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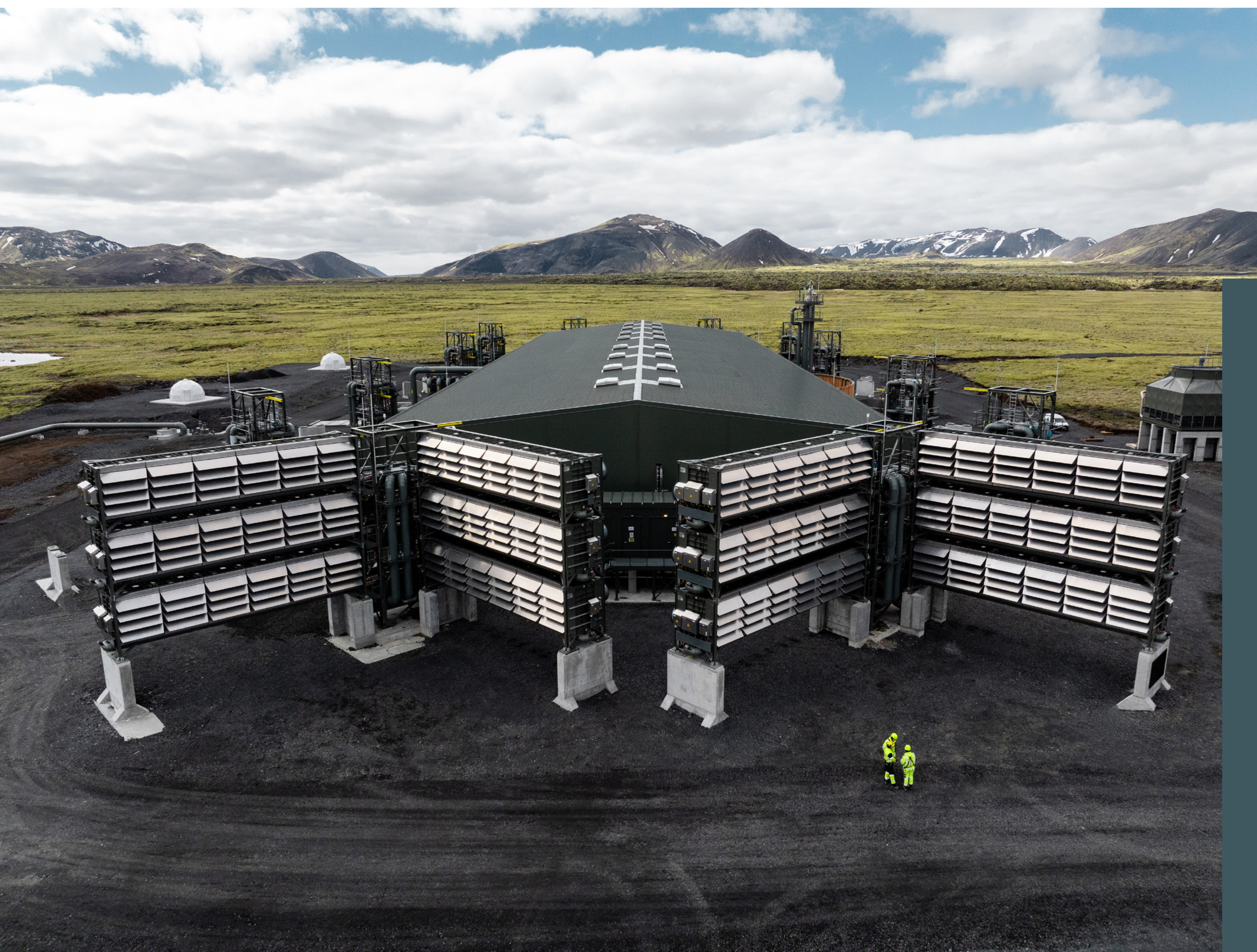

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Yingtong Li[1], Mengye Zhu[1], Xueting Peng[2], Tiruwork Berhanu Tibebu[1], Jingli Fan[3], Xinzhao Cheng[1], Sha Yu[1], Xian Zhang[2], Ryna Cui[1]

[1] Center for Global Sustainability, School of Public Policy, University of Maryland, College Park, USA
[2] The Administrative Center for China's Agenda 21 (ACCA 21), Beijing, China
[3] School of Energy and Mining Engineering, China University of Mining and Technology, Beijing, China

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LIST OF ACRONYMS AND ABBREVIATIONS

ACCA 21	The Administrative Center for China's Agenda 21
BECCS	Bioenergy with Carbon Capture and Storage
CA	California
CBO	Congressional Budget Office
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilization, and Storage
CDR	Carbon Dioxide Removal
CO	Colorado
DAC	Direct Air Capture
DACCS	Direct Air Carbon Capture and Storage
DOE	Department of Energy
DOS	Department of State
EISA	Energy Independence and Security Act
EOR	Enhanced Oil Recovery
EPA	Environmental Protection Agency
FYP	Five-Year Plan
GHG	Greenhouse Gas
GPO	Government Publishing Office
IEA	International Energy Agency
IIJA	Infrastructure Investment and Jobs Act
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
IRS	Internal Revenue Service
LCV	League of Conservation Voters
LULUCF	Land Use, Land-Use Change, and Forestry
MIIT	Ministry of Industry and Information Technology
MOST	Ministry of Science and Technology
MRV	Monitoring, Reporting, and Verification
NDC	Nationally Determined Contribution
NDRC	National Development and Reform Commission
NPC	National Petroleum Council
NSPS	New Source Performance Standards
R&D	Research and Development
RD&D	Research, Development, and Demonstration
SNG	Synthetic Natural Gas
UIC	Underground Injection Control
UNFCCC	United Nations Framework Convention on Climate Change
USDA	U.S. Department of Agriculture
USDWs	Underground Sources of Drinking Water
UT	Utah
WV	West Virginia

EXECUTIVE SUMMARY

Carbon dioxide removal (CDR) is a crucial strategy for addressing climate challenges and achieving net-zero emissions. As the world's two largest greenhouse gas (GHG) emitters and economies, the U.S. and China are essential to the global effort to scale up CDR technologies. The importance of their role was underscored by the U.S.-China Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis, announced in November 2023. This study reviewed and analyzed approximately 400 national-level and 500 subnational-level CDR-related policies from both countries. In addition, it compiled and examined information on approximately 350 CDR projects in the U.S. and China. The report offers a comprehensive overview of the CDR policy landscapes and practices at national and subnational levels, enhancing understanding of how CDR approaches contribute to mitigation strategies. It also identifies key opportunities to accelerate CDR deployment through bilateral collaboration.

The key findings of this study are as follows:

- Both countries have adopted various policy instruments to boost the research and development of CDR technologies and projects at the national and subnational levels. However, the two countries' policy approaches are different. The U.S. has implemented a diverse combination of policy tools, including regulatory instruments, government funding, tax exemption and financial subsidies, while China's approach is predominantly centered on general CDR strategies, and voluntary policies.

- The U.S. and China have CDR-related policies in specific sectors and various processes, but with uneven attention. At the national level, CDR policies in the U.S. focus on carbon capture and storage (CCS)/carbon capture, utilization, and storage (CCUS) for power plants, natural gas processing and industrial processes, with strong support for direct air capture (DAC), underground geological storage and enhanced oil recovery (EOR) as a utilization method. However, there is limited emphasis on bioenergy with carbon capture and storage (BECCS). In China, CDR policies also broadly support CCS/CCUS technologies, particularly in power plants, industrial processes, and EOR. But there is relatively little focus on DAC and BECCS, as well as on specific utilization, transportation, and storage applications. At the subnational level, U.S. states prioritize CCUS in power plants and industrial processes, EOR, and geological storage, with limited support for BECCS, while Chinese provinces generally adopt a broad approach to CDR, focusing on CCUS, EOR, and geological storage, alongside forestry and land use practices. Both countries show minimal subnational policy emphasis on BECCS, and on specific stages of the utilization, transportation, and storage value chains.

- The spatial distribution of CDR policies varies significantly across U.S. states and Chinese provinces, with differences in both policy stringency and coverage. For instance, states like Colorado, California, and Illinois have a higher concentration of CDR policies with greater stringency compared to other U.S. states. Similarly, in China, provinces such as Shanghai and Chongqing show higher policy stringency than others. In contrast, some states and provinces have few or even no policies related to CDR technologies.

- CDR projects are distributed unevenly across states and provinces, including differences in project numbers, types of CDR technologies, and development stages. In the U.S., CDR projects focus on CO_2 capture from industrial processes and natural gas processing, with additional projects targeting CCS/CCUS in power plants, as well as DAC and BECCS. Most U.S. projects store CO_2 in deep saline aquifers. In China, CDR projects mainly capture CO_2 from the chemical industry, power plants, steel production, and the oil and natural gas sectors, with CO_2 often utilized for enhanced oil recovery (EOR). In terms of development stages, some projects in both countries have reached commercial stages, while others are still in demonstration, planning, or construction phases.

Introduction

The Paris Agreement aimed to limit global temperature rise to well below 2°C and strive to limit it to 1.5°C above pre-industrial levels (UNFCCC, 2016). Meeting the Paris climate targets requires deep and widespread mitigation strategies globally. Carbon dioxide removal (CDR), capturing and durably storing carbon dioxide (CO_2) from the atmosphere, is one of the critical strategies to achieve global and national targets of net zero emissions (IPCC, 2022). Negative emission technologies, such as reforestation, biochar, bioenergy with carbon capture and storage (BECCS), and direct air capture (DAC), can remove carbon emissions already in the atmosphere and offset residual greenhouse gas (GHG) emissions from difficult-to-abate sectors (IEA, 2020). Modeling analyses indicate that achieving national net-zero emissions requires CDR methods in the long term (Smith et al., 2023). As the world's largest economies and CO_2 emitters, both the U.S. and China will likely depend on CDR as part of the overall decarbonization strategy to reach their net-zero targets around mid-century and to meet the Paris Agreement's 1.5°C commitment. These two countries have emphasized their intention to work collaboratively on CDR deployment and application of related technologies such as carbon capture, utilization and storage (CCUS) and DAC in both the U.S.-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s (2021) and the most recent Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis (2023), highlighting CDR as one of the key areas for U.S.-China cooperation and joint global leadership in addressing climate challenges (DOS, 2021, 2023).

Although CDR technologies are not yet ready for large-scale adoption due to factors such as cost, geological conditions, lack of commercialization, and policy constraints (ACCA 21 et al., 2023), both countries have introduced more CDR-related policies to incentivize and support the deployment of CDR technologies deployment following their commitments to carbon neutrality or net-zero targets. However, there has been little comprehensive review of CDR-related policies until now. Additionally, coverage and stringency of CDR-related policies across different technologies and applications have not yet been thoroughly assessed, limiting policymakers' ability to understand their impact on the development of CDR technologies and to design more effective CDR policies. This report analyzes CDR-related policies and application of CDR technologies focusing on the operational stages from carbon sources to storage/utilization (Goren et al., 2024). Carbon can be captured from various sources, including power plants, natural gas processing, industrial processes, atmospheric air, bioenergy and biomass processes. Once captured, the carbon can be stored underground or utilized for practical applications, such as enhanced oil recovery (EOR) and other utilization. In order to be comprehensive, CDR technologies in this report include carbon capture and storage (CCS), CCUS and CDR methods listed by the Intergovernmental Panel on Climate Change (IPCC) such as afforestation/reforestation, soil carbon sequestration, biochar, BECCS, DAC and ocean-based CDR methods (IPCC, 2023).

This report provides an overview of CDR policies in the U.S. and China across different technologies and applications at the national and subnational levels, along with a summary of CDR demonstration and commercialized projects. Through comprehensive analysis of different CDR technologies in policy frameworks and applications, this report provides valuable insights to better understand the roles of CDR technologies in mitigation strategies in the U.S. and China. It also identifies opportunities for scaling up CDR deployment through collaborative activities and research.

Comparative Overview of CDR Policies across Different Technologies and Applications

This section offers a comprehensive and systematic review, mapping existing CDR policies at both the federal/central level and the state/provincial level in the U.S. and China. Our goal is to address the following questions: 1) Which policy instruments are most or least frequently used to support CDR technology development? 2) Which CDR technologies are currently emphasized or preferred? 3) What are the commonalities and differences between the policy frameworks in both countries for supporting CDR technology development? The analysis encompasses policies broadly related to CDR technologies, as well as those specifically designed for various carbon capture methods and technologies, from CO_2 emission sources to utilization.

We collected and screened a total of around 900 CDR policies with the keywords of "carbon capture and storage", "carbon negative", "carbon dioxide removal" and their synonyms like "carbon sequestration", "greenhouse gas capture" and "direct air capture" from policy databases in both countries. Around 400 national policy documents, approximately 200 for each country, were selected and categorized by technology type and policy instrument dimensions (Figure 1). At the state and provincial level, 110 U.S. and 390 Chinese CDR policy documents were collected and categorized applying the same methodology(Figure 2). The types of policy instruments include strategic planning (e.g., action plans or Five-Year Plans), laws, regulatory policies (e.g., regulations and rules), incentive-based policies (e.g., government funding, carbon markets, tax credits, exemptions, subsidies, and financial benefits), and voluntary policies (e.g., pilot projects and government-sponsored programs). This study includes a broad scope of CDR technologies, including CCS, CCUS, DAC, BECCS, biochar, afforestation/reforestation, soil carbon sequestration, enhanced rock weathering and ocean-based CDR methods.

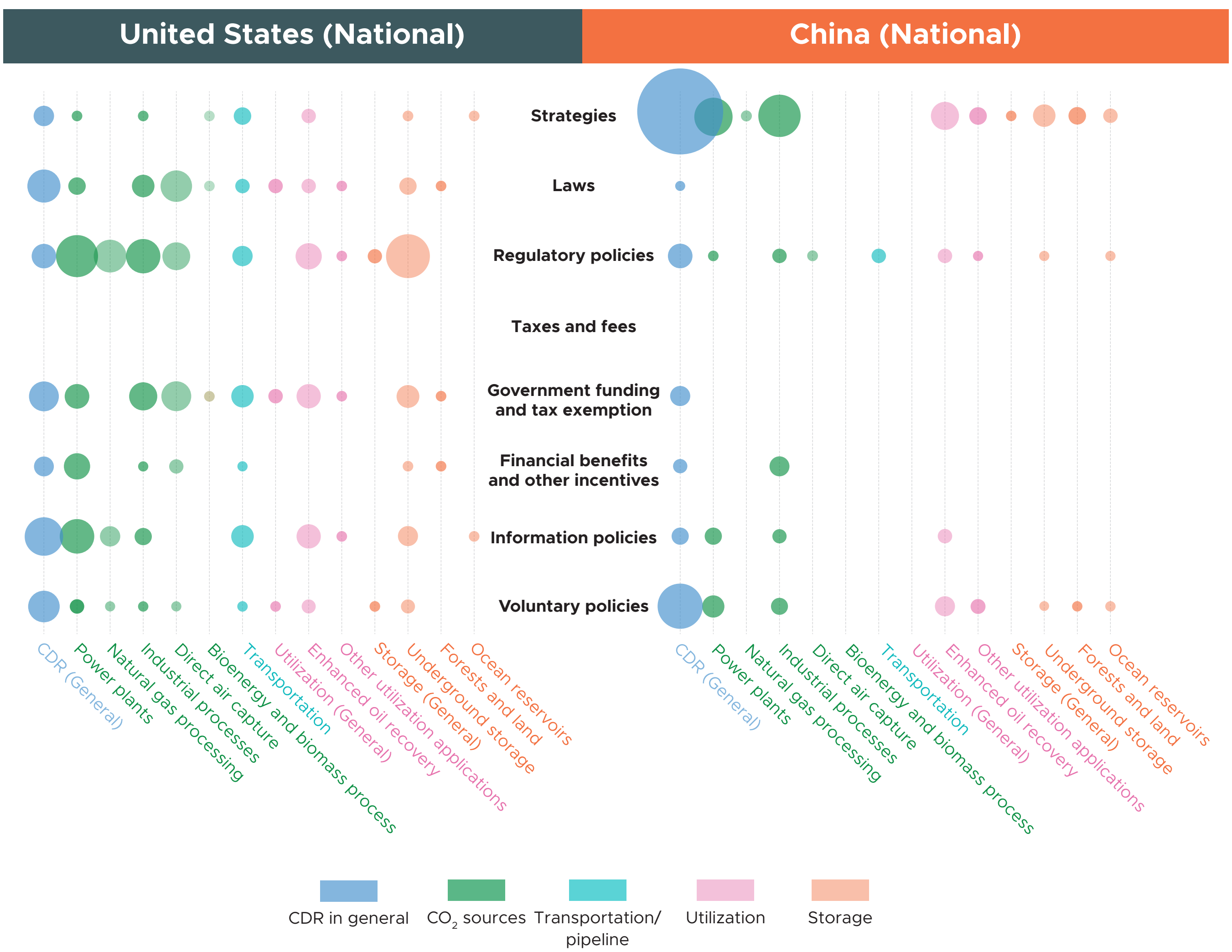
In terms of policy instruments, we classified CDR policies in the U.S. and China into four major instrument types and subsequently into eight subtypes for granularity purposes: 1) Strategic plans or strategies, such as action plans or Five-Year Plans (FYPs), set mid- to long-term goals and targets for specific policy issues; 2) Regulatory instruments are government mandates that usually employ legal tools. In the case of CDR policies, regulatory instruments include two subtypes—laws, and regulatory policies. These require compliance from regulated entities to follow rules that support CDR deployment; 3) Economic instruments are pecuniary incentives or disincentives. In this study, they include government funding and tax exemption, financial benefits and other incentives (e.g., carbon markets) as positive incentives, and taxes and fees as disincentives; 4) Soft instruments are non-mandatory or voluntary measures, including information policies and voluntary programs such as pilots, and government-sponsored programs specifically for CDR technologies and demonstration projects. Typically, laws and regulations, as well as economic instruments are more stringent than strategies or voluntary programs.

Regarding types of CDR technologies, we classified CDR policies based on the operational stages of CDR technologies: 1) CO_2 sources for capture, 2) transportation/transmission, 3) utilization, and/or 4) storage. For policies supporting technologies that target capturing CO_2 from point sources across different sectors, these can be categorized based on their sources as follows: 1) power plants (CO_2 emissions directly from power generation facilities), 2) natural gas processing (CO_2 emissions from natural gas production and processing), 3) industrial processes (CO_2 emissions from industry sectors such as cement production, steel production, chemical manufacturing processes), 4) direct air capture (removing CO_2 directly from the atmosphere), and 5) bioenergy and biomass processes (CO_2 emissions from bioenergy production such as biofuel and biomass power plants).

Some climate policies take a broad approach to support CDR technologies without targeting specific processes. In this case, these policies can be categorized as "general CDR policies". Policies that focus broadly on utilization and storage of CO_2 without specifying particular methods, can be categorized into general process categories, including "utilization (general)" and "storage (general)". Policies support CO_2 transportation pipeline and other transportation facilities fall into transportation categories. Captured carbon has several practical applications, including EOR, synthetic fuels and gas, chemical synthesis, algae cultivation, mineralization and building materials production. Since many CDR policies primarily focus on EOR, other utilization methods fall under a general category termed "other utilization applications". Policies supporting CDR storage methods are categorized based on storage environments: 1) underground storage (soil carbon sequestration and geologic sequestration in depleted oil and gas reservoirs, deep saline aquifers and abandoned mines), 2) forests and land (agricultural and forestry practices), 3) ocean reservoirs (ocean-related storage methods such as direct ocean injection and blue carbon sequestration).

Both the U.S. and China emphasize CDR technologies applied in power plants, industrial processes, and EOR at the national level. In the U.S., CCUS for power plants and industrial processes, DAC, and EOR as a form of utilization receive substantial support at the federal level. Underground geological storage—such as deep saline aquifers, depleted oil

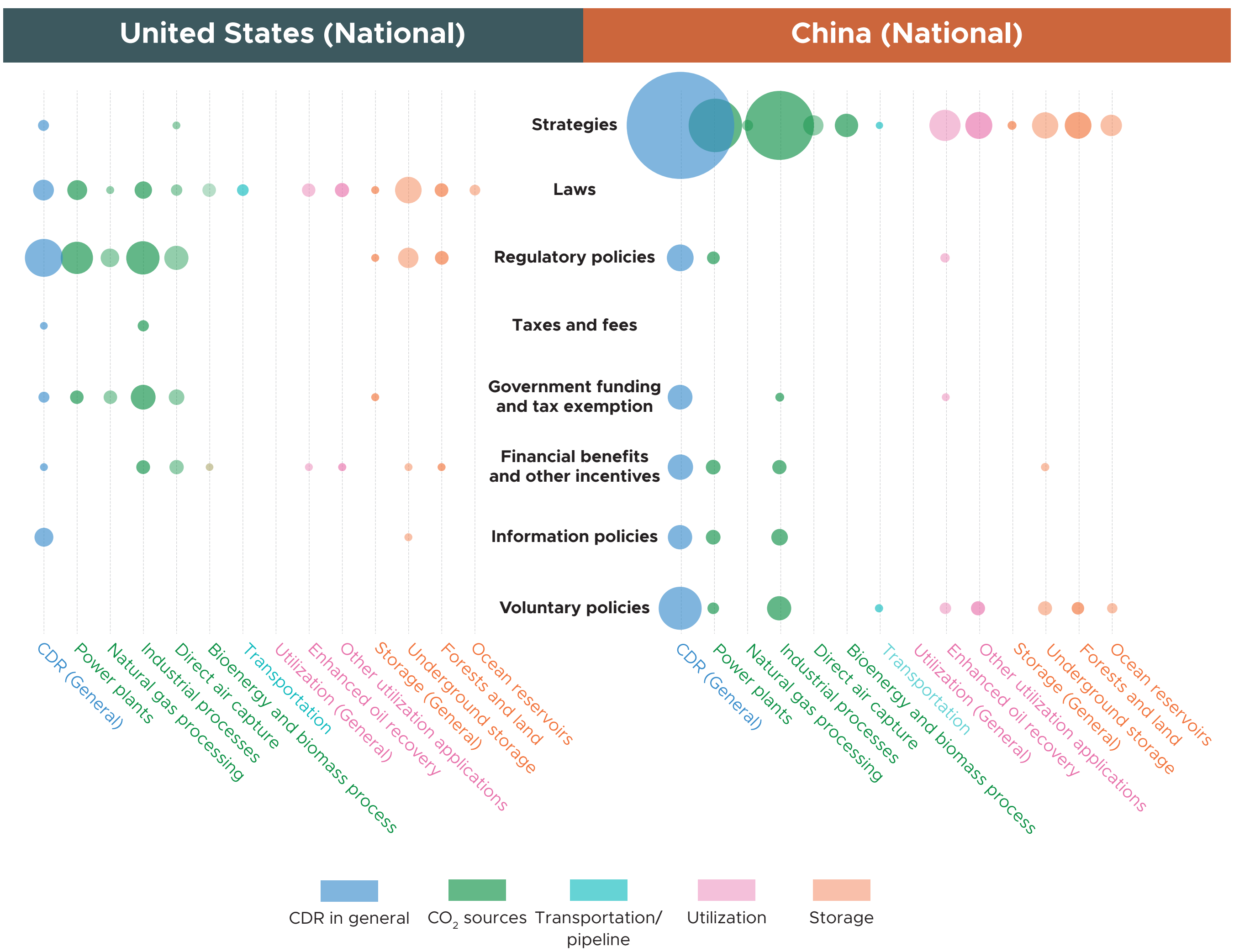
FIGURE 1: A comparison of the U.S. and China in terms of CDR-related policies by technology/application and policy instrument at the federal/central level. The size of the circle reflects the number of policies in a given policy instrument type.
Source: GovInfo Database, IEA Policy Database, PKULaw Database (GPO, 2024; IEA, 2024; PKULaw, 2024).
See the list of key policies in Appendix 1 and Appendix 2.



and gas reservoirs, and abandoned mines—is also a prominent storage method cited in various CDR policies. BECCS, however, receives limited focus in CDR-related policies. By comparison, China adopts a broad approach to CDR technologies, particularly focusing on CCUS in power plants and industrial processes, as well as EOR to enhance CO_2 utilization at the central level. For other CDR-related technologies, policies addressing DAC and BECCS are relatively scarce. National policies on utilization, transportation, and storage applications are also limited. To support CDR deployment, the U.S. has implemented a range of laws, regulatory policies, government funding, and tax incentives that promote CDR technologies and practices. In contrast, while the U.S. emphasizes laws and regulations, China relies heavily on strategies and voluntary policies, with limited government funding to support these initiatives. Overall, in terms of policy coverage and instruments at the national level, the U.S. has broader policy coverage and a variety of policy instruments, including financial incentives, whereas China's approach is less diverse, with minimal government funding as policy incentives.

At the state level, U.S. policies emphasize carbon capture technology for power plants and industrial processes, underground geological storage, and

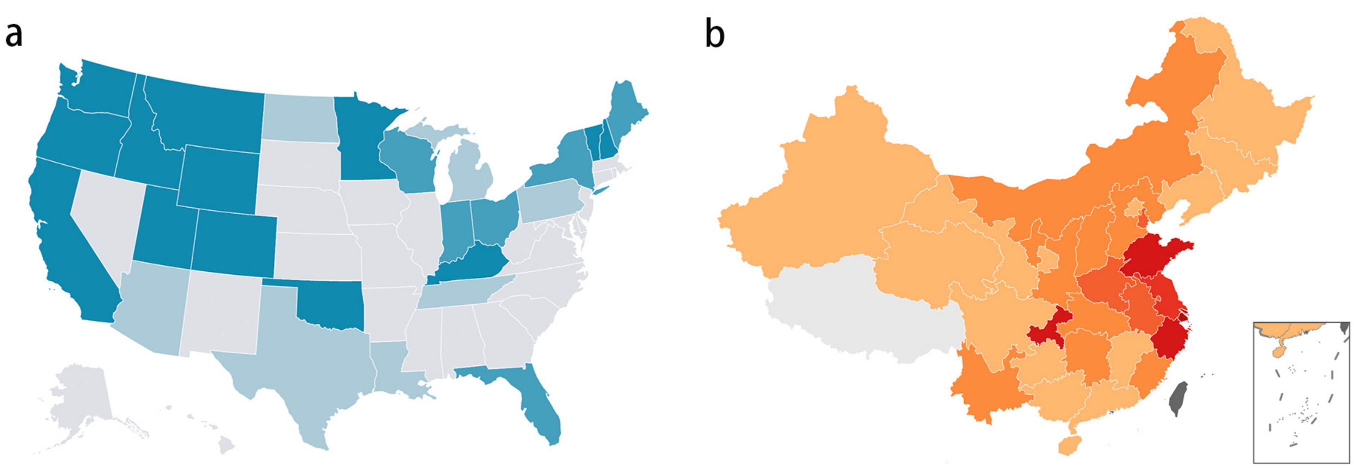
FIGURE 2: A comparison of the U.S. and China in terms of CDR-related policies by technology/application and policy instrument at the state/provincial level. The size of the circle reflects the number of policies in a given policy instrument type.
Source: RegHug Database, WestLaw Database, PKULaw Database (Mercatus Center, 2024; PKULaw, 2024; Thomson Reuters, 2024). See the list of key policies in Appendix 1 and Appendix 2.



EOR as a form of carbon utilization. China, at the provincial level, focuses on general CDR technologies, including CCUS for power plants and industrial processes, EOR, geological storage, and enhanced forestry and land use practices. Both countries place limited emphasis on DAC and BECCS technologies, with few state-level policies specifically addressing utilization, transportation, and storage. In terms of policy instruments, various U.S. states promote CDR technology deployment through laws, regulatory policies, and economic incentives, such as government funding, tax exemptions, and financial benefits. Some states have adopted innovative incentives to support CDR technology practices locally. For instance, Illinois imposes penalties for non-compliance in clean coal synthetic natural gas (SNG) carbon capture, while some states implement carbon credits to incentivize CDR technology applications. In contrast, Chinese provinces favor broader strategies and voluntary measures, with a general lack of government funding and specific financial support. In addition, the U.S. offers more mechanisms for government funding at the subnational level than China.

Figure 3 shows the spatial distribution of state/provincial CDR policies in the U.S. and China. A total of 110 CDR-related policy documents are identified in half of the U.S. states. Oklahoma, Colorado, Illinois, California, and Montana have the largest number of CDR-related policies. In China, a total of 390 CDR-related policies are identified in all provinces except for Tibet. These policies tend to be concentrated in populated areas, with Shandong, Tianjin, Zhejiang, and Chongqing having the largest number of CDR-related policies.

FIGURE 3: Spatial distribution of state/provincial CDR policies in the U.S. and China. The shading, from light to dark, indicates the number of policies. Figure 3a shows the distribution of CDR policies in the U.S., ranging from 0 to 15. Figure 3b shows the distribution of CDR policies in China, ranging from 0 to 31. Dark grey representing areas where data is not available (N/A).
Source: RegHug Database, WestLaw Database, PKULaw Database (Mercatus Center, 2024; PKULaw, 2024; Thomson Reuters, 2024).



Comparative Analysis of CDR Policy Frameworks between the U.S. an China

U.S. CDR Policy Framework

To support CDR deployment in the U.S., a range of economic incentives, regulatory measures, specific regulations, and tracking and reporting requirements have been implemented at both the federal and state levels (Appendix 1). Under the Biden Administration, the 45Q tax credits and the Department of Energy's (DOE) grant funding for specific CDR projects promote the development of CDR technologies and position CCS as a crucial component of U.S. climate policy (Lebling et al., 2022). Regulations issued by the Environmental Protection Agency (EPA) also guide the CDR technologies deployment and improve transparency through the Monitoring, Reporting, and Verification (MRV) systems at the federal level.

CDR policies at the federal level

Economic incentives

In recent years, the 45Q Credit for Carbon Sequestration, has been regarded as the most progressive CCS-specific incentive globally (Beck, 2020). It originally provided tax credits for EOR and geologic formation storage. In 2018, 45Q was reformed as part of the Bipartisan Budget Act and allowed credits for DAC and CO_2 utilization. The Internal Revenue Service (IRS) issued final regulations for claiming Section 45Q tax credits in 2021, demonstrating requirements for secure geological storage and clarifying taxpayer eligibility to claim the credits related to CCUS. The 2022 Inflation Reduction Act (IRA) also contains Section 45Q in tax incentives to boost the development of commercial projects for CCUS. It increases the maximum credit amount to $85 per ton for CCUS for industrial facilities and power plants for saline geological formations. The tax incentive also provides $60 per ton for utilization of captured CO_2 and its precursor, carbon monoxide, to produce low and zero-carbon fuels, chemicals, building materials, and other products, or for EOR. In terms of DAC, it offers tax credits from $50 to $180 per ton for DAC stored in saline geologic formations and from $35 to $130 per ton for utilization or EOR (Bipartisan Policy Center, 2022).

To accelerate the development and deployment of CDR technologies, the federal government has provided financial support to CDR-related research and programs. Under the Energy Independence and Security Act (EISA) of 2007 and the American Recovery and Reinvestment Act of 2009, R&D investment for carbon capture and sequestration technologies increased, which also provided funding for DOE's programs. Recent legislation, the Infrastructure Investment and Jobs Act (IIJA) of 2021, provides $8.2 billion in advance appropriations for CCS programs over the 2022–2026 period to support these efforts (Musick, 2023). At the same time, preferential loans are introduced in the above legislation. The DOE introduced loan guarantees for projects that employ innovative technologies in EISA (2007). The 2021 IIJA established the Carbon Dioxide Transportation Infrastructure Finance and Innovation Program, which provides 2.1 billion USD in loans for transportation (DOE, 2022). Additionally, state-level incentives, such as carbon credits, government funding, and other financial benefits, further enhance financial support for CDR-related technologies and projects.

Regulatory incentives

In 2024, the EPA finalized New Source Performance Standards (NSPS) to regulate GHG emissions from existing fossil fuel-fired power plants, as well as new, modified, and reconstructed fossil fuel-fired power plants. The NSPS (2024) highlights the importance of the implementation of carbon capture and sequestration/storage (CCS) technology to address GHG emissions from fossil fuel-fired electric generating units (Kerschner et al., 2024). Additionally, some states introduced penalties to regulate emitters. For instance, Illinois imposed penalties on clean coal SNG facilities under the Public Utilities Act of 2021 and 2022. To further facilitate CCS implementation, administrative barriers to CO_2 streams in geologic sequestration have been addressed under the EPA's Hazardous Waste Management System rule (2014), which provides a conditional exclusion for CO_2 streams in geologic sequestration activities (EPA, 2014).

Regulations

While promoting CDR technologies, it is also important to be balanced with mitigating their potential impacts on the environment and keeping robust tracking of GHG emissions. Under the EPA's Underground Injection Control (UIC) Program, the wells designed for CO_2 geologic storage need to meet the Class VI well requirements, including relative buoyancy of CO_2, subsurface mobility, corrosivity in the presence of water and large injection volumes, which aims to protect public health and underground sources of drinking water (USDWs). This rule not only establishes minimum technical criteria to protect USDWs but also addresses the impact of the long-term storage of CO_2 (EPA, 2024).

Tracking and reporting

In terms of tracking and reporting GHG emissions when applying CCS facilities, the EPA issued regulations to require owners of injection and geologic sequestration sites to report the quantities of CO_2 they inject or sequester annually, such as Mandatory Reporting of Greenhouse Gases: CO_2 captured, Stored, and Used (2009) and Mandatory Reporting of Injection and Geologic Sequestration of CO_2 (2010). These rules are a supplement to the EPA's rule for mandatory reporting of GHGs (Jones, 2021).

CDR policies at the state level

California is leading the way to promote CDR at the state level while other states such as Colorado, Oklahoma, Louisiana, and Arkansas issued legislation for the management of specific CDR technologies, including carbon capture, geological storage and bioenergy with carbon capture (Manhart, 2023). The four pillars of policy instruments mentioned above also support CDR technology deployment across states. However, it should be noted that many states lack a robust CDR policy infrastructure, and some states do not have any policies related to CDR technologies.

Economic incentives

Economic incentives play an important role in supporting CDR technologies at the state level, especially CCS/CCUS for power plants and industrial processes. Louisiana, Illinois, Washington, and Wyoming provide government funding to support R&D for CDR technologies. Kentucky offers financial subsidies to companies that construct, retrofit, or upgrade facilities to be carbon capture-ready (Kentucky General Assembly, 2024). Some states, such as Colorado, Montana, New Jersey, and Pennsylvania, offer tax credits to companies that incorporate CCUS technology in project facilities. Additionally, a few states—California, Washington, Colorado, and Illinois—use carbon markets to incentivize CCS/CCUS, DAC, and other CDR projects. (See Appendix 1 for more details).

Regulatory incentives

Several states have issued regulations requiring the implementation of CCUS and DAC facilities alongside power generation facilities. The Low Carbon Fuel Standard Amendments enacted in California mandate that carbon capture must occur onsite at crude oil production or transport facilities. (CA Air Resources Board, 2024). Other states, such as Illinois, Oregon, Washington, Wyoming, and Colorado, also outline standards for implementing projects and programs that should use CCS/CCUS technology when producing and transporting fuels. The recently enacted Clean Energy & Climate Action Package in Michigan requires natural gas plants to capture 90% of their carbon emissions. This represents one of the highest requirements for gas plants among states with similar standards across the country (Michigan LCV, 2024). The Public Utilities Act in Illinois imposes penalties on clean coal SNG facilities for non-compliance with requirements (Illinois General Assembly, 2022). The Illinois Commerce Commission requires the owner of a clean coal SNG facility to capture and sequester at least 90% of emissions annually. Failing to meet this target will result in a penalty of $20 per ton of excess emissions, capped at $40 million annually. Penalties will be deposited into the Energy Efficiency Trust Fund.

Regulations

Before implementing CDR projects, it is important to consider the environmental and public health impacts of CDR technologies. Several states have highlighted potential risks and proposed regulations to manage the processes of carbon capture, direct air capture, pipeline transportation, and storage. For example, the Economic Regulation enacted in Texas requires the state to pursue primacy for the Class VI UIC program, which mandates that wells used for carbon dioxide injection meet Class VI requirements to protect USDWs and public health (EPA, 2024). California and Utah make rules to ensure meeting adequate health and safety standards and minimize the risk of unacceptable leakage from the injection well and injection zone for carbon capture and geologic sequestration (CA Health & Safety Code, 2023; UT Division of Public Utilities, 2022).

- **Tracking and reporting**

Tracking and reporting are also essential for measuring the effectiveness of CDR deployment. Colorado's Regulation Number 22, Greenhouse Gas Reporting and Emission Reduction Requirements, mandates that a feasibility assessment of carbon capture and underground storage or utilization technology for any single emissions unit must be reported (CO Air Quality Control Commission, 2024). West Virginia also requires a performance assessment of all commercial forestland permits, evaluating productivity, carbon capture, wildlife habitat, stream and wetland biota, and hydrologic function (WV Division of Mining and Reclamation, 2021).

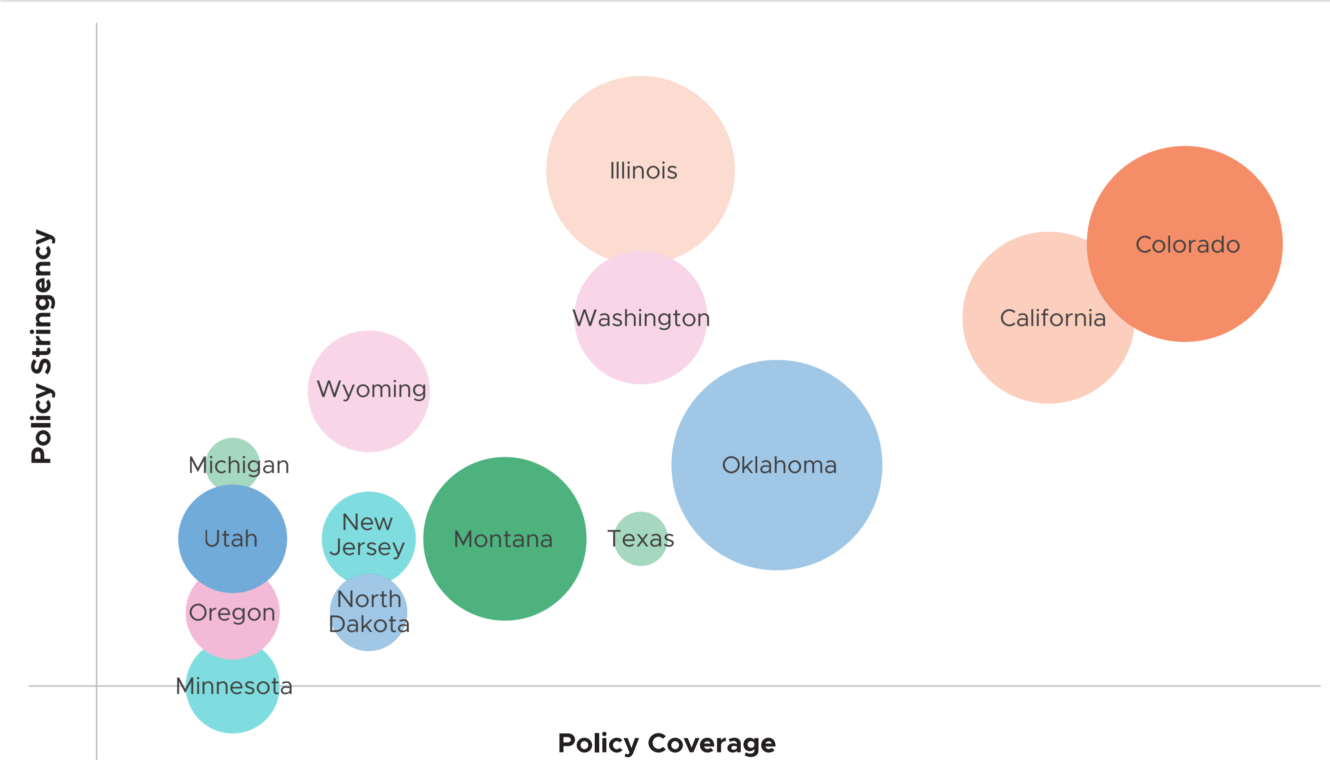
Policy coverage and stringency at the state level

The strength of CDR policies is evaluated based on two criteria: policy objectives and policy mechanisms. Policy coverage refers to the breadth of CDR technologies, applications, and supply chain processes that the policies address ("policy objectives"), while policy stringency refers to the presence and rigor of state laws, regulations, and economic incentives specifically designed to address CDR issues ("policy mechanisms") (Brunel & Levinson, 2016). Each sub-category is assigned a specific score based on the content of CDR policies and policy instruments in each state (Appendix 3). Figure 4 shows the distribution of states by coverage and stringency of their CDR policies. The size of each bubble represents the number of policies identified in the states. Colorado, California, Illinois, and Oklahoma have introduced more CDR policies than other states. Among these, Colorado, California, and Illinois have higher policy stringency, while Oklahoma has a greater number of policies but with less stringency. This is because Oklahoma mostly adopts laws and regulations to support the development and deployment of CDR technologies within its region, however there is little financial support.

China's CDR Policy Framework

As one of the largest emitters, China has set a goal to peak CO_2 emissions by 2030 and achieve net-zero emissions by 2060, requiring CDR methods to offset residual emissions (IEA, 2021). Despite its critical role in reducing carbon emissions, CDR technology practices did not attract significant attention from the Chinese government until recent years. The importance of CCUS technology for achieving carbon peaking is mentioned in China's 2030 carbon peak strategy, particularly for the iron and steel industries, power generation, and green finance. However, the application of CCUS technology is not mandated in the mitigation strategy, and there is insufficient information about its application across different sectors. Emerging CDR technologies, such as BECCS and direct air carbon capture and storage (DACCS), are not included in China's 2030 carbon peak and 2060 carbon neutrality goals. The updated Nationally Determined Contribution (NDC) briefly references some CDR methods, such as forestation and ocean-based CDR, under the UNFCCC inventory category Land Use, Land-use Change, and Forestry (LULUCF), pledging to enhance carbon sinks in the LULUCF sector (Schenuit et al., 2024). So far, China has not yet enacted any dedicated laws to support CDR-related research and the deployment of CDR technologies (IEA, 2021). In general, CDR policies and regulations are still limited in China. However, strategic planning and voluntary policies remain the two main pillars supporting the development of CDR technologies. Other incentives have also been increasing in recent years to encourage the adoption of CDR methods.

FIGURE 4: State-level policies by coverage and stringency in the U.S.
Source: RegHug Database, WestLaw Database (Mercatus Center, 2024; Thomson Reuters, 2024).



CDR policies at the national level

Strategic planning

The State Council highlighted CCUS technology as a key area for research and development, particularly within the coal mine sector, in China's National Plan to Address Climate Change in 2007. This was the first instance of CCUS technology being included in Chinese national policies, following the initial proposal of CCUS in 2006 (Wang et al., 2023). In the same year, other ministries and commissions also issued relevant policies that introduced CCS/CCUS technology as a key carbon mitigation technology, including the National Program on Climate Change and China's Special Action Plan on Science and Technology to Address Climate Change, both issued by the National Development and Reform Commission (NDRC). Since the 12th FYP (2011–2015), China has included CCUS in its national carbon reduction strategies and in its commitments under the NDC (Jiang et al., 2020). CCUS technology is listed as a key priority for research and development of low-carbon technologies in the 12th FYP (2011–2015) and the National Climate Change Response Plan (2014–2020). In recent years, the national government has announced demonstration and pilot projects as part of strategic planning to promote RD&D and the demonstration of CCS/CCUS in hard-to-abate sectors (Schenuit et al., 2024). The 13th and 14th FYPs included research and development for large-scale CCUS demonstration and pilot projects. The Innovation Action Plan of Energy Technological Revolution (2016–2030) provided strategic direction and set goals for 2030 and 2060 to achieve large-scale CCUS demonstration projects, emphasizing the importance of this technology in China's long-term carbon mitigation strategy. The National Development and Reform Commission (NDRC), the Ministry of Industry and Information Technology (MIIT), and other ministries have also identified key areas for CCUS demonstration and pilot studies in their published strategies.

Voluntary policy

The application of CCS/CCUS technology is primarily linked to CO_2 point sources from power plants and industrial processes. CCS/CCUS demonstration and pilot projects focus on geological storage, ocean-based storage, and EOR utilization, supported by policies such as the Special Plan for National Science and Technology Development in Response to Climate Change during the 12th FYP period, the Action Plan for Addressing Climate Change in the Industrial Sector (2012–2020), the Plan for Green Industrial Development (2016–2020), and the Action Plan for Clean and Efficient Utilization of Coal (2015–2020).

Guidelines for demonstrating CCUS technology are also included in national policies, such as the Notice of the General Office of the Ministry of Environmental Protection on Strengthening Environmental Protection Work for Carbon Capture, Utilization, and Storage Experimental Demonstration Projects, the Notice of the National Development and Reform Commission (NDRC) on Promoting Carbon Capture, Utilization, and Storage Pilot Demonstration, and the 12th FYP for the Development of National Carbon Capture, Utilization, and Storage Technology. These guidelines also raised awareness of the environmental impacts associated with CCS/CCUS technology during demonstration and pilot projects.

In addition to supporting the development of CCS/CCUS demonstration and pilot projects, the NDRC, the Ministry of Science and Technology (MOST), and other ministries have encouraged cooperation with major developed countries and international organizations, such as the European Union, in areas including research and development of CCUS technology, demonstration and pilot projects, capture and storage capacities and standards, and the establishment of environmental and security policies (MOST, 2013). Other policy instruments, such as standards, financial incentives, subsidies, and tax exemptions, have supported the research and development of CCS/CCUS at the national level in recent years.

CDR policies at the provincial level

Similar to the national level, CCS/CCUS technology and demonstration projects receive broad support through strategies and voluntary policies at the provincial level. Provincial CDR-related policies are designed based on key policies issued by the central government. Following the earliest climate policies related to CDR technologies in 2007, Guizhou Province launched the first provincial CDR policy, Notice of The People's Government of Guizhou Province on Climate Change Response Plan, in 2008. In recent years, some provinces also offered government funding, financial incentives, and tax exemptions to promote the RD&D of CDR technologies, such as Notice of Hebei Provincial Department of Finance and Hebei Provincial Department of Science and Technology on Adjusting and Distributing Part of the 2023 Special Fund for Technological Innovation Guidance, the 14th FYP for the Development of the Financial Industry in Hubei Province, Action Plan for Promoting Green Finance Development and Serving Carbon Peaking and Carbon Neutrality Strategies in Shanghai's Banking and Insurance Industry during the 14th FYP Period. In 2023, Shandong Province and Tianjin were the first to introduce carbon markets to incentivize the commercialization of CCS/CCUS technology.

Strategic planning

To support technological innovation in CDR technologies and the development of demonstration and pilot studies, national strategies play an important role in provincial strategic planning. For instance, Chongqing and Heilongjiang Provinces have both issued their 14th FYP for Science and Technology Innovation (2021–2025) at the provincial level to promote research and development of new materials and innovative processes for CCUS applications. Some provinces encourage the application of CCUS technology in the industrial and energy sectors within their provincial strategies, such as the Implementation Plan for Carbon Peaking in the Industrial Sector for Anhui, Jiangsu, and Shanxi Provinces; the Science and Technology Support Carbon Peak and Carbon Neutrality Implementation Plan in Henan and Hunan Provinces; and the Implementation Opinion for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy issued by Shanghai, Sichuan, Qinghai, Zhejiang, and other provinces. These provincial plans align with national objectives and facilitate the advancement of CCUS technology, which is critical for achieving carbon peaking and carbon neutrality. Additionally, emerging CDR technologies ,such as DACCS and BECCS are included in the strategic plans of several provinces, including Chongqing, Beijing, Jiangxi, Heilongjiang, Shanxi, and the Ningxia Hui Autonomous Region.

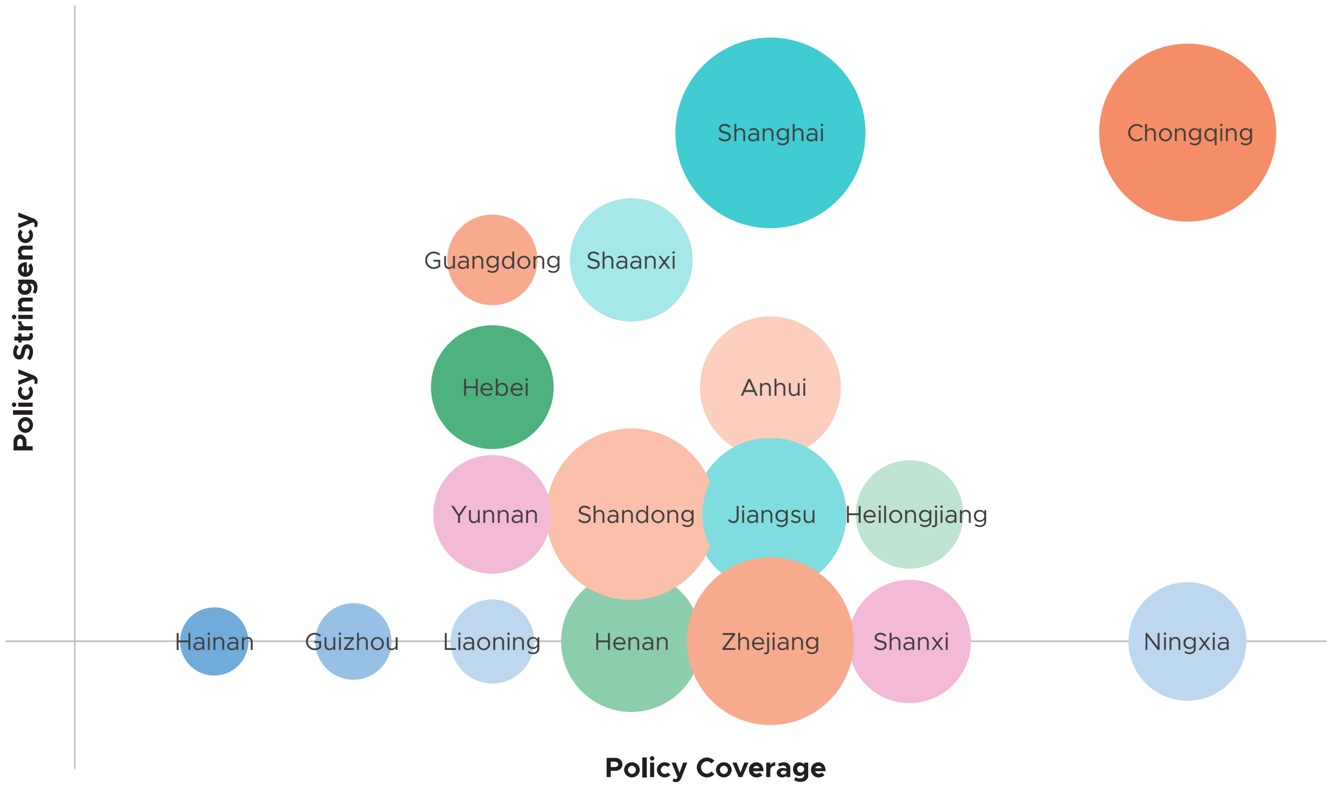
- **Voluntary policy**

To encourage research and development of CDR-related technologies, many provinces have issued voluntary policies to incentivize pilot studies and promote demonstration projects for CDR technologies. Guangxi and Zhejiang Provinces, for example, have both issued voluntary policies to support demonstration projects focused on the application of forestry science and technology, including reforestation, afforestation, and the use of advanced techniques for forest management. Some provinces have also established standards or guidelines for the application of CDR technology demonstration projects to ensure effective project implementation. Examples include the Notice of Yunnan Provincial Department of Science and Technology on Issuing Guidelines for Application of 2023 Science and Technology Plan Projects in Key Fields such as Biomedical Science and Technology, the Notice of the Office of the Development and Reform Commission of Henan Province on Organizing the Application for Green and Low Carbon Advanced Technology Demonstration Project, the Notice from the Department of Science and Technology of Fujian Province on the Release of the 2022 Xinjiang Uygur Autonomous Region Science and Technology Project List, and the Notice of Anhui Provincial Department of Science and Technology on Organizing the Application for Anhui Province Science and Technology Support Carbon Peak and Carbon Neutrality Science and Technology Innovation Special Project (First Batch). These voluntary policies help establish best practices for project design, monitoring, and evaluation regarding carbon capture, storage, and utilization in key areas at the provincial level.

Policy coverage and stringency at the provincial level

To assess the strength of CDR policies at the provincial level, the same approach is used to measure policy coverage and stringency in each province (Appendix 3). Compared to the U.S., the overall stringency of CDR policies in China is lower. About one-third of provinces lack dedicated policies to support and incentivize the development of CDR technologies. The policy stringency in Shanghai and Chongqing is higher than in other provinces. Although Ningxia has introduced CDR policies across various technologies and applications, these policies remain primarily strategic, lacking immediate action and enforcement mechanisms to effectively support the implementation of CDR technologies.

FIGURE 5: Provincial level policies by coverage and stringency in China.
Source: PKULaw Database (PKULaw, 2024).



Overview of CDR Projects in the U.S. and China

CDR projects in the U.S.

The first CDR facility in the U.S. is the Terrell Natural Gas Processing Plant in Texas, which has been operating since 1972 (NPC, 2019). Most early CCS/CCUS projects were developed to capture CO_2 and use it to enhance oil recovery from existing fields. Over the past 10 years, CCS/CCUS projects have increased rapidly due to Congressional appropriations (CBO, 2023). The DOE, USDA, EPA, and other national government agencies have allocated funding and grants to support CDR projects under federal policies and programs, such as the American Reinvestment and Recovery Act, the Bipartisan Infrastructure Law, the IRA, and the IIJA. Recently, the U.S. government announced new funding and tax credits to promote the research and development of innovative CDR technologies, including the deployment of DAC Hub facilities, scaling up to commercialization, and supporting low-cost bioethanol facilities (DOE, 2023). There are currently approximately 250 CDR projects in the U.S. Figure 5 shows the distribution of CDR projects across different states, with Texas, Louisiana, and California having a high concentration. Texas has the largest number of CDR projects, with up to 37 projects, including 24 that have reached the commercialization stage.

Figure 7 summarizes the CDR projects based on their CO_2 point source, capture/storage capacity, storage/utilization types, and development stages. Most projects capture CO_2 from sources such as power plants, oil and natural gas operations, and industrial processes for geological storage or EOR utilization. Many CDR projects have scaled up to the commercialization stage and enjoy broad market support.

FIGURE 6: CDR projects in the U.S.
Source: Global CCS Institute Database, Clean Air Task Force Database (Clean Air Task Force, 2024; Global CCS Institute, 2024).

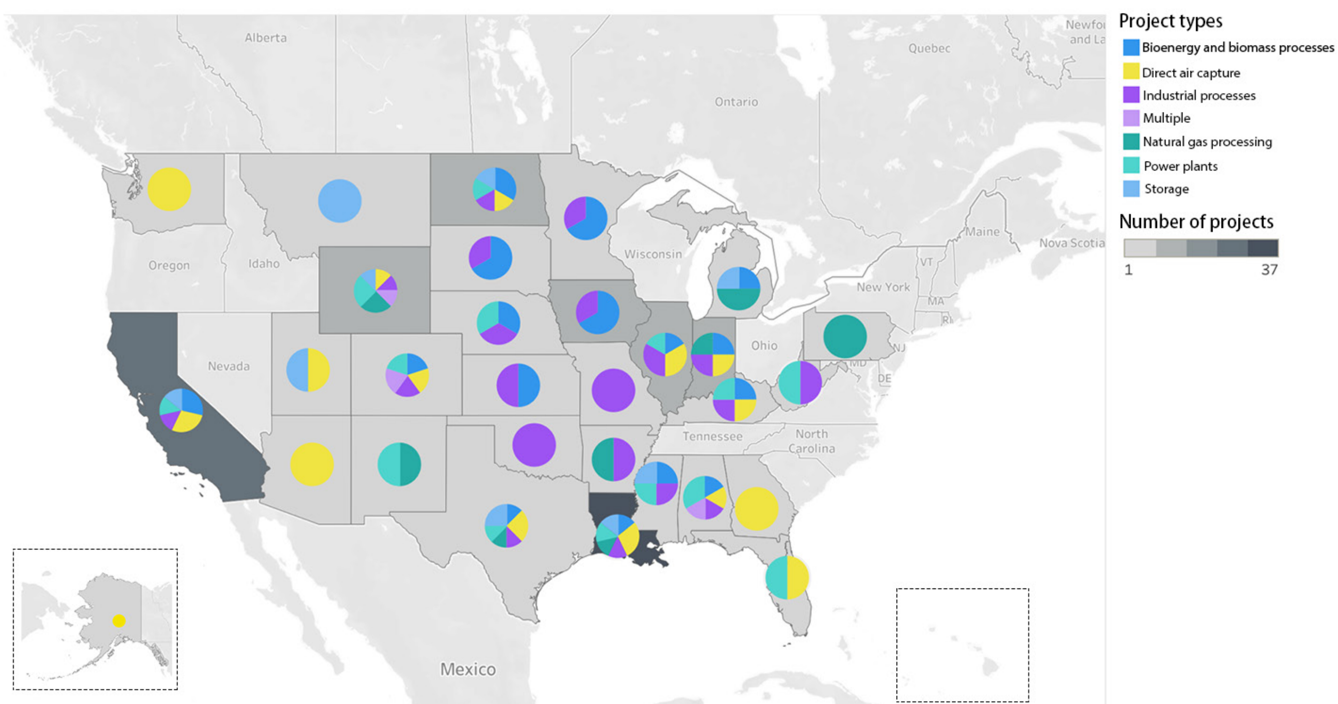
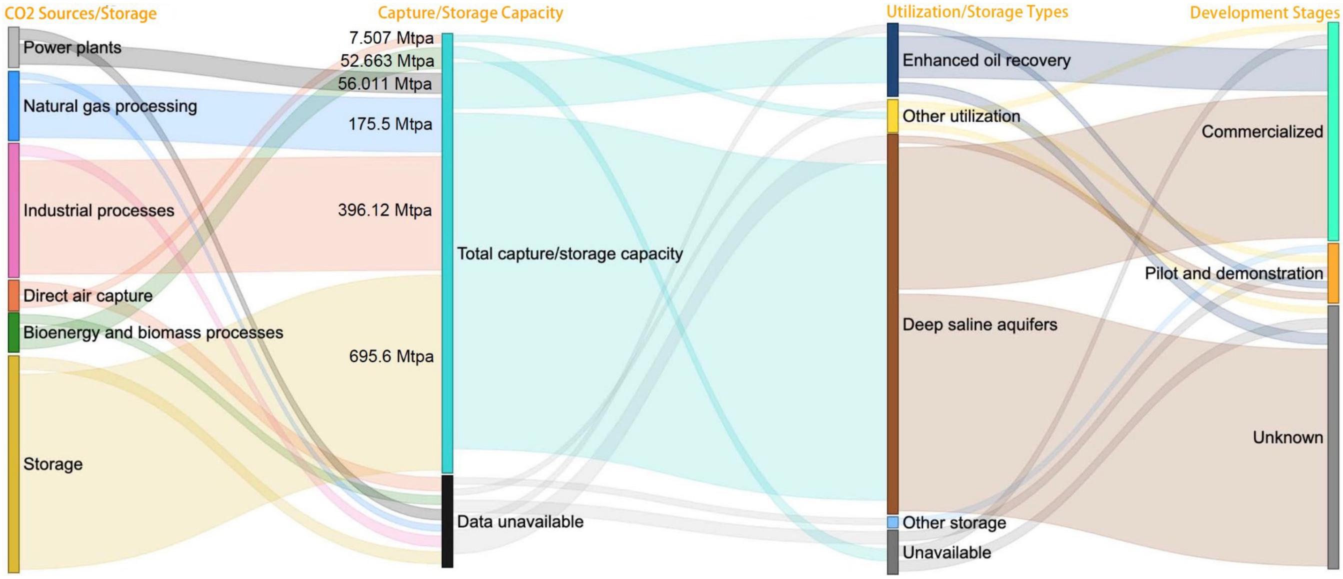


FIGURE 7: U.S. CDR projects flow diagram.
Source: Global CCS Institute Database, Clean Air Task Force Database (Clean Air Task Force, 2024; Global CCS Institute, 2024).



CDR projects in China

Although China's CDR projects started relatively late compared to those in the U.S., CCUS demonstration projects have made significant progress in recent years (Jiang et al., 2020). China's earliest CCUS efforts primarily focused on EOR, similar to those in the U.S., with initial projects mainly targeting large industrial sources such as power plants, steel production, and the chemical industry. Additionally, China has begun exploring novel CDR technologies like DAC, as DACCS can enhance the country's negative emissions capacity, especially given sustainability-related limitations on bioenergy supply (Kim et al., 2024). By 2022, China had approximately 100 CCUS demonstration projects at various stages of operation or planning, with nearly half of these projects already operational (ACCA 21 et al., 2023). These projects are primarily in the power sector, oil and gas sector, and other industrial sectors, such as the chemical industry, cement production, and steel production. Due to variations in CO_2 storage capacity, as well as differences in energy and agricultural systems, CDR deployment and technology composition vary across provinces (Figure 8). A higher concentration of CDR projects is found in Xinjiang, Inner Mongolia, Shanxi Province, and Jiangsu Province. Some CDR projects are also located in central China, including Shanxi Province, Shaanxi Province, and Henan Province.

With the rapid development of CCUS demonstration projects in China, capture and storage capacities are expected to increase significantly as these projects become operational (Figure 9). For example, China's first Mtpa-scale CCUS project, the Qilu Petrochemical-Shengli Oilfield project, officially began operation in August 2022. Other large-scale projects, including a 1.5 Mt coal power CCUS project in Gansu by Huaneng, CNPC's projects at Daqing Oilfield (1.4 Mtpa) and Jilin Oilfield (1 Mtpa), and a 5 Mt project led by Shaanxi Yanchang Petroleum, are currently in planning or construction stages (ACCA 21 et al., 2023).

FIGURE 8: CDR projects in China
Source: ACCA 21 in-house data

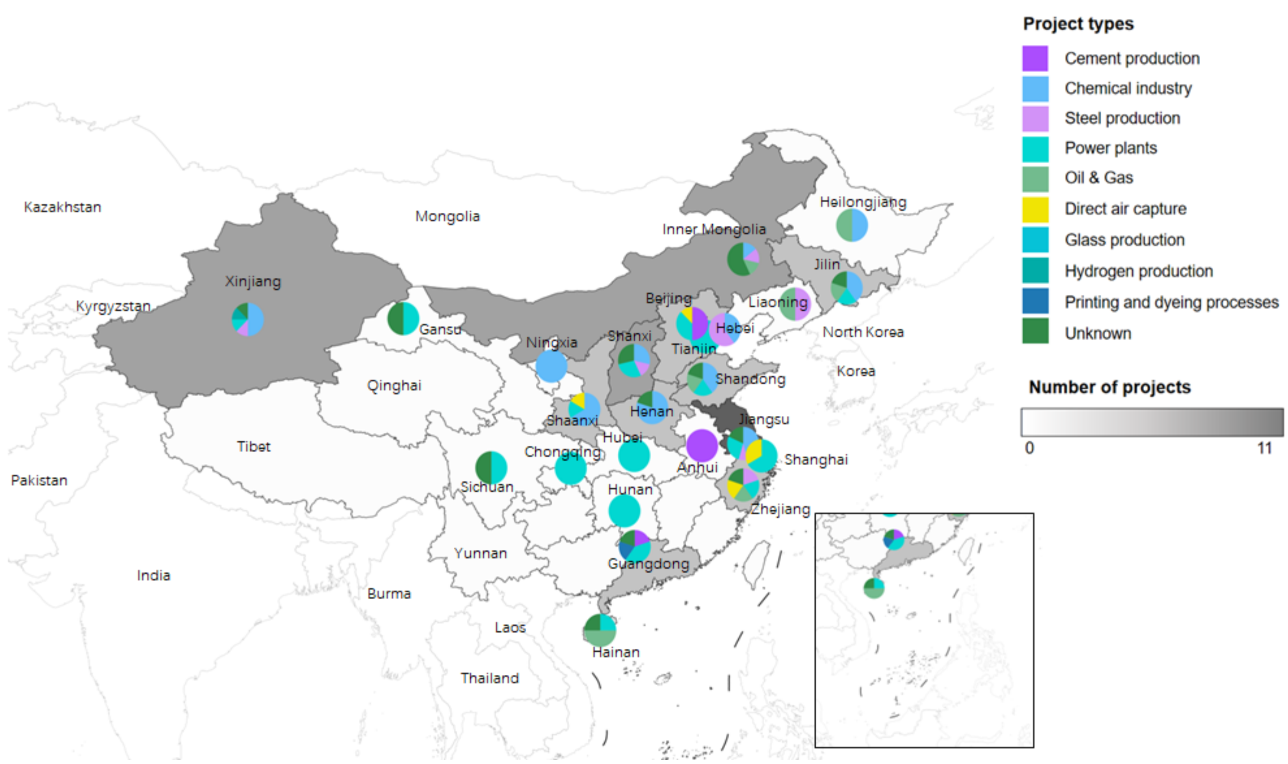
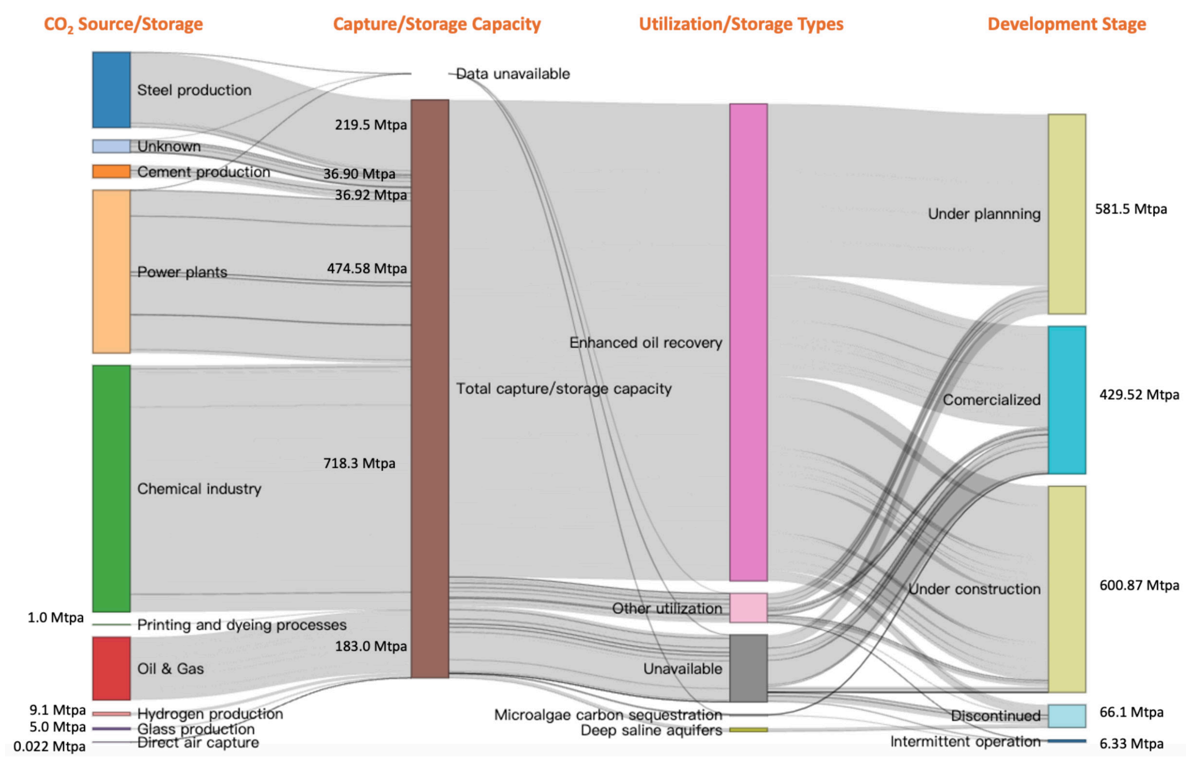


FIGURE 9: China CDR projects flow diagram.
Source: ACCA 21 in-house data



Conclusion and Policy Recommendations

An exploration of CDR policies and practices in the U.S. and China reveals that both countries have utilized various policy tools to boost the development of CDR technologies and support CDR projects at national and subnational levels in recent years. However, commonly used policy instruments in the U.S. and China differ significantly. Federal laws and diverse economic incentives, particularly the 45Q tax credits under the IRA, are driving state-level interest in developing CDR frameworks in the U.S., while China has primarily focused on strategic planning and voluntary programs. At the subnational level, many states and provinces lack basic climate policies tailored to CDR technologies and practices. CDR projects in both countries capture CO_2 point sources mainly from industrial sectors, including power plants, oil and gas, and the chemical industry. In the U.S., most captured CO_2 is stored in deep saline aquifers, whereas in China, it is primarily used for EOR.

For emerging CDR technologies such as DAC, BECCS, and ocean sequestration, dedicated national laws and economic incentives are essential to support experimentation and practical implementation. To effectively scale up technology deployment and commercialize CDR projects, it is crucial for the U.S. and China to collaborate on CDR policy design and the transition of demonstration projects to commercial stages. Their shared experiences and mutual policy learning will not only accelerate national efforts but also contribute to global CDR development. Based on the review and analysis in previous sections, several policy recommendations are identified to address existing policy gaps and promote collaborative opportunities for the U.S. and China in developing and applying CDR technologies.

Filling existing CDR policy gaps

Both countries should address policy gaps in carbon storage and utilization and adopt more policies that directly promote pilot studies and demonstration projects for CDR technologies. Given regional diversity in resources and socio-economic conditions at subnational levels, it is essential for both countries to incorporate local contexts into policy design and promote policy experiments that allow for adaptive learning and innovation tailored to specific regional needs. This approach will ensure that new initiatives align with existing local priorities and conditions.

Establishing clear standards for CDR deployment

Both countries need to establish clear standards for CDR technologies to enable consistent comparisons of CDR deployment across different regions and nations. To scale up CDR deployment, it is important to set carbon emissions standards for new facilities and establish safety criteria for CO_2 transportation and storage. Engaging stakeholders across sectors in developing these standards is essential to ensure they are comprehensive and widely accepted. Additionally, robust management and reporting standards are necessary to ensure the effectiveness and accountability of CDR initiatives within climate mitigation efforts. Implementing consistent and transparent MRV systems will enable accurate assessments of CDR performance.

Diversifying policy instruments for CDR technologies

To effectively promote the research and development of CDR technologies, it is crucial to implement a comprehensive policy framework. Governments should provide a range of funding options tailored to specific CDR technologies, including grants, subsidies, and low-interest loans, to encourage innovation and development across different sectors. In addition to financial support, legislative and regulatory measures are essential. These measures, by providing clear guidelines, create a holistic framework for implementing CDR technologies while safeguarding the environment from potential negative impacts.

Since many CDR technologies are new to the public, information policies should be introduced to raise awareness and promote understanding of these innovative technologies and their applications. Additionally, pilot studies and demonstration projects should be encouraged not only through financial incentives but also through voluntary programs to demonstrate the effectiveness and feasibility of CDR technologies in various sectors.

Promoting private investment and public-private partnerships in CDR technologies

It is essential to promote private investment in CDR projects and to develop demonstration projects into commercial operations. Collaboration between public and private sectors facilitates scaling up CDR deployment, particularly for emerging CDR technologies, which require significant research and development (R&D) investment. Simplifying procedures and regulations for business operation approvals can encourage more private capital investment into carbon removal markets. Regular dialogue between government entities and private companies can strengthen cooperation and identify opportunities for collaboration.

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Appendix

Appendix 1 U.S. CDR Policy Framework

Policy Instrument		Federal Level CR Policies	State Level CDR Policies
Laws	**Dedicated Act**	Inflation Reduction Act (2022) Infrastructure Investment and Jobs Act (2021) Utilizing Significant Emissions with Innovative Technologies Act (2020) Bipartisan Budget Act (2018) American Recovery and Reinvestment Act (2009) Energy Independence and Security Act (2007)	Colorado Carbon Management Act (2023) Oklahoma Carbon Sequestration Enhancement Act (2001) Oklahoma Carbon Capture and Geologic Sequestration Act (2009) Louisiana Geologic Sequestration of Carbon Dioxide Act (2009) Louisiana Carbon Capture and Sequestration (2023) Arkansas Laws Act 693 regarding bioenergy and carbon capture technology (2023) California (in progress): Carbon Dioxide Removal Market Development Act (SB308) New York (in progress): Carbon Dioxide Removal Leadership Act (CDRLA)
Economic Incentives	**Government funding, tax credits, financial benefits**	Bipartisan Budget Act (2018) Utilizing Significant Emissions with Innovative Technologies Act (2020) Inflation Reduction Act (2022) Energy Independence and Security Act (2007) American Recovery and Reinvestment Act (2009) Infrastructure Investment and Jobs Act (2021) Loan Guarantees for Projects that Employ Innovative Technologies (2007)	Kentucky: Incentives for energy-related business Act (2021) Colorado: an act concerning tax policy that advances decarbonization (2023) Illinois: An act concerning appropriations (2023) Louisiana Carbon capture and sequestration (2023) Montana: an act providing property tax incentives for alternative fuel production (2023) New Jersey: An act concerning the purchase and use of low embodied carbon concrete and supplementing (2023) Pennsylvania: An act relating to tax reform and State taxation by codifying and enumerating certain subjects of taxation and imposing taxes thereon (2023) Washington: WA LEGIS 475 (2023) Wyoming: Enrolled act no. 37, house of representatives (2023)

Policy Instrument		Federal Level CR Policies	State Level CDR Policies
	Carbon markets		California: Air Resources Board (2022) Washington: Transportation Fuel Clean Fuels Program (2022) Colorado: Regulation Number 27 Greenhouse Gas Emissions and Energy Management for the Manufacturing Sector (2024) Illinois: Public Act 103-0563 An act concerning State government (2023)
Regulatory Incentives	**Regulatory incentives**	New Source Performance Standards for Greenhouse Gas Emissions From New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions From Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule (2024) Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO2) Streams in Geologic Sequestration Activities (2014)	California: Low Carbon Fuel Standard Amendments (2024) Illinois: Clean Coal FutureGen for Illinois Act (2011) Oregon: Oregon Clean Fuels Program (2021) Washington: Transportation Fuel Clean Fuels Program (2022) Wyoming: Reliable and Dispatchable Low-Carbon Energy Standards (2022) Colorado:Regulation Number 27 Greenhouse Gas Emissions and Energy Management for the Manufacturing Sector (2024) Michigan: Clean Energy & Climate Action Package (2023)
	Penalties for non-compliance		Illinois Public Utilities Act (2022)
Regulations	**Regulations on CDR impacts**	Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells (2010)	California: Carbon Sequestration (2022) Colorado: Regulation Number 22 Colorado Greenhouse Gas Reporting and Emission Reduction Requirements (2022) Illinois: Public Utilities Act (2022) North Dakota: Mineral Exploration and Development (2021) Ohio: State Highways - Use; Obstruction (2021) Oklahoma: Carbon Capture and Geologic Sequestration Act (2009) West Virginia: West Virginia Surface Mining Reclamation (2021) Texas: Economic Regulation (2023) Utah: Energy Resource Procurement Act (2022)

Appendix 2 China's CDR Policy Framework

Policy Instrument	National Level CDR Policies	Provincial Level CDR Policies
Strategic Planning	China's National Plan to Address Climate Change (2007) Action Plan for Carbon Dioxide Peaking Before 2030 (2021) 12th Five-Year Plan (2011) 13th Five-Year Plan (2016) 14th Five-Year Plan (2021) Action Plan for Addressing Climate Change in the Industrial Sector (2012-2020) (2012) National Climate Change Response Plan (2014-2020) (2014) Action Plan for Addressing Climate Change in the Industrial Sector (2012-2020) (2012) Innovation Action Plan of Energy Technological Revolution (2016-2030) (2016) Catalog of Low Carbon Technologies Key for National Promotion (2014) Catalog of Encouraged Key Environment Protection Technology and Equipment (2011)	Chongqing's 14th Five-Year Plan for Science and Technology Innovation (2021-2025) (2022) Heilongjiang Province's 14th Five Year Plan for Science and Technology Innovation (2021-2025) (2021) Anhui Province's Implementation Plan for Carbon Peaking in the Industrial Sector (2022) Shanxi Province's Implementation Plan for Carbon Peaking in the Industrial Sector (2023) Jiangsu Province's Implementation Plan for Carbon Peaking in the Industrial Sector (2023) Henan Province's Science and Technology Support Carbon Peak and Carbon Neutrality Implementation Plan (2022) Hunan Province's Science and Technology Support Carbon Peak and Carbon Neutrality Implementation Plan (2022) Shanghai's Implementation Opinion for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy (2022) Sichuan Province's Implementation Opinion for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy (2022) Qinghai Province's Implementation Opinion for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy (2022) Zhejiang Province's Implementation Opinion for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy (2022)

Policy Instrument	National Level CDR Policies	Provincial Level CDR Policies
Voluntary Policy	Special Plan for National Science and Technology Development in Response to Climate Change during the 12th Five-Year Plan period (2012) Plan for Green Industrial Development (2016-2020) (2016) Action Plan for Clean and Efficient Utilization of Coal (2015-2020) (2015) Notice of the General Office of the Ministry of Environmental Protection on Strengthening the Environmental Protection Work of Carbon Capture, Utilization, and Storage Experimental Demonstration Projects (2013) Notice of National Development and Reform Commission (NDRC) on Promoting Carbon Capture, Utilisation and Storage Pilot Demonstration (2013)	Notice of the Beijing Municipal Bureau of Ecology and Environment on soliciting pilot projects for advanced low-carbon technologies in Beijing in 2022 (2022) Notice of the Office of the Forestry Bureau of Guangxi Zhuang Autonomous Region on Carrying out the Application Work for the 2023 Autonomous Region Forestry Science and Technology Promotion Demonstration Project (2022) Action plans for Shanghai to promote the development of green and low-carbon industries, cultivate a new track of the "metaverse", and promote high-quality development of the intelligent terminal industry (2022) Notice of the Office of the Development and Reform Commission of Henan Province on Organizing the Application for Green and Low Carbon Advanced Technology Demonstration Project (2023) Implementation Plan for Improving the Evaluation Mechanism of Scientific and Technological Achievements (2022)

Appendix 3 CDR Policy Coverage and Stringency: Criteria and Score

Criteria		Score Mechanism	Value for each state/ province
Policy Coverage ("Policy Objects")	CDR (General)	For each criteria of policy coverage, Assign 1 if at least 1 policy in that state/ province mentions it; 0 if not	Sum of all coverage values (Max = 9, Min = 0)
	Power plants		
	Natural gas processing		
	Industrial processes		
	Direct air capture		
	Bioenergy and biomass process		
	Transportation		
	Utilization		
	Storage		
Policy Stringency ("Policy Mechanism") *Strategies, informative policies, and voluntary policies are excluded	Dedicated laws	For each criteria of policy stringency, Assign 1 if at least 1 policy in that state/ province belongs to the respective policy instrument; 0 if not	Sum of all stringency values (Max = 8, Min = 0)
	General Environmental Laws		
	Regulatory policies (Standard and Procedures)		
	Regulatory incentives		
	Regulations		
	Taxes and fees		
	Government funding and tax credits		
	Financial benefits and other incentives		

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University of Maryland
7805 Regents Drive, Third Floor
College Park, Maryland 20742