NOIA POLICY PAPER

CARBON CAPTURE, USE, & STORAGE

An Economic, Employment, and Climate Opportunity for the U.S. Offshore Region

WHY CARBON CAPTURE, USE, & STORAGE?

Progress towards addressing the climate challenge will depend upon increased innovation, conservation, efficiency, resiliency, mitigation, and adaptation. Carbon capture, use, and storage (CCUS) is an innovative approach to mitigating greenhouse gas emissions. The wide-spread deployment of CCUS will be critical for achieving the climate change ambitions and goals that have been established by a diverse group of stakeholders around the world. CCUS can serve as an important tool for balancing environmental, economic, and energy needs. U.S leadership in CCUS will help ensure the availability of abundant, reliable, and affordable domestic energy, while continuously driving down emissions.

According to the National Petroleum Council (NPC):

CCUS is an essential element in the portfolio of solutions needed to change the emissions trajectory of the global energy system. In its Fifth Assessment Report, the IPCC concluded that the costs for achieving atmospheric CO_2 levels consistent with holding the increase in average global temperature to 2 degrees Celsius—referred to as a "2-degree Celsius world"—will be more than twice as expensive without CCUS.

According to the International Energy Agency:

Carbon capture, utilisation and storage (CCUS) technologies offer an important opportunity to achieve deep carbon dioxide emissions reductions in key industrial processes and in the use of fossil fuels in the power sector. CCUS can also enable new clean energy pathways, including low-carbon hydrogen production, while providing a foundation for many carbon dioxide removal (CDR) technologies.

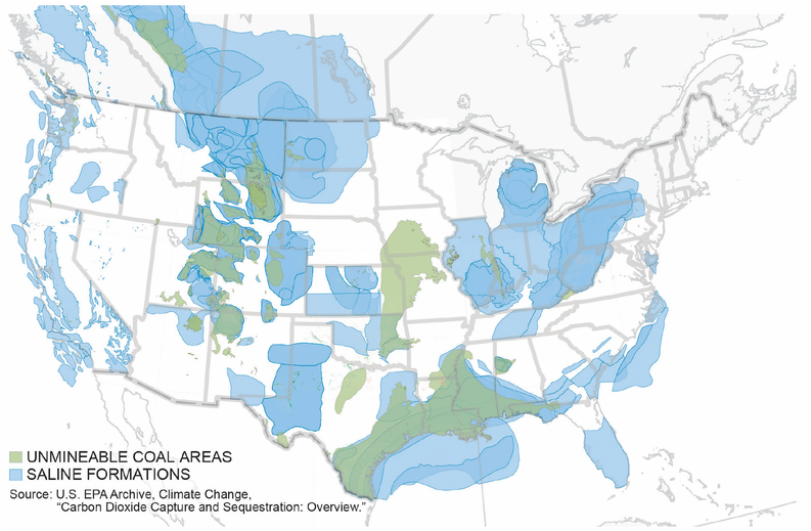
CCUS ON THE GLOBAL STAGE

The technical and commercial feasibility of large offshore storage projects is being proven on the global stage. The first large-scale CO_2 capture and injection project with dedicated CO_2 monitoring and storage was commissioned at the *Sleipner* offshore gas facility in Norway in 1996. Today, the facility has stored more than 20 $MtCO_2$ one km under the North Sea.

With operations beginning in 2024, *Northern Lights* is a new CCS project under construction that will initially store up to 1.5 million tonnes of CO_2 per year with the goal to achieve 5 million tonnes of CO_2 per year by 2027. The Northern Lights project is part of a larger carbon capture and storage initiative that will capture CO_2 from industrial sources within Norway, ship liquid CO_2 from capture sites to an onshore terminal on the coast, and then transport the CO_2 by pipeline to an offshore storage site below the North Sea in water depths of more than 300 meters and total depth to injection of 2,500 to 3,000 meters. In the U.S., the Gulf of Mexico is well suited for the development of projects like *Northern Lights*.

CCUS + THE GULF OF MEXICO?

The U.S. Gulf of Mexico offshore region provides tremendous advantages for an emerging U.S. CCUS sector. The Gulf of Mexico is characterized by vast geologic prospects for CO_2 storage, extensive and established energy infrastructure along the Gulf Coast and throughout the outer continental shelf, a proximity to industrial centers for capturing emissions, and an accessible engineering and energy knowledge base and workforce, along with associated RD&D capabilities.

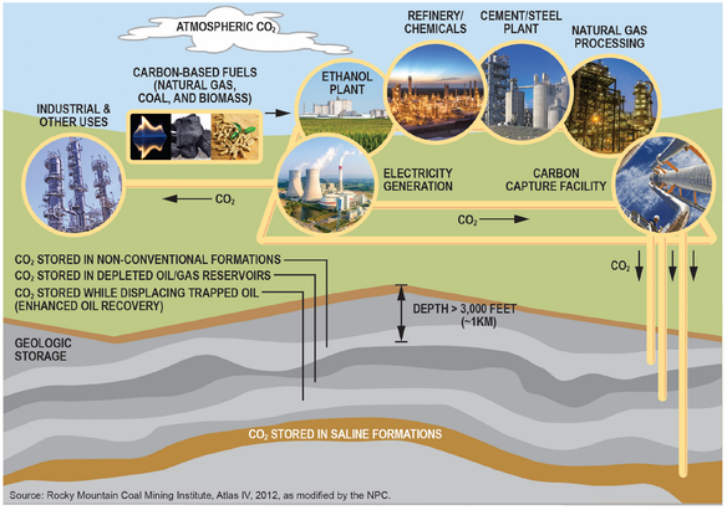


The United States has one of the largest assessed CO_2 geologic storage capacities in the world. Most of U.S. states possess some subsurface CO_2 storage potential. While estimates of U.S. storage resource vary, experts generally agree that it is adequate to store hundreds of years of CO_2 emissions from U.S. sources.

Source: National Petroleum Council, 2019

HOW DOES CCUS WORK?

As its name suggests, CCUS involves the capture of CO_2 from either large point sources – including power generation or industrial facilities – or directly from the atmosphere. The captured CO_2 is then compressed and transported to either be injected into deep geological formations which permanently trap the CO_2 or is used in a range of applications. CCUS uses a robust supply chain and combines various technologies to effectively reduce the amount of carbon dioxide that is emitted into the air, thus mitigating against warming effects and the impacts of greenhouse gases in the atmosphere. Carbon dioxide is the most common greenhouse gas, and it is emitted through various industrial processes and the transportation sector, among others. Industrial processes include emissions from power plants, industrial furnaces and stoves, steel blast furnaces, cement plants, and others.



Source: National Petroleum Council, 2019

CCUS combines several technologies to reduce the level of CO_2 emitted to the atmosphere or remove CO_2 from the air. The CCUS supply chain involves the capture of CO_2 from stationary sources so it can be compressed and transported to a suitable location where it is converted into useable product or injected deep underground for safe, secure, and permanent storage.

CAPTURE

Through CCUS, CO_2 is captured from industrial processes by separating the CO_2 from other gas within the stream of emissions. There are four methods for separating CO_2 from other gas during industrial processes, including absorption, adsorption, membranes, and cryogenic processes. The oil and gas industry has extensive experience in separating CO_2 from hydrocarbons and is uniquely positioned to deploy capture technologies. The Gulf Coast, with its network of industrial centers and facilities, presents a significant opportunity for carbon capture.

TRANSPORT

Once captured, it will generally be necessary to transport the CO_2 to the location where the CO_2 will either be stored or used. Pipelines are recognized to be the most cost-effective means for transporting CO_2. Prior to shipment by pipeline, the CO_2 is converted into a fluid so that the CO_2 can be pumped like other liquids for ease of transportation. Other methods of transportation include railcars, trucks, ships, and barges. The Gulf Coast with its robust network of pipelines and energy transport expertise is well situated for the transport of CO_2 for use or storage.

USE

While the prevalent application of CCUS may be permanent storage, there are other valuable commercial uses for CO_2. This includes the application of technologies to convert CO_2 into products like fuels, chemicals, and materials. This is accomplished through chemical reactions or biological conversions such as thermochemical CO_2 conversion, electrochemical and photochemical CO_2 conversion, carbon mineralization of CO_2, and biological CO_2 use. The conversion of CO_2 to useful products presents a tremendous technological opportunity for future maturation and growth. Also, a common application for CCUS today is for enhancing oil recovery (EOR) by injecting CO_2 into oil-bearing reservoirs for increasing oil production. Some of the injected CO_2 remains trapped—or stored—within the formation, while some of the CO_2 is recovered with the produced oil and re-injected into the same formation for storage.

STORAGE

CO_2 storage involves the injection of CO_2 into subsurface geologic formations either onshore or offshore. Subsurface geologic formations must have sufficient pore space to hold CO_2 (defined as porosity) in commercial quantities, as well as pathways within the pore space (defined as permeability) so that the CO_2 can be injected throughout the storage reservoir. The formation must also have a seal of non-porous, impermeable rock to prevent the CO_2 from escaping the formation. Finally, the formations must be at the appropriate depths to ensure effective and efficient storage. The Gulf of Mexico, in waters under both state and federal jurisdiction, presents a significant CO_2 storage opportunity because of its recognized geologic capacity for long-term storage of CO_2 (i.e., high porosity, high permeability, and a good seal to maintain containment).

THE CCUS OUTLOOK

The U.S. currently stands as a global leader in CCUS, with 10 of the 19 worldwide projects operating and located in the U.S. in 2019. Most projects to date have included an EOR component, and the U.S. is now well positioned to lead in CO_2 storage projects in the offshore region. According to the National Petroleum Council, the U.S. has become a world leader in CCUS by:

- Executing successful CO_2 capture projects
- Investing in CO_2 pipeline infrastructure
- Establishing a supporting regulatory framework
- Enacting world-leading policy support
- Investing in research, development, and demonstration

The Gulf Coast region is distinctly situated to emerge as a global hub for CCUS. The Gulf Coast is home to the full supply chain of energy companies with the engineering experience, expertise, and vision to deploy CCUS projects with the scale and efficiency necessary for success. As with any capital-intensive industry, the U.S. CCUS sector requires certainty and predictability in the regulatory system, both at the state and federal level. Improvements must be made in U.S. laws and regulations to foster growth and enable success in U.S. CCUS.

NOIA POLICY RECOMMENDATIONS

The legislative and regulatory changes below provide a reasonable, effective roadmap for promoting the build-out of the U.S. CCUS sector. Some of the recommendations come directly from the National Petroleum Council, which is a federally chartered advisory group comprised of balanced representation from the oil and natural gas industry and from consumers, states, Native Americans, academic, financial, research, and public interest organizations and institutions.

1. The U.S. Department of the Interior and individual states should, respectively, promptly promulgate regulations to authorize access to and use of pore space for geologic storage of CO_2 in federal and state waters.
    a. Interior should establish clear lease terms, processes, and regulations to enable access to pore space in federal waters.
2. The U.S. Department of the Interior should take the lead in promptly completing necessary reviews under the National Environmental Policy Act for approvals of CCUS projects in the Gulf of Mexico, including leases and rights-of-way. Interior should coordinate a whole-of-government approach to confirm that all agency actions in the federal family are covered by NEPA review to the extent required by law.
3. Congress should amend Section 45Q to eliminate the deadline for starting construction, extend the duration of credits, lower the CO_2 volume threshold, and increase the value of credit for storage and use applications.
4. As recommended by the NPC, the combined incentives need to reach a level well above the current credit amounts under Section 45Q.
5. Congress should provide grant funding to help develop infrastructure to support the development of the CCUS sector in the Gulf of Mexico and along the Gulf Coast.
6. Congress should amend existing appropriations language to allow for all CO_2 sources and fuel types in the allocation of RD&D funding for CCUS.
7. The Administration should create a CO_2 infrastructure working group made up of relevant federal and state regulatory agencies and interested stakeholders to study the best way to harmonize the federal, state, and local permitting processes; grant access; administer eminent domain authority; facilitate corridor planning; and possibly coordinate tariffs.
8. The Administration should convene an industry and stakeholder forum to consider liability issues.
9. State and federal leaders should publicly embrace and promote offshore CCUS and the role it will play as a climate solution and economic stimulator, including the expansion of state level credits. The efforts of policy makers should seek to educate the public and build confidence in the emerging role of CCUS as a safe and secure means of managing emissions.

For a deeper look at CCUS and NOIA policy recommendations for CCUS visit noia.org/ccus