

Carbon Dioxide (CO₂) Transport Infrastructure

BUILDING A CO₂ TRANSPORTATION NETWORK FOR CARBON CAPTURE

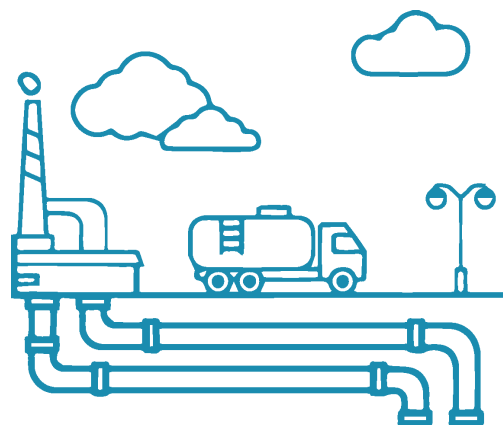
KEY TAKEAWAYS

- Carbon dioxide (CO₂) transport infrastructure will be essential to decarbonizing key industries and regions. Current estimates indicate that CO₂ pipelines in the United States (US) will need to expand by up to 68,000 miles to meet net zero and midcentury climate goals.
- CO₂ pipelines have been operating in the US for 50 years, with over 5,000 miles of pipelines currently in operation. Safety data show that CO₂ pipelines have been and can be operated at the highest level of safety by utilizing industry best practices.
- CO₂ pipelines are regulated at both the federal and state level. Federal agencies regulate safety requirements, and state agencies oversee the siting and permitting process.

CO₂ TRANSPORT FOR CARBON MANAGEMENT

While CO₂ can be transported by truck and rail in small quantities, pipelines are the most efficient, cost effective, and safest way to transport captured CO₂ to geologic storage sites or to sites for utilization. These pipelines can be used to form extensive transportation networks for CO₂ and are the focus of this factsheet.

CO₂ pipelines can be built underground or underwater and safely and reliably transport CO₂ captured from emitting sources or directly from the ambient air. These sources include industrial facilities such as steel, cement, chemicals manufacturing, ammonia, natural gas processing and ethanol, as well as power facilities and direct air capture facilities.



CO₂ TRANSPORT INFRASTRUCTURE IS A CLIMATE SOLUTION

Globally, organizations researching climate change have stated that [carbon capture, removal, transport, use, and storage](#) will be needed to meet net-zero emissions to enable midcentury climate goals. The Intergovernmental Panel on Climate Change (IPCC) estimates in their [1.5°C target scenario](#) that we'll need to capture and eventually remove huge amounts of legacy CO₂ already in the atmosphere — up to ten billion metric tons per year by 2050 globally, roughly twice of the US's current annual emissions.

Removing this carbon will require the global carbon management industry to scale at a massive rate. The International Energy Agency estimates in their [Net Zero by 2050 report](#) that the global carbon management industry will need to grow to well over 2,000 facilities, capturing 2.8 billion metric tons of CO₂ per year to meet net-zero by 2070. To reach the more-ambitious net-zero by 2050, capture rates must more than double to almost 8 billion metric tons per year. As the number of facilities capturing CO₂ increases, the CO₂ pipeline networks moving and transporting this CO₂ will also need to expand. Specifically, CO₂ captured away from areas suitable for geologic storage or near utilization sites will need to be transported, sometimes

across large regions. Not all emitting facilities are near these locations, making [coordinated, interconnected CO₂ transportation networks](#) an essential aspect of using carbon capture to meet climate goals.

The Regional Carbon Capture Deployment Initiative brings together state officials with diverse industry, NGO, labor, and other stakeholders to promote broad scale deployment of infrastructure for carbon management. The Initiative is staffed by the Great Plains Institute (GPI), a nonpartisan nonprofit working to transform the energy system to benefit the economy and environment.

For more information on this effort, go to carboncaptureready.org or contact Matt Fry at mfry@gpisd.net.

CO₂ TRANSPORT IN THE UNITED STATES

Pipelines are the most common way to transport CO₂ in the US and have been operating throughout the country for more than 50 years. Currently, 50 operating pipelines in the US span over 5,000 miles. Some individual pipelines transport millions of tons of CO₂ annually over hundreds of miles across entire regions. As CO₂ transport scales to support the decarbonization of key industries and regions in the US, current estimates indicate that the US must expand this infrastructure by up to 68,000 miles, although, increased coordination and hubs would decrease the number of miles of pipeline needed (Table 1). In comparison, nearly 385,000 miles of operational pipelines in the US carry petroleum, natural gas, oil, and other products. Planning and investing in this infrastructure now will reduce costs and land-use impacts while realizing needed economies of scale.

Building out climate essential infrastructure, including CO₂ pipelines in the US will require projects to be operated at the highest level of safety. CO₂ pipelines in the US have an excellent safety record overall, one that surpasses the safety record of other types of infrastructure. Safety data show that CO₂ pipelines have been and can be operated at the highest level of safety by best-practice industry operators. However, it's important to recognize that, as with all infrastructure, there are risks associated with CO₂ pipelines. To learn more about CO₂ pipeline safety in the US, read our [CO₂ Pipeline Safety factsheet](#).

EXISTING, PROPOSED, AND PROJECTED NEED OF CO₂ PIPELINES

Pipeline Status	Length (mi)	Annual CO ₂ Transport (MtCO ₂ /yr)
Existing ^{1,2}	5,300	68
Proposed ^{3,4,5}	3,650	39
Projected Requirements ⁶	68,000	1,360

Table 1: CO₂ pipelines have been safely operating in the United States for decades, with over 5,000 miles in operation today. Reducing carbon emissions and atmospheric CO₂ levels will likely require expanding this pipeline infrastructure by up to 68,000 miles.

CO₂ PIPELINE REGULATIONS IN THE UNITED STATES

In anticipation of an expanding CO₂ pipeline network, the US regulatory framework must enable efficient permitting while also ensuring CO₂ pipelines are designed, constructed, managed and maintained at standards delivering the highest levels of reliability and safety.

In the US, CO₂ pipelines are regulated at both the state and federal level. State regulators oversee the pipeline siting and permitting process, while federal regulators enforce safety regulations.

State Regulations

Broadly, states regulate the permitting process and siting of CO₂ pipeline projects. The state's review process begins after a pipeline project developer applies to build a project. This process can vary from state to state and may be managed by different state and local government agencies. These agencies will review all aspects of the pipeline siting, construction, and operation plans to determine if the project should be approved. Agencies will also review if the project has a beneficial purpose and is economically feasible.

After reviewing those factors, the state will compare the benefits to the potential negative impacts of all aspects of the proposal and determine if they will approve the application. Once a state approves a project's application, the state will authorize a project, and construction can begin.

Federal Regulations

After a project is built, the federal Pipeline and Hazardous Materials Safety Administration (PHMSA) regulates pipeline safety. PHMSA oversees the inspection, maintenance, and monitoring of CO₂ pipelines.

PHMSA also publicly reports CO₂ pipeline safety data. If an incident occurs with a CO₂ pipeline, PHMSA oversees the incident response. This response can include, among other items, investigating the incident, writing a report about the incident, and issuing a fine. For more information about what PHMSA requires pipeline operators to do to ensure the safe operation of CO₂ pipelines, read our [CO₂ Pipeline Safety factsheet](#).

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For more carbon management related resources visit the [Carbon Capture Coalition](#), [Industrial Innovation Initiative](#), [Carbon Action Alliance](#), or [Carbon Capture Ready](#) websites.