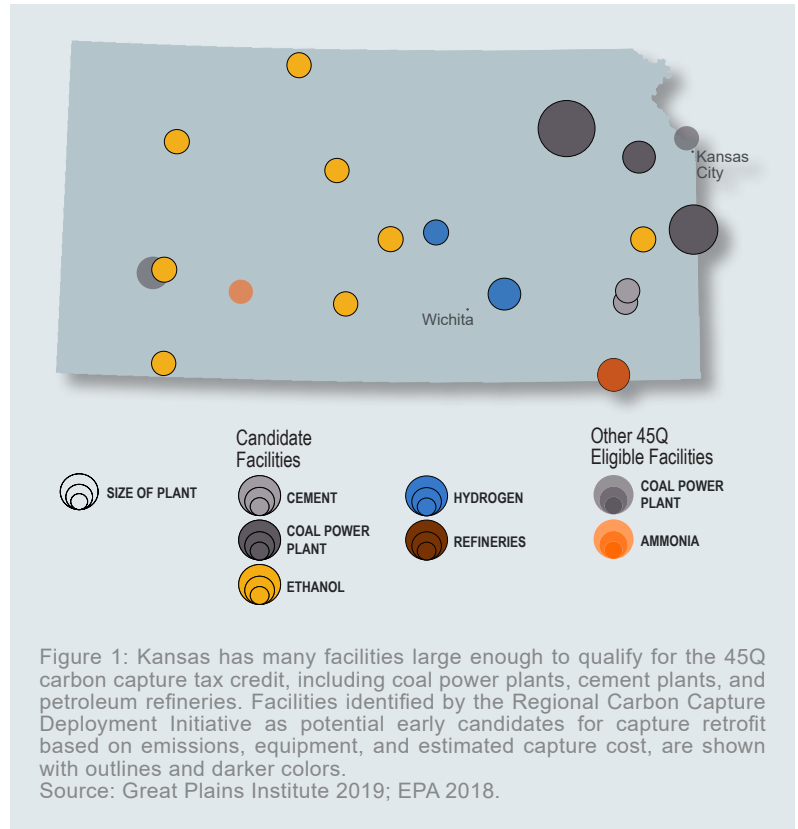


Kansas has immense opportunity for economic growth and environmental benefits by implementing carbon capture technology across multiple industrial sectors. Important financial incentives are now available to capture CO<sub>2</sub> from fermentation in ethanol production, putting financial feasibility of carbon capture from ethanol plants at an all-time high. Two notable incentives are the recently reformed and extended federal 45Q tax credit and California’s Low Carbon Fuel Standard (LCFS). In addition to ethanol, other industrial sectors in Kansas, including nitrogen fertilizer production, hydrogen production, cement, coal power plants and refineries also show strong potential for carbon capture technology deployment.

Kansas oil fields have significant potential to provide an important source of market demand for captured CO<sub>2</sub> for use in enhanced oil recovery (EOR). Captured CO<sub>2</sub> could expand additional markets through development of increased CO<sub>2</sub> pipeline capacity to the Permian Basin, the largest existing hub in the world for CO<sub>2</sub> transport, utilization and storage. Recent modeling described below shows the beneficial economic impact that development of CO<sub>2</sub> pipeline infrastructure and associated capture and storage projects can have for Kansas and the region, while substantially reducing carbon emissions from existing industries.

### SOURCES BY INDUSTRY & VOLUME



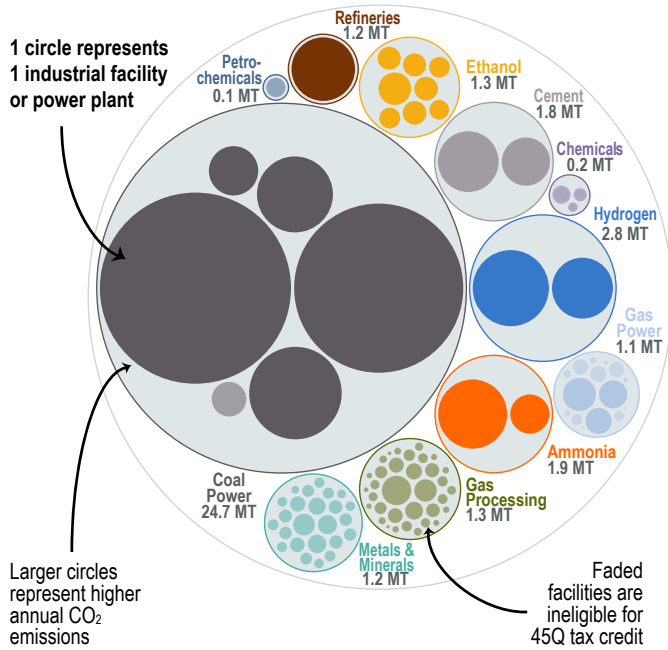
### STATE CAPTURE POTENTIAL

The ethanol industry in Kansas has a strategic opportunity to deploy technology and infrastructure to increase revenue and reduce carbon emissions. At around \$20 per ton, ethanol plants are the least expensive industrial CO<sub>2</sub> to capture. The value of credits traded for compliance with California’s LCFS further enhances the economic feasibility of deploying carbon capture at ethanol plants and investing in pipeline infrastructure to transport that CO<sub>2</sub>. As the ninth largest biofuel producer in the US, Kansas has the potential to capture over one million metric tons (MT) of CO<sub>2</sub> annually from ethanol plants alone. Kansas is already leading the country in commercial capture of CO<sub>2</sub> from ethanol production for use and geologic storage through EOR, as the first facilities in the US to do so are located in Kansas (Conestoga Energy Partners’ Arkalon Bioethanol plant in 2009, followed by the Conestoga Energy Partners/ Petro Santander Bonanza Bioethanol

plant in 2012). Today, operations at each plant supply over 100,000 tons of CO<sub>2</sub> per year for EOR in Kansas and Texas.

Kansas also has tremendous potential for carbon capture technology in a number of industries beyond biofuels, including hydrogen production, cement, petroleum refineries and coal power plants. Carbon capture from nitrogen fertilizer production has been successfully deployed in Kansas at the CVR Energy Coffeyville Gasification Plant, where approximately 850,000 tons of CO<sub>2</sub> per year are captured and transported for EOR and ultimate geologic storage in Oklahoma. While the ethanol, oil and gas, and refining industries are often competitors, in Kansas, carbon capture and EOR creates a win-win opportunity for strategic partnership between these industries.

## FACILITIES AND EMISSIONS BY INDUSTRY



MT: Million metric tons CO<sub>2</sub>.

Figure 2: This bubble diagram visualizes the number of facilities and corresponding annual CO<sub>2</sub> emissions for each industry in Kansas. The darker large bubbles are eligible for the 45Q carbon capture tax credit, while the faded bubbles are too small to be eligible. The total amount of CO<sub>2</sub> emissions in Kansas is listed for each industry. Source: GPI 2019; EPA 2018.

## RELEVANT STATE LEGISLATION

Rules and regulations related to carbon capture have been established in Kansas. The Carbon Dioxide Reduction Act sets property and income tax reductions for carbon dioxide capture, storage, or utilization and provides for regulation of CO<sub>2</sub> injection wells. The Kansas State Corporation Commission also developed a storage trust fund to handle expenses related to permitting, monitoring, storage and remediating adverse environmental impacts after injection.

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 capture, CO<sub>2</sub> pipelines, enhanced oil recovery (EOR), other forms of geologic storage, and beneficial utilization of CO<sub>2</sub> in the Western and Midwest regions of the country.

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](http://carboncaptureready.org) or contact Patrice Lahlum at [plahlum@gpisd.net](mailto:plahlum@gpisd.net).

Maps and graphics within this document are based on work by the Great Plains Institute (GPI) to help the Regional Carbon Capture Deployment Initiative identify facilities that qualify for the federal 45Q tax credit and are optimal near-term investment opportunities for carbon capture for each state. For more information, visit [carboncaptureready.org](http://carboncaptureready.org).

## CO<sub>2</sub> PIPELINES

Kansas is ideally situated to incorporate both carbon capture and geologic storage within the state and region. Kansas is centrally located and holds the opportunity to benefit from future pipeline infrastructure deployment to connect upper Midwest states with storage areas in the South such as the Permian Basin of Texas and New Mexico as modeling in Figure 3 suggests.

The Great Plains Institute and Improved Hydrocarbon Recovery recently undertook an economic analysis for the Kansas Geological Survey as part of the CarbonSAFE project, which evaluated potential scenarios for large-scale CO<sub>2</sub> capture, compression and pipeline transport from Midwestern ethanol plants to Kansas oilfields and beyond to the Permian Basin. In the first scenario, a pipeline network involving 15 Nebraska and Kansas ethanol plants transports 4.2 million MT of CO<sub>2</sub> per year from Nebraska ethanol plants to Kansas oilfields for use and storage through EOR (projected cost of \$42 to \$53 per MT), increasing Kansas oil production by 10 million barrels per year, or 28 percent, and adding \$600 million in annual gross revenue. A second larger scenario gathers 9.85 million MT of CO<sub>2</sub> annually and links Upper Midwestern ethanol plants to an existing CO<sub>2</sub> pipeline network in the Permian Basin (\$47 to \$60 per MT). Although the range of estimated costs per MT across both scenarios is not competitive with the current West Texas CO<sub>2</sub> market for EOR, financial incentives such as the recent federal 45Q tax credit reform (\$35 per MT), credit generation in the California LCFS and revenues from the sale of CO<sub>2</sub> to EOR producers present economic opportunities that, cumulatively, can justify private investment in carbon capture and pipeline infrastructure deployment to serve ethanol plants and other industries.

## REGIONAL CAPTURE OPPORTUNITIES

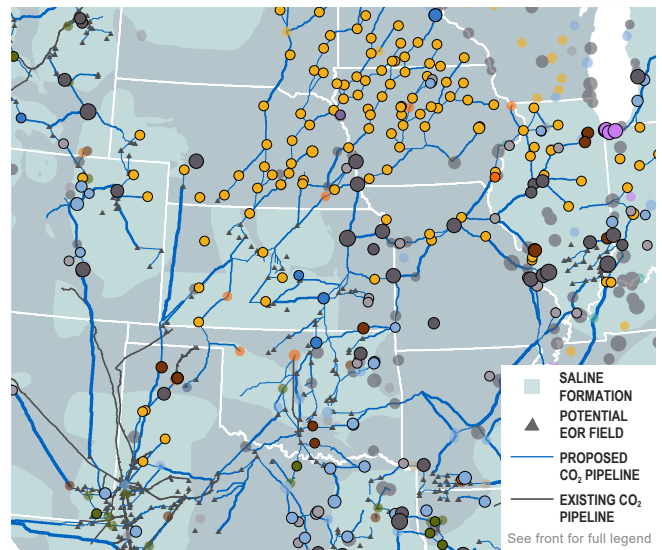


Figure 3: Potential regional CO<sub>2</sub> sources and pipeline corridors for transportation to utilization and storage sites as modeled by the Regional Carbon Capture Deployment Initiative.