impossible without CCUS”.⁸

Majority of the world’s electricity is still derived from fossil fuels like coal and gas. Approximately two-thirds of the power generation is fuelled by coal and gas despite the availability of various low-cost alternatives. In the countries of Republic of China (China) and India, more than 60% of the electricity is generated from coal.⁹

CCUS technologies play a crucial role in providing low-carbon dispatchable electricity according to the IEA Sustainable Development Scenario.

Technologies like the Bioenergy with Carbon Capture and Storage (BECCS) and the Direct Air Capture and Storage (DACCS) require the Carbon Capture and Storage (CCS) technology.¹⁰

The United Nations Sustainable Development Goals have incorporated within themselves the Paris Agreement’s Goal to ensure that the increase in the global average temperature does not exceed 2°C above the pre-industrial level. It becomes crucial for the governments, industries and the power sector to take long-terms measures to ensure the adherence to these climate goals.

Meeting such long-terms goals without CCUS technologies could virtually lead to the elimination of industries and power plants depending upon fossil fuels. CCUS technology would assist such industries to operate, ensuring the long-term flexible compliance with such goals. Usage of CCUS technology would also mean that such industries and plants can achieve negative emissions and in turn run at high-capacity factors.¹¹

CCUS technology can be beneficial in the oil-industry. Injecting CO₂ into the subterranean oil reservoirs can increase the production. The CO₂ injected pressurises the oil, increasing its mobility and facilitating easier flow.¹²

Additionally, CCUS technologies offer the basis for "negative emissions" or carbon removal when the CO₂ originates from the atmosphere or bio-based processes. The main applications for the captured CO₂ are Enhanced Oil Recovery (EOR) and fertilizer production. CO₂ is also used commercially in greenhouses, water treatment, cooling, and the production of food and beverages.

⁸ Energy Technology Perspectives – Special Report on Carbon Capture, Utilisation and Storage in Energy Transitions – IEA, CCUS in clean energy transitions, 13 (2020).

⁹ Why carbon capture technologies are important – The role of CCUS in low-carbon power systems – Analysis, IEA, <https://www.iea.org/reports/the-role-of-ccus-in-low-carbon-power-systems/why-carbon-capture-technologies-are-important> (last visited Oct 27, 2024).

¹⁰ Matt, *supra* note 6.

¹¹ Lebling et al., *supra* note 7.

¹² What is CCUS and why is it necessary? | IEF, INTERNATIONAL ENERGY FORUM, <https://www.ief.org/news/what-is-ccus-and-why-is-it-necessary> (last visited Oct 27, 2024)

Fuels (converting hydrogen into a synthetic hydrocarbon fuel using carbon in CO₂), chemicals (producing certain chemicals using carbon in CO₂ instead of fossil fuels), and building materials (producing building materials using CO₂ to replace water in concrete or as a raw material in its constituents) are examples of new CO₂ usage pathways.¹³

Certain governments provide incentives and various financial assistance to industries with CCUS technologies in an attempt to encourage industries, power plants etc., to implement such technologies. Establishments that capture and store CO₂ become eligible to claim tax credit per metric ton of CO₂ stored (or sequestered) in USA. Section 45Q Tax Credit provides incentives and reduces federal revenues¹⁴. In China, guidance and encouragement mechanisms are included in the CCUS policies. Regional financial subsidies are also made available in cities like Shenzhen and Beijing.¹⁵

II. 2. Carbon Capture, Utilisation and Storage as a Decarbonisation Pathway:

“Negative Emissions” become inevitable in order to achieve the goals of the Paris Agreement. Though natural alternatives may assist carbon removal, existing levels of CO₂ require large-scale deployment of technologies like CCUS.

According to the Intergovernmental Panel on Climate Change’s (IPCC) Sixth Annual Assessment Synthesis Report, when CCUS is applied to fossil fuels, there is a reduction of CO₂ emissions by 0 to 5 GtCO₂ by 2030 with a median of 1 GtCO₂. By the year 2050, approximately 6% of the mitigation required to achieve net-zero emissions would have been contributed by CCUS.¹⁶

According to the IEA Sustainable Development Scenario, global CO₂ emissions fall to zero on a net-basis by 2070, CCUS would be responsible for 15% of the reductions in the CO₂ emissions in comparison with the State Policies Scenario.¹⁷

The least-cost low-carbon hydrogen production made possible by CCUS can aid in the decarbonization of other energy-related sectors, including industry, trucks, and ships. CCUS can balance emissions that are impossible to prevent or technically challenging to reduce by removing

¹³ Carbon capture, utilisation and storage | UNFCCC, <https://unfccc.int/technology/carbon-capture-utilisation-and-storage> (last visited Oct 27, 2024). (last visited Oct 27, 2024).

¹⁴ Carbon Capture and Storage in the United States | Congressional Budget Office, (2023), <https://www.cbo.gov/publication/59832> (last visited Oct 27, 2024).

¹⁵ Song Weize, Li Zheng, Sun Boda - Policy Incentives of CCUS Development under China Carbon Neutrality Goal. https://lce.tsinghua.edu.cn/_local/4/66/C4/86E4A05F1FB60B0021BDAB56640_AD00CB96_3B6BB4.pdf (last visited Oct 27, 2024)

¹⁶ Lebling et al., *supra* note 7; KATHERINE CALVIN ET AL., *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (Eds.)]. IPCC, Geneva, Switzerland.*, (First ed. 2023), <https://www.ipcc.ch/report/ar6/syr/> (last visited Oct 28, 2024).

¹⁷ CCUS in the transition to net-zero emissions – CCUS in Clean Energy Transitions – Analysis, IEA, <https://www.iea.org/reports/ccus-in-clean-energy-transitions/ccus-in-the-transition-to-net-zero-emissions> (last visited Oct 28, 2024).

CO₂ from the atmosphere.¹⁸

III. CCUS POLICY FRAMEWORK IN USA:

III. 1. Mission:

The Office of Fossil Energy and Carbon Management's goal is to make sure that fossil fuels and industrial processes have as little effect on the environment and climate while also trying to get the U.S. economy to have net-zero emissions by 2050. Among the most crucial areas of technological work are carbon capture at the source, hydrogen management with carbon, reducing methane emissions, creating necessary minerals, and eliminating CO₂ from the environment. The Office of Fossil Energy and Carbon comprehends that reducing carbon emissions around the world is important for meeting climate goals, so it works with colleagues from other countries to share their knowledge in these areas.¹⁹

III. 2. Report by Environment Protection Agency (EPA):

The Environment Protection Agency (EPA) of the United States of America publishes an annual report known as the Inventory of U.S Greenhouse Gas Emissions and Sinks. The word “sinks” here refers to the carbon absorption. This report analyses the emission of CO₂ and other GHG from various sources such as industrialisation, commercialisation and other various human activities. The gases covered by the Inventory include CO₂, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, and nitrogen trifluoride. Certain key findings of the latest Inventory report of 2022 show that U.S. GHG emissions totalled 6,343 million metric tons of CO₂ equivalents, and 5,489 million metric tons of CO₂ equivalents after accounting for sequestration from the land sector. GHG emissions in 2022 (after accounting for sequestration from the land sector) were 17% below 2005 levels.²⁰ U.S. net emissions declined 15% from 2005 to 2021 due to a range of market and policy related factors.²¹

The US being a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) submits the Inventory to United Nations (UN) in accordance with the reporting requirements of UNFCCC guidelines on annual inventories for parties.²²

¹⁸ Carbon Capture, Utilisation and Storage - Energy System, IEA, <https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage> (last visited Oct 28, 2024).

¹⁹ Mission, ENERGY.GOV, <https://www.energy.gov/fecm/mission> (last visited Oct 28, 2024).

²⁰ OAR US EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, (2017), <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks> (last visited Oct 27, 2024).

²¹ U.S. Emissions, CENTER FOR CLIMATE AND ENERGY SOLUTIONS, <https://www.c2es.org/content/u-s-emissions/> (last visited Oct 28, 2024).

²² Reporting requirements | UNFCCC, <https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/reporting-requirements> (last visited Oct 27, 2024).

The Enhanced Transparency Framework (ETF) under the Paris Agreement also provides for reporting of the inventories, hence the parties under the Paris Agreement or the Paris Climate Accords are required to submit their national inventory report and also submit the same to the UN.²³

III. 3. Policies Adopted:

The White House Council on Environmental Quality (CEQ) and the U.S. Department of Energy signed a Memorandum of Understanding (MOU) on October 31, 2023, outlining the agencies' respective responsibilities for overseeing the two – Carbon dioxide Capture, Utilization, and Sequestration Permitting Task Forces. These two Task Forces were formed under the Utilizing Significant Emissions with Innovative Technologies Act (USE IT Act) in compliance with the MOU.²⁴ Although both the Task Force has the same goal, their areas of focus vary; for example, one Task Force concentrates on Federal lands and the Outer Continental Shelf, while another Task Force concentrates on non-Federal territories. The Committee determines the challenges and achievements that project developers and permitting agencies faced in effectively and ethically authorising projects. Its objective is to improve regional co-operation and the permitting procedure in order to facilitate the efficient and ethical construction of CO₂ pipelines and carbon capture plants. On these matters, the Committee will also advise and recommend solutions to the Secretary of Energy and the Chair of CEQ.²⁵

The Inflation Reduction Act of 2022 relates to Section 45Q tax credits which incentivises the use of carbon capture and storage. The Section 45Q federal tax credit provides financial incentives for companies that capture and store CO₂.²⁶ This tax credit enables eligible businesses to claim amount for the emission of CO₂ which they capture and store. The goal of this incentive is to persuade businesses to deploy CCUS systems to reduce GHG emissions and tackle climate change.²⁷

There are several clauses pertaining to carbon capture and removal in the US Energy Act of 2020. The Act reauthorizes the U.S. Department of Energy's (DOE) Fossil Energy Research and Development activities and authorizes over USD 7 billion for various carbon management and removal activities over a five-year period.

²³ Preparing for the Enhanced Transparency Framework | UNFCCC, <https://unfccc.int/process-and-meetings/transparency-and-reporting/preparing-for-the-ETF> (last visited Oct 27, 2024).

²⁴ USE IT Act Carbon Dioxide Capture, Utilization, and Sequestration (CCUS) Permitting Task Forces, ENERGY.GOV, <https://www.energy.gov/fecm/use-it-act-carbon-dioxide-capture-utilization-and-sequestration-ccus-permitting-task-forces> (last visited Oct 28, 2024).

²⁵ Charter - ccus federal lands permitting task force.pdf, [https://www.energy.gov/sites/default/files/2024-04/Charter %20-%20ccus%20federal%20lands%20permitting%20task%20force.pdf](https://www.energy.gov/sites/default/files/2024-04/Charter%20-%20ccus%20federal%20lands%20permitting%20task%20force.pdf) (last visited Oct 28, 2024).

²⁶ Carbon Capture and Storage in the United States | Congressional Budget Office, (2023), <https://www.cbo.gov/publication/59832> (last visited Oct 28, 2024).

²⁷ ira-carbon-capture-fact-sheet.pdf, <https://cdn.catf.us/wp-content/uploads/2023/02/16093309/ira-carbon-capture-fact-sheet.pdf> (last visited Oct 28, 2024).

III. 4. Role of Federal Government:

The Federal Government ensures fund for research in the field of CCUS, making an effort to minimise the emissions of carbon. Currently in the U.S., there are about 15 CCUS facilities which are in operation. All together they can absorb 0.4% of the country's yearly CO₂ emission. The concept of CCUS appears to be a fast-growing sector in the U.S., there are an additional of 121 CCUS facilities being established in the country which would increase the country's CCUS capacity to 3%.

Storing of carbon gives rise to its potential utilisation which helps to reduce carbon emissions and offset the cost of carbon capture. In U.S., carbon is mainly used for the purpose of manufacturing chemicals, building materials, fuels, plastics, cement, products of coal utilisation in power systems, etc.²⁸

III. 5. The Oldest Operating CCUS Project:

The Terrel Natural Gas Processing, Texas is the oldest CCUS project of the U.S. which was established in the year 1972. This process removes CO₂ from methane to comply with the specifications of pipeline. The plant majorly supplied CO₂ for recovery of oil.

III. 6. America's First Large CCUS Power Plant Project:

The Petra Nova CCUS project, situated in Thompsons, Texas, took over as America's first industrial-scale coal-fired power plant with CCUS on January 10, 2017. The facility absorbed about 4,717 metric tons of CO₂ every day. Utilising a high-performance solvent for CO₂ absorption and desorption, the project makes use of a carbon capture method that is co-developed by Mitsubishi Heavy Industries, Ltd. (MHI) and the Kansai Electric Power Co. Following compression, CO₂ that is captured will be sent to an active oil field via an 80-mile pipeline which is used in EOR before being sequestered.²⁹

III. 7. Regulations by EPA:

The Safe Drinking Water Act (SDWA) provides that the EPA shall be in charge of Underground Injection Control (UIC) programs and makes rules for CO₂ disposal into the ground. EPA also makes guidelines to help the states carry out their programs. Some of these requirements include standards for building and maintaining wells, monitoring and testing, reporting and keeping records, closing down the site and being financially responsible.³⁰

²⁸ Angela C Jones & Ashley J Lawson, *Carbon Capture and Sequestration (CCS) in the United States*, 16.

²⁹ Petra Nova - W.A. Parish Project, ENERGY.GOV, <https://www.energy.gov/fecm/petra-nova-wa-parish-project> (last visited Oct 28, 2024).

³⁰ Jones and Lawson, *supra* note 28 at 27.

IV. CCUS POLICY FRAMEWORK IN CHINA:

China is the world's second-largest consumer of oil, fifth-largest producer of oil, and the primary catalyst of the rise in gas demand worldwide. It also has the largest hydroelectric and renewable energy capacity in the world, the largest coal consumer, the second-largest nuclear capacity, and has half of the world's coal power plants. Since 2006, China is also the world's largest GHG emitter.³¹ According to the IEA, in 2022, China emitted 31.1% of the global CO₂ emissions from fossil fuels, equivalent to 10,613.171 Mt of CO₂.

China is an active participant in international climate negotiations and is a signatory to the UNFCCC and the Paris Agreement. However, it is “non-annex – I” party to the UNFCCC, and thus, exempt from the Kyoto Protocol's requirement to make legally binding emission reductions and is not obligated to provide climate finance.³²

Nationally Determined Contributions (NDCs) are a key part of the Paris Agreement. It outlines each country's climate action plan under the Agreement and how they plan and contribute in reduction of GHG emissions in order to achieve the global goal of limiting the global average increase in temperature to 1.5°C.³³

IV. 1. CCUS Policies in China:

Though the concept of CCUS was developed back in 2000 in China, its importance as an essential mechanism for large-scale emission-reduction was only realised when China announced its goal of achieving carbon neutrality by 2060 in September, 2020. Various stakeholders like the Government, financial organisations and corporations have since then become aware of the important role of CCUS.³⁴

IV. 1.1. Policy Framework before the Carbon Neutrality Declaration:

CCUS was first mentioned in 2006 in the ‘Outline of the National Medium and Long-Term Science and Technology Development Program’ announced by the State Council. The outline termed CCUS as a ‘cutting-edge technology’.³⁵

CCUS has been included and addressed as an essential mechanism for emission reduction and to mitigate climate change in various plans issued by the Ministry of Science and Technology, National Development and Reform Commission and Ministry of Ecology and Environment. The plans of the government are - ‘Technology Roadmap Study on Carbon Capture, Utilization and

³¹ Hongqiao Liu Prater Simon Evans, Zizhu Zhang, Wanyuan Song, Xiaoying You, Joe Goodman, Tom, *The Carbon Brief Profile: China*, CARBON BRIEF (2023), <https://interactive.carbonbrief.org> (last visited Oct 28, 2024).

³² Prater, *supra* note 31.

³³ United Nations, *All About the NDCs*, UNITED NATIONS, <https://www.un.org/en/climatechange/all-about-ndcs> (last visited Oct 28, 2024).

³⁴ Zhang Jiutian et al., *Several Key Issues for CCUS Development in China Targeting Carbon Neutrality*, 1 CARBON NEUTRALITY 17, 2 (2022).

³⁵ Outline of the National Medium- and Long-Term Science and Technology Development Plan (full text), https://www.gov.cn/jrzq/2006-02/09/content_183787.htm (last visited Oct 28, 2024).

Storage in China’, ‘Technical Guidelines for Environmental Risk Assessment of Carbon Dioxide Capture, Utilization and Storage (Trial)’³⁶, ‘National Development and Reform Commission on Promoting Carbon Capture, Utilisation and Storage Experimental Demonstration’³⁷

The 12th Five-Year Plan of China (2011 to 2015) emphasised on environmental protection, green development and energy conservation.³⁸ The Plan discussed concepts of mandatory emission targets, environmental quality and commitments for major polluting sectors and setting up of new energy regimes to ensure that 15% of energy would be sourced from renewable sources by 2020.³⁹ The 12th Five-Year plan also set out the Specialised Plan for Technology Development of CCUS in February 2013.⁴⁰

In 2015, NDC was submitted by China to the UNFCCC, expressing its intention to achieve carbon peaking by 2030 and reduce the CO₂ emissions per unit of GDP by 60-65% in comparison to the emissions in 2005.⁴¹

During the 13th Five-Year Plan (2016 to 2020), major national policies and national regulations on CCUS were adopted. Unlike the U.S.’s Section 45Q Tax Credit, these policies and regulations do not encourage the large-scale commercial CCUS projects.⁴²

Major Policies and Regulations during the 13th Plan on CCUS were:

‘Catalogue of National Key Low-Carbon Energy Technologies for Promotion (Second Batch)’ by the National Development and Reform Commission (NDRC) in 2015;

‘Technical Guide for Environmental Risk Assessment of Carbon Dioxide Capture, Utilization and Storage (Trial)’ by the Ministry of Ecology and Environment (MEE) in 2016;

‘National Science and Technology Innovation Plan of the 13th Five-Year Plan’ by The State Council, PRC in 2016;

³⁶ Notice on the release of the “Technical Guidelines for Environmental Risk Assessment of Carbon Dioxide Capture, Utilization and Storage (Trial),” https://www.mee.gov.cn/gkml/hbb/bgt/201606/t20160624_356016.htm (last visited Oct 28, 2024).

³⁷ Notice of the National Development and Reform Commission on Promoting Carbon Capture, Utilization and Storage Pilot Demonstration, https://www.gov.cn/zwqk/2013-05/09/content_2398995.htm (last visited Oct 28, 2024).

³⁸ THE 12TH FIVE-YEAR PLAN FOR ECONOMIC AND SOCIAL DEVELOPMENT OF THE PEOPLE’S REPUBLIC OF CHINA (2011-2015) – Policies, IEA, <https://www.iea.org/policies/2123-the-12th-five-year-plan-for-economic-and-social-development-of-the-peoples-republic-of-china-2011-2015> (last visited Oct 28, 2024).

³⁹ APCO Worldwide - China’s 12th Five-Year Plan, <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=700&menu=1515> (last visited Oct 28, 2024).

⁴⁰ Hao Zhang, *Regulations for Carbon Capture, Utilization and Storage: Comparative Analysis of Development in Europe, China and the Middle East*.

⁴¹ China Submits INDC, SDG KNOWLEDGE HUB, <https://sdg.iisd.org/news/china-submits-indc/> (last visited Oct 28, 2024).

⁴² ASIAN DEVELOPMENT BANK, *Road Map Update for Carbon Capture, Utilization, and Storage Demonstration and Deployment in the People’s Republic of China*, 7 (0 ed. 2022), <https://www.adb.org/publications/road-map-update-carbon-capture-utilization-storage-prc> (last visited Oct 28, 2024).

‘The 13th Five-Year Plan for Greenhouse Gas Emission Control’ by The State Council, PRC in 2016;

‘The 13th Five-Year Plan for Petroleum Development, and the 13th Five-Year Plan for Natural Gas Development’ by NDRC in 2016;

‘Directive Catalogue of Key Products and Services for Strategic Emerging Industries (2016 Edition)’ by NDRC in 2017;

‘The 13th Five-Year Special Plan for Climate Change Science and Technology Innovation’ by Ministry of Science and Technology (MOST), MEE, China Meteorological Administration in 2017;

‘Design Standard of Flue Gas Carbon Dioxide Capture and Purification Engineering’ by Ministry of Housing and Urban-Rural Development in 2018; and

‘The Roadmap for Carbon Capture, Utilization, and Storage Technology in China (2019)’ by MOST in 2019.⁴³

IV. 1.2. Policy Framework after the Carbon Neutrality Declaration:

The 14th Five-Year Plan (2021 to 2025) became the first Five-Year Plan to refer to the country’s long term climate goals and also introduced the concept of “CO₂ Emission Cap”. However, the plan fails to set the emission cap.⁴⁴

The plan also was the first Five-Year Plan to expressly mention CCUS; it proposed ‘supporting the demonstration of important projects such as carbon capture, utilisation, and storage’.⁴⁵The plan expressly proposed for and suggested the development of significant CCUS demonstration initiatives.⁴⁶

Furthermore, the 14th Five-Year Plan for Circular Economy Development was introduced by the NDRC in July 2021. In order to achieve peak carbon emissions and ultimately carbon neutrality, the plan placed a strong emphasis on the need to advance the development of the circular economy over the ensuing five years.

In the first year of the 14th Five-Year Plan, China's major government documents continued to address carbon neutrality issues. Ahead of Conference of Parties 26 (COP26), the government also announced a number of significant policies that outlined a plan for becoming carbon neutral.⁴⁷

On October 24, 2021, the State Council of the People's Republic of China and the Central

⁴³ *Id.*

⁴⁴ Carbon Brief Staff, *Q&A: What Does China’s 14th ‘Five Year Plan’ Mean for Climate Change?*, CARBON BRIEF (2021), <https://www.carbonbrief.org/qa-what-does-chinas-14th-five-year-plan-mean-for-climate-change/> (last visited Oct 28, 2024).

⁴⁵ Jiutian et al., *supra* note 37 at 3.

⁴⁶ Dongdong Song, Tong Jiang & Chuanping Rao, *Review of Policy Framework for the Development of Carbon Capture, Utilization and Storage in China*, 19 INT. J. ENVIRON. RES. PUBLIC. HEALTH 16853, 9 (2022)

⁴⁷ Sohee Park, *Korean and Chinese Carbon Neutrality Strategies: Comparative Analysis and Implications for Policy*, 27 KIET IND. ECON. REV., 54, 55 (2022), <https://www.ssrn.com/abstract=4210835> (last visited Oct 27, 2024).

Committee of the Communist Party of China issued ‘Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy’.

The national ‘1+N’ policy is the framework on carbon peaking and carbon neutrality, where "1" denotes 2030 carbon dioxide peaking and 2060 carbon neutrality guidance. "N" denotes the Action Plan for Carbon Dioxide Peaking before 2030 and pertinent policies and action plans for important sectors and areas.

The policy can be viewed as China's national and international development strategy's high-level guidelines for the green and low-carbon transition. The goal of the policy is to bring the 2030 and 2060 climate targets and their corresponding implementation directions into line with China's overall socioeconomic development requirements as well as with the individual sector development directions, technology roadmaps, standards, laws and regulations, policy and implementation mechanisms, and more.⁴⁸

A plan for China's transition to carbon neutrality is outlined in the Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy.

The Action Plan for Carbon Dioxide Peaking suggests a timeline for peak carbon emissions as a first step towards achieving carbon neutrality.

In a summary of the two policy documents, China outlines its plan to set the stage for reaching carbon neutrality by 2060, starting a reduction in carbon emissions after they peak in 2030, and reaching peak emissions and carbon neutrality by 2025.⁴⁹

IV. 2. Recent Policies Facilitating CCUS:⁵⁰

In February 2024, the Chinese Government announced three policies in order to boost the low-carbon technologies and industries. These policies facilitate the deployment of technologies like CCUS in a commercial and large-scale level. These policies become significant in assisting China’s energy-transition goals and various targets.

On 18th February, 2024, an implementation plan titled “Notice on Issuing the Implementation Plan

⁴⁸ 1+N - Policy Briefing: Working Guidance For Carbon Dioxide Peaking And Carbon Neutrality - SUSTAINABLE TRANSITION CHINA, <https://transition-china.org/mobilityposts/policy-briefing-working-guidance-for-carbon-dioxide-peaking-and-carbon-neutrality-in-full-and-faithful-implementation-of-the-new-development-philosophy/> (last visited Oct 28, 2024).

⁴⁹ Park, *supra* note 50 at 55.

⁵⁰ Recent Chinese Policy Announcements Will Help Facilitate Deployment of Low Carbon Technologies, Including CCUS, GLOBAL CCS INSTITUTE, <https://www.globalccsinstitute.com/news-media/latest-news/three-recent-policies-announced-by-the-chinese-government-will-help-facilitate-deployment-of-low-carbon-technologies-including-ccus/> (last visited Oct 28, 2024).

for the Collection and Promotion of National Key Low-Carbon Technologies”⁵¹ was announced by the country’s MEE and five other ministries in order to encourage the crucial low-carbon technologies across the country. Among the five focus areas recognised by China, CCUS is one of the key focus.

On 21st February, 2024, a guidance titled “Notice of the General Office of the Ministry of Industry and Information Technology on Issuing the Guidelines for the Construction of the Carbon Peak and Carbon Neutrality Standard System in the Industrial Sector”⁵² was issued by the Ministry of Industry and Information Technology. The guidance was framed for the creation of carbon peaking and carbon neutrality standards in the industrial sector and focused on standards including CCUS and DAC.

On 29th February, 2024, 2024 Catalogue titled “The National Development and Reform Commission and other departments issued Green and Low-Carbon Transformation Industry Guidance Catalogue (2024 Edition)”⁵³ was released by the NDRC, with nine other ministries. The catalogue included a new category of GHG emission control, including CCUS as one of the control mechanisms.

IV. 3. Need for Legal Framework:

Though the above policies and regulations exist, there is a lack of laws and regulations encouraging enterprises to implement the CCUS Demonstration Projects. These policies and regulations lack the special financial and tax assistance to the enterprises. Relevant laws and regulations pertaining to the selection, construction, operation, and geological use of demonstration project sites, as well as the evaluation and monitoring of environmental risks following the closure of storage sites, are also lacking.⁵⁴

V. CCUS POLICY FRAMEWORK IN INDIA:

Sustenance is the core of Indian ethos which emphasises a harmonious relationship with nature in sharp contrast with the concept of overconsumption prevailing in the other parts of the so-called developed nations.

As the world’s most populated country and the fifth largest economy, the energy needs of India are expected to grow making it one of the largest polluters across the world. India is the third largest

⁵¹ Notice on Issuing the Implementation Plan for the Collection and Promotion of National Key Low-Carbon Technologies, https://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202402/t20240222_1066647.html (last visited Oct 28, 2024).

⁵² Notice of the General Office of the Ministry of Industry and Information Technology on Issuing the Guidelines for the Construction of the Carbon Peak and Carbon Neutrality Standard System in the Industrial Sector, https://www.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2024/art_0d2f46b823ed4fcd93d2422ac6a4852e.html (last visited Oct 28, 2024).

⁵³ [Notice on Issuing the “Green and Low-Carbon Transformation Industry Guidance Catalogue (2024 Edition)” (NDRC [2024] No. 165)] - National Development and Reform Commission, https://www.ndrc.gov.cn/xxgk/zcfb/tz/202402/t20240229_1364291_ext.html (last visited Oct 28, 2024).

⁵⁴ ASIAN DEVELOPMENT BANK, *supra* note 45 at 8.

emitter of CO₂ in the world after China and the U.S. with an estimated emissions of about 2.6 gigatonne per annum (gtpa).

India is a signatory to the Paris Agreement and acknowledged the importance and benefits of CCUS. The Indian government has aimed to reduce carbon emissions by 50% by 2050 and to achieve a net-zero by 2070.

In India, the Department of Science and Technology (DST) promotes CCUS by giving importance to research and also focuses on improving infrastructure and technologies in order to deal with issues related to the challenges of CCUS such as high cost, power consumption, safety and logistics. DST constituted the CO₂ Sequestration Applied Research (ICOSAR) Network in 2007 as a part of their research program.

V. 1. Existing Initiatives:

CCUS has been considered as a mitigation solution to implement the National Action Plan for Climate Change, 2008 (NAPCC). India participated in 2015 in the Mission Innovation Challenge at CoP21 which dealt with CCUS research and technology.

Recent report of 2021 show that India has a great potential in the sector of CCUS by mitigating carbon emissions at low cost over the next three decades.⁵⁵ CCUS processes in India is majorly practiced by the private industries. The steel, iron and cement industries are the second largest industry emitting CO₂ in India after the energy sector.

India and USA together held a ministerial meeting on the U.S.-India Strategic Clean Energy Partnership (SCEP) between Indian Minister of Petroleum and Natural Gas and U.S. Energy Secretary in New Delhi.

The meeting highlighted the importance of bilateral energy cooperation between the two countries. The meeting consisted of discussions to reduce emissions through Low-Emissions Gas Task Force by introducing new technologies such as CCUS, alternative fuel and methane abatement technologies. Acknowledging the importance that CCUS play in decreasing emissions, the parties opted to encourage collaboration in this area by expanding on their current relationship and encouraging new ones, such as investigating the possibility for geologic carbon storage. Under the Emerging Fuels and Technology Pillar, the parties applauded the inclusion of CCUS as a work stream.⁵⁶

V. 2. Initiative to an Atmanirbhar Bharat:

⁵⁵ DST-UKRI CCUS Report.pdf, <https://dst.gov.in/sites/default/files/DST-UKRI%20CCUS%20Report.pdf> (last visited Oct 28, 2024).

⁵⁶ U.S.-India Strategic Clean Energy Partnership Ministerial Joint Statement, <https://pib.gov.in/pib.gov.in/Pressreleaseshare.aspx?PRID=2055504> (last visited Oct 28, 2024).

National Institution for Transforming India, Government of India (NITI Aayog) has come up with a report on the study of CCUS Policy Framework and its Deployment Mechanism in India which mentions the importance of CCUS as a weapon to reduce emissions to achieve the goal of decarbonisation from hard-to-abate sectors.

The report also outlines the necessary of policy interventions for implementation of CCUS. This also ensures that the nation's vision of Atmanirbhar Bharat i.e., self-reliant India is adhered to. According to the report, CCUS can offer a wide range of opportunities to transform the captured CO₂ into various value-added products, such as green urea, uses for food and drink, building materials (concrete and aggregates), chemicals (methanol and ethanol), polymers (including bio-plastics), and EOR, all of which have a large market in India and can significantly support a circular economy.

The report also provides for approaches to be adopted to promote CCUS technologies in India, which includes the following:

- Technology transfer: U.S. has already established at a commercial scale, the technologies used in CCUS. India should assimilate and adopt such proven technologies rather than reinventing the wheel. This reduces technology, operational and cost risk.
- Promoting R&D in novel technologies: The government should ensure to support research and development in CCUS as foster innovations which will help the nation is sustainable development and decarbonisation.
- Private sector participation: This step helps in promotion of the existing technology and knowledge among the private sector which helps them to commercialize CCUS in both capturing and utilisation.⁵⁷

V. 3. Need for Policy Framework:

There are no specific laws or policies relating to CCUS in India, however there are various action plans and government initiatives which promotes the development of CCUS in India. The only policy that specifically mentions about CCUS is from Ministry of Petroleum and Natural Gas which makes it compulsory for all oil fields to be assessed for potential enhanced solutions for CO₂ injection for EOR and EGR.

It is important to understand that private sector is unlikely to invest in CCUS technologies unless any incentives are provided or when there is a benefit from utilization of carbon or any credits are provided.

Clearly, India is in need of carbon incentive policy or carbon credits and a policy based on carbon tax.

⁵⁷ CCUS-Report.pdf, <https://www.niti.gov.in/sites/default/files/2022-11/CCUS-Report.pdf> (last visited Oct 28, 2024).



CCUS is a key to achieve sustainable development and reduce GHG, hence there is a requirement for financing CCUS projects.

For successful implementation of CCUS it is important to fund and support CCUS projects in various industries depending on the emission of carbon. This can be achieved with the aid of government grants and initiatives. CCUS technology at present is at an empirical stage and hence it can begin with demonstration projects to assess the viability of the proposed solutions.⁵⁸

VI. SUGGESTIONS AND CONCLUSION:

CCUS is one of the key mechanisms that can be adopted by countries in order to mitigate the long-term climate change impacts and to adhere with the sustainable development goals. It becomes highly crucial in order to ensure the reduction of CO₂ emissions and to achieve the goals of net-zero emissions.

We see speedy growth of CCUS technology in the US. There is direct government backing for projects to capture, use, and store CO₂; these projects are starting to get investment for trial runs and full-scale demonstrations.

Though coal remains the China's primary source of energy, the capacity of the nation's non-fossil power generation now surpasses that of the fossil fuels. China's wind and solar capacity reached 1,206 GW in July 2024, six years ahead of schedule, surpassing its NDC target. However, the lack of legal framework around the CCUS in China is one of the limitations to the implementation of the same.

Over the years, lack of policies in India has resulted in unintended consequences. If India being largely populated, chooses to go down this path, the climate consequences for the country and the world will be hugely negative. Therefore, India needs to follow its own path and look at the problem through its own lens if the nation is to empower its citizens through economic development while simultaneously addressing the issue of climate change. India requires considerable climate finance and technology transfer with effective international collaboration to enter this arena on any significant scale. For successful implementation of CCUS it is important to fund and support CCUS projects in various industries depending on the emission of carbon. This can be achieved with the aid of government grants and initiatives. CCUS technology at present is at an empirical stage and hence it can begin with demonstration projects to assess the viability of the proposed solutions.

⁵⁸ India_LTLEDS.pdf, https://unfccc.int/sites/default/files/resource/India_LTLEDS.pdf (last visited Oct 28, 2024).