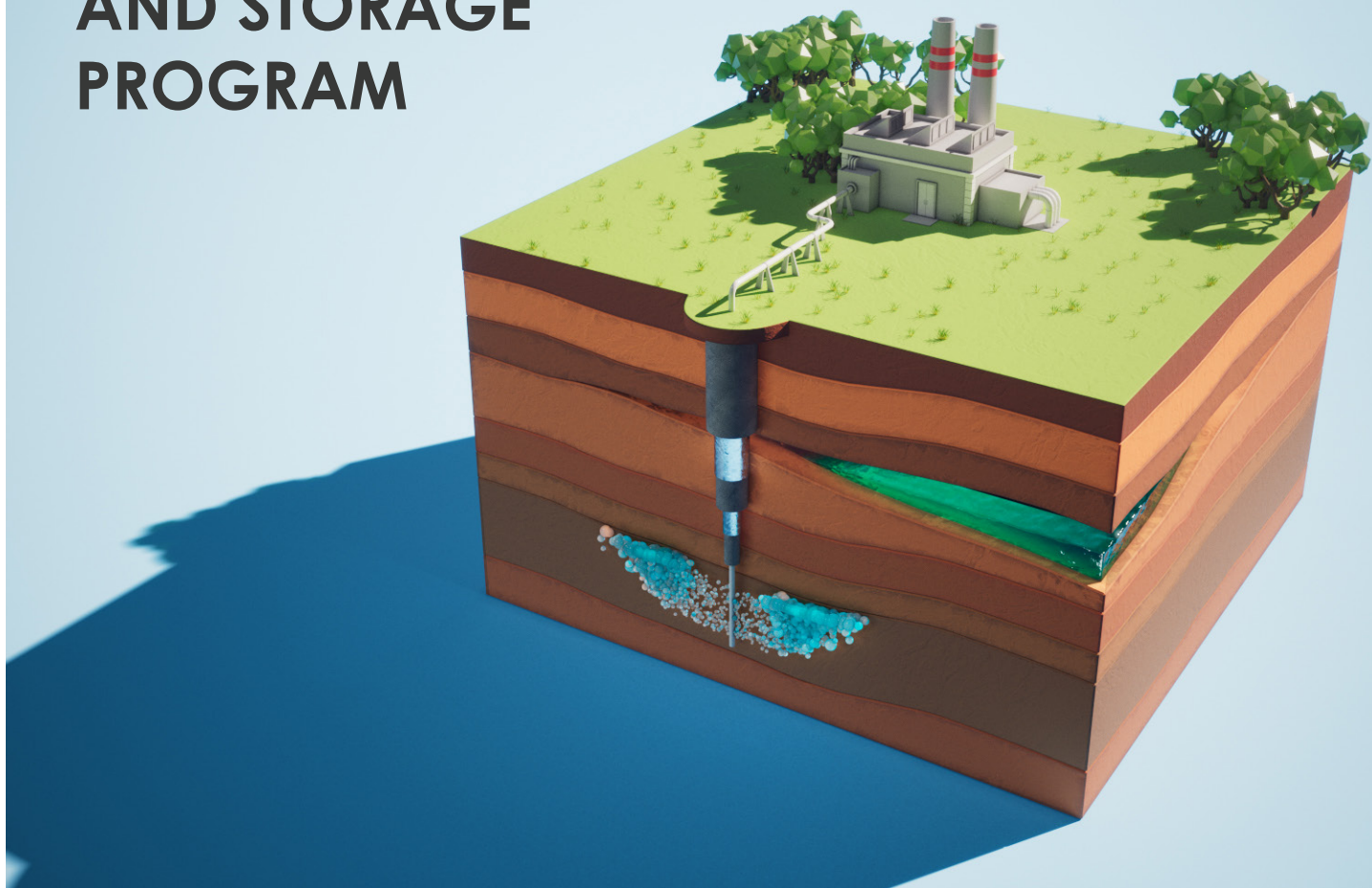


CARBON TRANSPORT AND STORAGE PROGRAM



NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

OVERVIEW

The National Energy Technology Lab (NETL) is driving innovation that will help enable a carbon-free power sector by 2035 and a net-zero carbon-emissions economy by 2050. As we work toward that goal with a progressively greater reliance on renewable energy resources, fossil fuels currently account for a significant percentage of U.S. energy consumption due to their 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 to ensure that the CO₂ 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 CO₂ 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 CO₂ 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 CO₂ storage; (2) supporting strategic planning for CO₂ transport infrastructure to ensure 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 is using the CTS program's own capabilities, the national laboratory network, and international collaborations. NETL provides an onsite lab for a DOE Fossil Energy R&D Program where fundamental and applied fossil energy R&D is performed by government engineers and scientists. 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 CO₂ transport networks.

The Carbon Storage Infrastructure Technology Component carries out 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 five key areas: Carbon Storage Assurance Facility Enterprise (CarbonSAFE); Regional Initiatives; Offshore Characterization Field Projects; Brine Extraction Storage Test (BEST); 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 in support of launching a variety of carbon management industries, including geologic storage of captured CO₂.

The Advanced Carbon Storage R&D Technology Component focuses on the CO₂-centric aspects of onshore and offshore storage, such as the development of technologies that can improve performance and reduce the cost of tools and techniques to assess wellbore and pipeline



To better understand geologic formations, researchers at NETL's High-Pressure Immersion and Reactive Transport Laboratory in Albany are studying subsurface systems.

integrity, increase reservoir storage efficiency, improve management of reservoir pressure, confirm permanent storage and identify and mitigate the potential release of CO₂ from all types of storage complexes and transport systems. In addition, Small Business Research projects are funded through this technology area to help ensure carbon capture, utilization and storage technologies are 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 CO₂ 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 the planning of CO₂ transport. 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 ensure a safe and reliable CO₂ transport network via rails, trucks, ships, and pipelines.

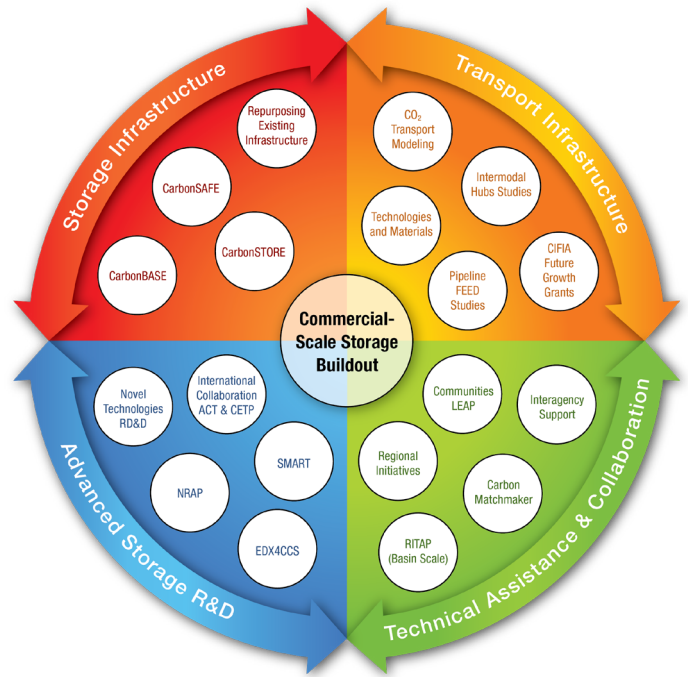
The Risk and Integration Tools, such as the National Risk Assessment Partnership (NRAP), the Energy Data Exchange (EDX), the Science-Informed Machine Learning for Accelerating Real-Time Decisions in Subsurface Application (SMART) Initiative, NETL's Offshore Risk Modeling (ORM) suite, and NETL's carbon storage analysis support all program components. This effort focuses on the development and validation of effective quantitative risk assessment tools validated in field projects. These tools are integrated with other tools developed under the Carbon Transport and Storage Program to predict a storage system's response to large-scale CO₂ injection, understand site performance, identify potential site problems, and develop mitigation procedures to quickly and effectively address any unwanted condition, should one arise.

RESOURCES

NETL's Carbon Transport and Storage Program has a distinguished record of working with universities and initiatives that include 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>.

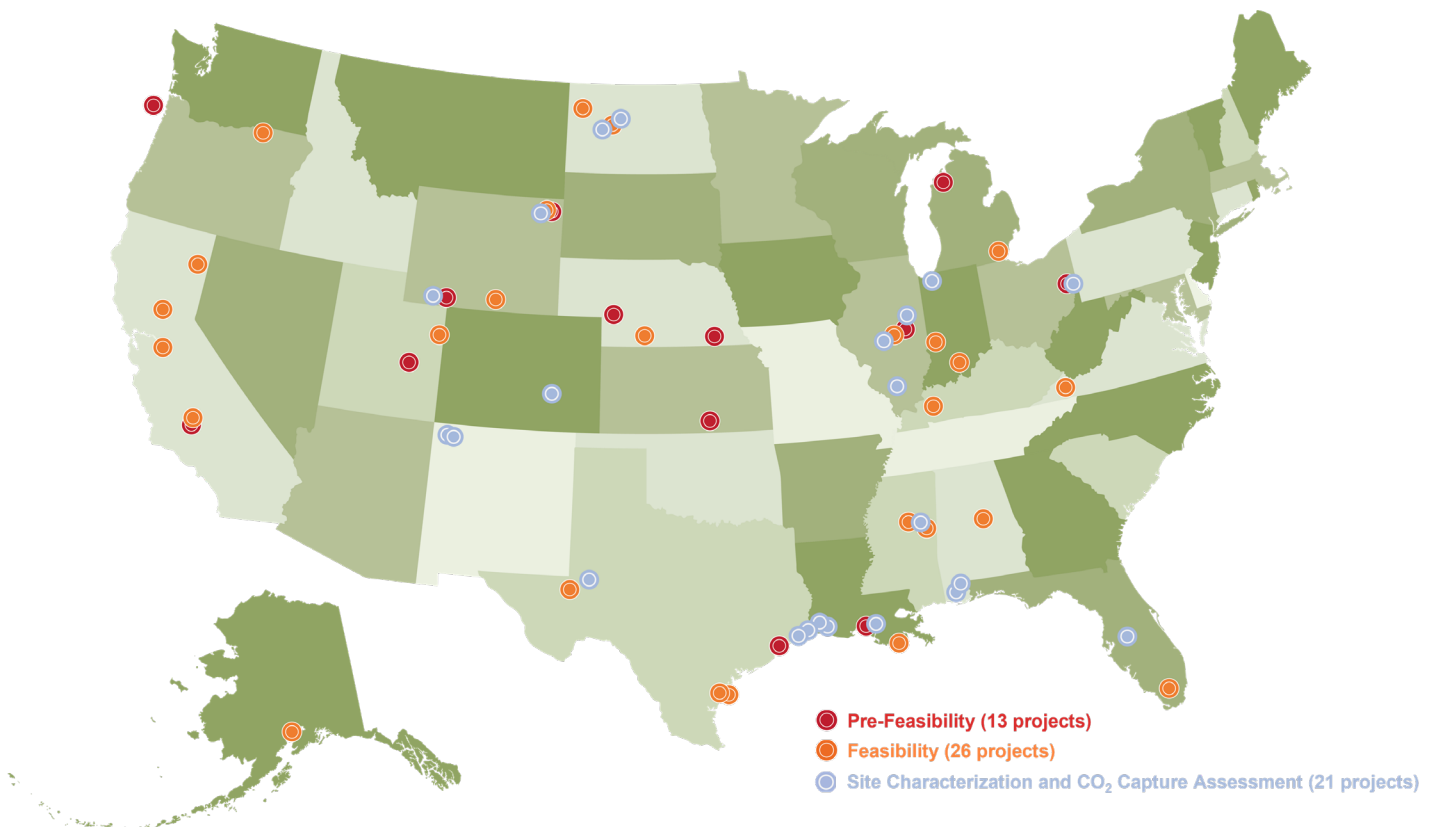
The Energy Data eXchange (EDX) is an online coordination and collaboration platform developed by NETL to support subsurface energy research. Efficient and timely research has always been driven by access to existing information, the ability to quickly share and coordinate data with collaborators, and 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, to include our 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





NETL is a [U.S. Department of Energy](https://www.doe.gov) national laboratory that drives innovation and delivers technological solutions for an environmentally sustainable and prosperous energy future. Through its world-class scientists, engineers and research facilities, NETL is ensuring affordable, abundant and reliable energy that drives a robust economy and national security, while developing technologies to manage carbon across the full life cycle, enabling environmental sustainability for all Americans, advancing environmental justice and revitalizing the economies of disadvantaged communities.

Leveraging the power of workforce inclusivity and diversity, highly skilled innovators at NETL's research laboratories in Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania conduct a broad range of research activities that support DOE's mission to ensure America's security and prosperity by addressing its energy and environmental challenges through transformative science and technology solutions.

NETL lends its expertise toward achieving a carbon-free power sector by 2035 and a net-zero economy by 2050 while catalyzing economic revitalization, creating good-paying jobs and supporting workers in energy communities, especially hard-hit coal, oil and gas, and power plant communities across the country. One of the most rewarding aspects of NETL's research is that our innovations and technologies have the potential to improve people's lives in meaningful ways.

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