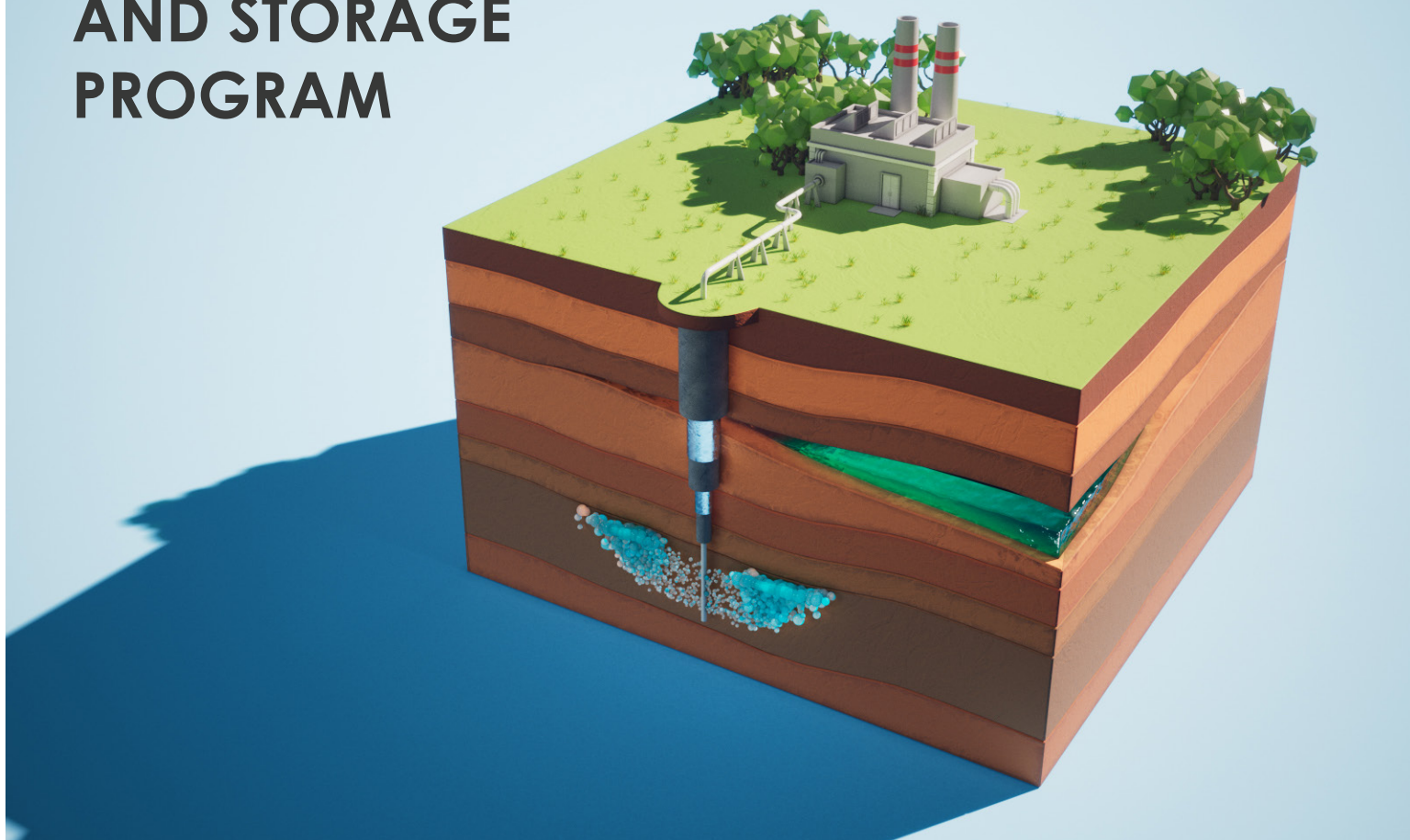


# CARBON TRANSPORT AND STORAGE PROGRAM



Program 116, March 2025



## OVERVIEW

NETL is driving innovation that will help enable cleaner energy production in the future. Even with a progressively greater reliance on renewable energy resources, fossil fuels account for a significant percentage of U.S. energy consumption due to its abundance, high-energy density and the relatively low cost associated with production, safe transport and use. To ensure energy security for our nation's future, an environmentally sustainable approach is required so that the CO<sub>2</sub> captured from industrial sources or removed from the atmosphere can be transported and stored safely and permanently in the earth's subsurface. Our primary focus is to further develop a carbon management approach, which is capable of lowering industrial emissions in a manner that is both economical and publicly acceptable.

Our Carbon Transport and Storage (CTS) Program is focused on developing and advancing technologies to enable safe and cost-effective CO<sub>2</sub> transport and permanent geologic storage in different depositional environments. The program also serves to increase the understanding of the effectiveness of advanced technologies in different geologic reservoirs appropriate for CO<sub>2</sub> storage.



The vision of the program is to establish the foundation for a successful carbon storage and transport industry by making key investments in research, development, and demonstration (RD&D), as well as in large-scale transport and storage facilities and regional hubs to support the rapid deployment of carbon storage necessary to enable the decarbonization of the U.S. economy.

## OBJECTIVE

The CTS program is (1) expanding reliable storage infrastructure and evaluating the potential of repurposing appropriate existing oil and gas infrastructure for CO<sub>2</sub> storage; (2) supporting strategic planning for CO<sub>2</sub> transport infrastructure to help make optimal integration with other DOE initiatives; (3) improving storage performance and integrity technologies to advance emerging low-cost, high-performance technologies for eventual commercial adoption in storage projects; (4) strengthening carbon transport and storage through technical assistance, coordination, and collaboration.

The DOE leverages the RD&D capabilities of national laboratories, industry, non-governmental research organizations and international collaborations to achieve programmatic objectives. For example, NETL houses several laboratories where research is done on topics such as wellbore cement integrity during exposure to CO<sub>2</sub>-laden brines, supercritical CO<sub>2</sub> interactions with minerals and native fluids in rock samples at elevated pressures and temperatures, development of sensors for measuring the changes in concentrations of ions or CO<sub>2</sub> in ground water and sensors for detecting the on-set of conditions in pipelines that could lead to corrosion. The DOE has partnered with several international organizations, like the International Energy Agency's Greenhouse Gas R&D Program and the Carbon Sequestration Leadership Forum, and has directly engaged in several large-scale CCS demonstration projects around the world, spanning five continents. The Carbon Dioxide Transportation Infrastructure Finance and Innovation Act (CIFIA) Program is partnering with the CTS program to support design and construction of transport systems capable of providing additional flow capacity to large-scale CO<sub>2</sub> transport networks.

**The Carbon Storage Infrastructure Technology Component** funds field projects in storage site characterization to demonstrate the feasibility of commercial-scale storage, test the diverse and emerging storage techniques and technologies developed under Advanced Carbon Storage R&D and provide technology transfer and technical assistance to large-scale projects and stakeholders. This program component focuses on three key areas: Carbon Storage Assurance Facility Enterprise (CarbonSAFE); Regional Initiatives; Unconventional Storage Projects.

**The Technical Assistance and Collaboration Component** focuses on leveraging the technical and non-technical knowledge and experience acquired through a series of regional initiatives to provide assistance to launch a variety of carbon management industries including geologic storage of captured CO<sub>2</sub>.

### **The Advanced Carbon Storage R&D Technology Component**

focuses on research and development to support geologic CO<sub>2</sub> storage, both onshore and offshore. This sub-program funds the development of technologies that can improve performance and reduce the cost of tools and techniques to assess wellbore and pipeline integrity, increase reservoir storage efficiency, improve management of reservoir pressure, confirm permanent storage and identify and mitigate the potential release of CO<sub>2</sub> from all types of storage complexes and transport systems. In addition, Small Business Research projects are funded through this technology area to support the commercialization of technologies ready to enter the market and help make services and technologies available to storage facility developers. These projects also help make carbon capture, utilization and storage technologies cost-effective and commercially available.

**The Carbon Transport Infrastructure Component** is designed to identify technical gaps, prioritize research needs and develop tools to facilitate and optimize a robust, national-scale CO<sub>2</sub> transport infrastructure. RD&D focuses on challenges related to pipeline transport and multimodal transport to facilitate deployment of CCS activities. Front-End Engineering and Design (FEED) studies support financial investment decisions and contracting for detailed design and construction of facilities. In addition, the DOE is working with the U.S. Department of Interior's (DOI) Bureau of Safety and Environmental Enforcement (BSEE) and Bureau of Ocean Energy Management (BOEM), as well as the U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) to promote a safe and reliable CO<sub>2</sub> transport network via rails, trucks, ships and pipelines.

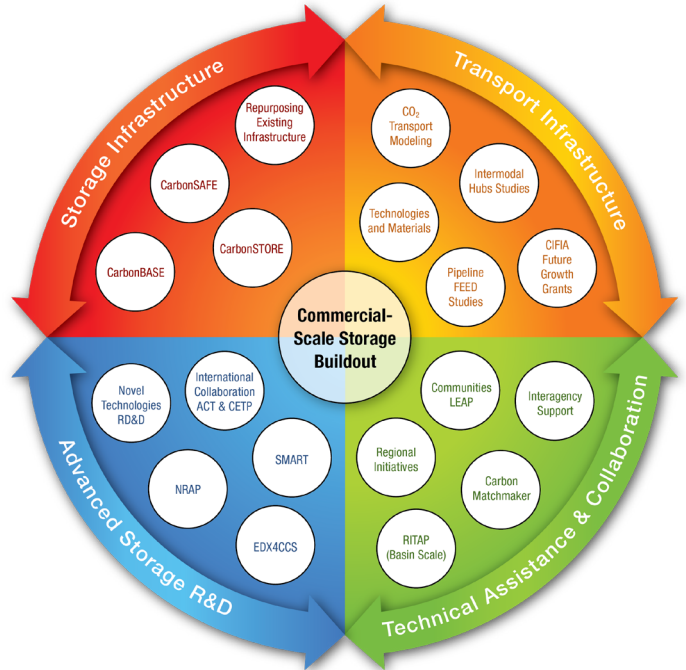
**The Risk and Integration Tools**, such as those created by or as a part of the National Risk Assessment Partnership (NRAP), the Energy Data Exchange (EDX), the Science-Informed Machine Learning for Accelerating Real-Time Decisions in Subsurface Application (SMART) Initiative, NETL's Offshore Risk Modeling (ORM) suite and NETL's carbon storage analysis support all program components. This effort focuses on the development and validation of effective risk assessment tools to predict a storage system's response to large-scale CO<sub>2</sub> injection, understand site performance and identify potential site problems.

**RESOURCES**

**NETL's Carbon Transport and Storage Program** has a distinguished record of working with universities industrial stakeholders, other national laboratories, international organizations, regional partnerships and government engineers and scientists. Additional information about that history of cooperation and new opportunities for collaboration can be found on NETL's Carbon Storage Program website: <https://go.usa.gov/xsBEw>.

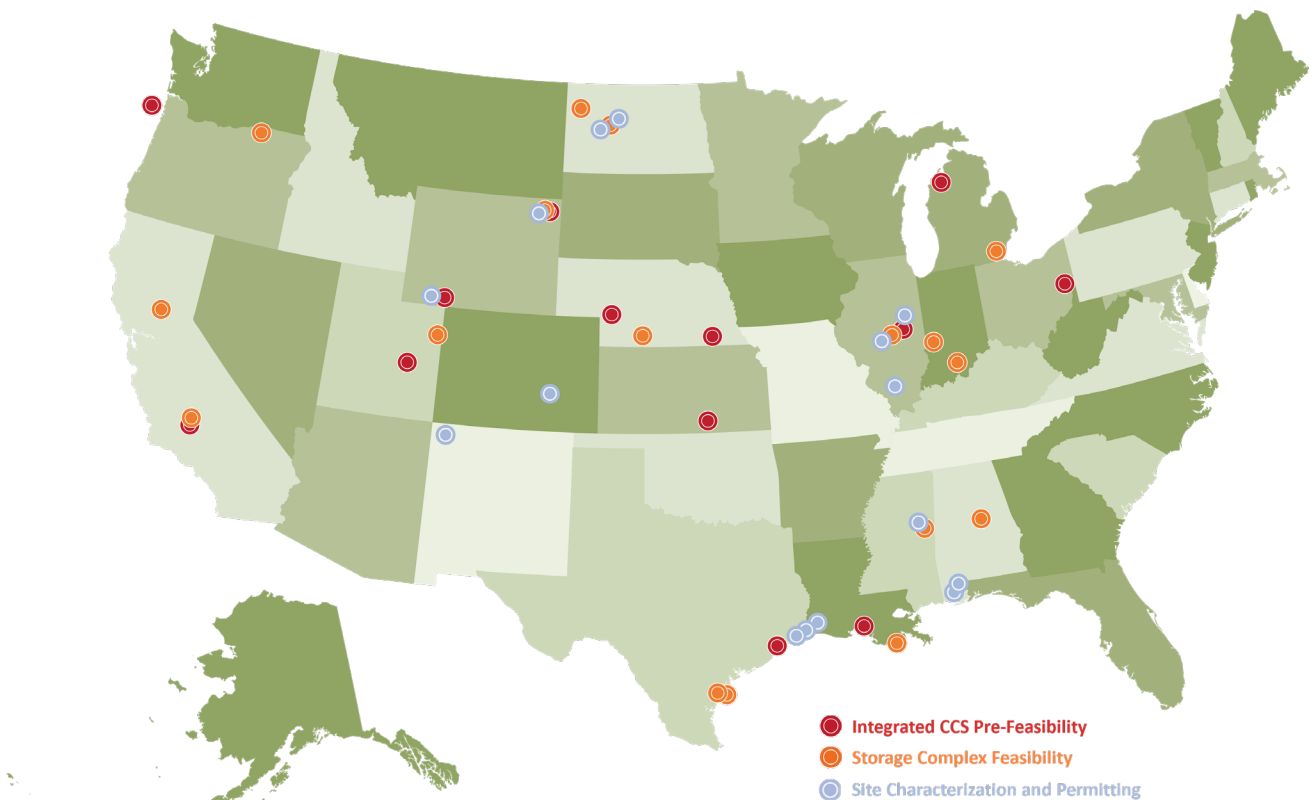
**The Energy Data eXchange (EDX)** is an online coordination and collaboration platform developed by NETL to support subsurface energy research. Efficient and timely research has always been driven by access to existing information, the ability to quickly share and coordinate data with collaborators and the ability to disseminate the results of work products as they develop. EDX supports these needs, offering timely access and coordination to data for researchers that require information associated with subsurface energy sources. EDX is utilized as a platform for rapidly disseminating NETL's research products such as the monthly Carbon Storage Newsletter. More information is available on the EDX website: <https://edx.netl.doe.gov/>.

NETL's **CCS Database** includes active, proposed and completed CCS projects worldwide. The information is taken from publicly available sources to provide convenient access to information regarding efforts by various industries, public groups and governments toward development and deployment of CCS technology. Information about NETL's CCS Database is available at <https://netl.doe.gov/carbon-management/carbon-storage/worldwide-ccs-database>.



CTS Program's technical plan with various ongoing and planned RD&D initiatives.

**CarbonSAFE STORAGE INFRASTRUCTURE**





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NETL is a U.S. Department of Energy (DOE) national laboratory dedicated to advancing the nation's energy future by creating innovative solutions that strengthen the security, affordability and reliability of energy systems and natural resources. With laboratories and computational capabilities at research facilities in Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania, NETL addresses energy challenges through implementing DOE programs across the nation and advancing energy technologies related to fossil fuels. By fostering collaborations and conducting world-class research, NETL strives to strengthen national energy security through energy technology development.

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