REGIONAL CARBON CAPTURE DEPLOYMENT INITIATIVE

Minnesota

IMPLEMENTING CARBON CAPTURE AND STORAGE TECHNOLOGY

KEY TAKEAWAYS

- Minnesota ranks in the top five ethanol producing states and holds potential to capture 3.8 million metric tons (MT) of CO_2 per year from 16 ethanol facilities identified as likely feasible candidates for capture. These 16 ethanol facilities are among the 33 industrial and power facilities in Minnesota that qualify for the 45Q tax credit.
- Electric utilities are setting pivotal emissions reduction goals to serve 100 percent carbon-free electricity to their customers by 2050.
- Capturing CO_2 by-product from pulp and paper facilities and anaerobic digestion plants could result in a carbon-neutral waste management process – a strategic step toward meeting US climate goals and supporting Minnesota's bioeconomy market.
- Over 750 miles of potential near-term CO_2 transport infrastructure has been modeled for Minnesota, with the capacity to transport up to 4.4 million MT of CO_2 to out-of-state storage and utilization sites each year, positioning Minnesota to become a major CO_2 transport and storage hub in the Midwest region.

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**.

SOURCES BY INDUSTRY & VOLUME

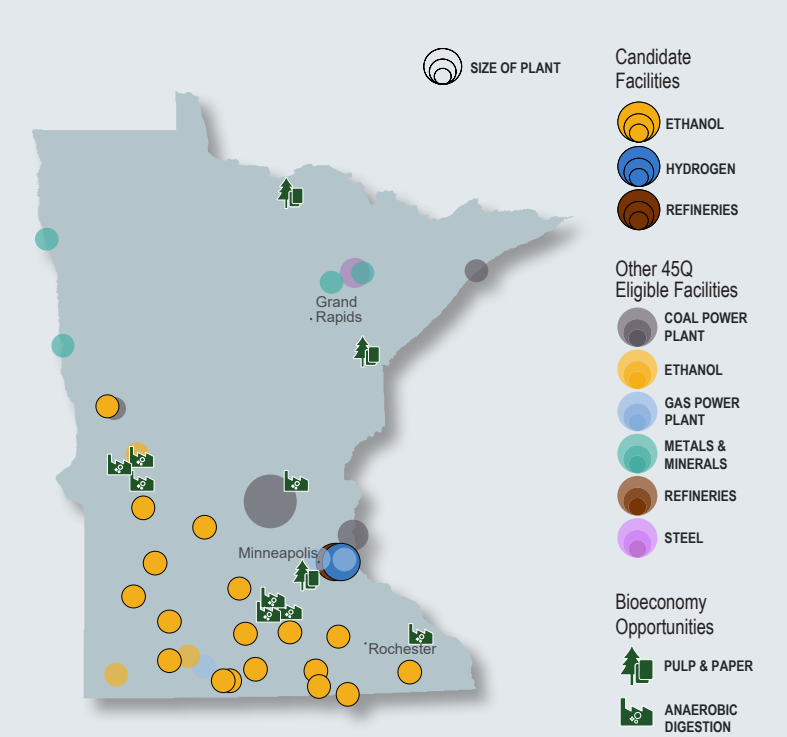


Figure 1: Minnesota has many facilities large enough to qualify for the 45Q carbon capture tax credit, including steel, refining, and ethanol plants. Facilities identified by the Regional Carbon Capture Deployment Initiative as potential early candidates for capture retrofit based on emissions, equipment, and estimated capture cost, are shown with outlines and darker colors. Details on these facilities are shown in the graphic below.
Source: Great Plains Institute 2020; EPA 2018.

POTENTIAL CANDIDATE FACILITIES FOR CAPTURE WITH ANNUAL EMISSIONS

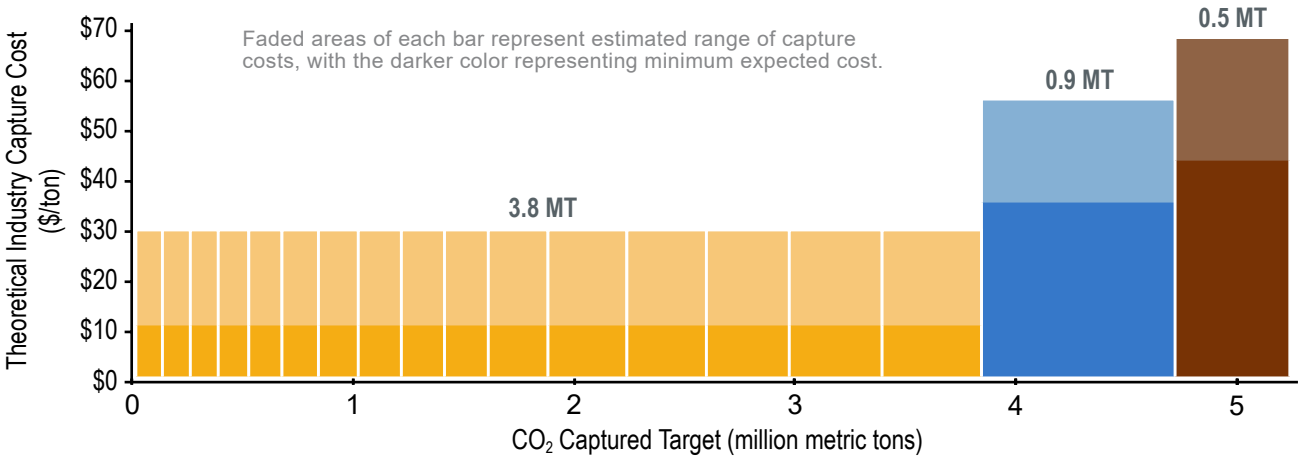


Figure 2: The Regional Carbon Capture Deployment Initiative estimated theoretical facility capture costs based on published capture equipment costs, facility-specific operational patterns, existing equipment, and level of emissions. Most states have a large number of facilities eligible for 45Q. Of those facilities, the above graph depicts likely economically feasible candidates based on estimated capture cost. The facilities represented in this graph are not meant to be definitive. Commercial decisions by participating companies, and policy and regulatory decisions by state governments, will ultimately determine if a project is feasible for carbon capture. CO_2 Captured Target refers to the amount of carbon dioxide that can be expected to be captured at a facility considering relevant technological and economic constraints. Source: GPI 2020; EPA 2018.

LEGISLATIVE CONTEXT

Minnesota has achieved emission reduction success with both the Next Generation Energy Act, which set an 80 percent greenhouse gas reduction goal by 2050, along with the Minnesota Renewable Energy Standard, requiring Minnesota utilities to obtain at least 25 percent of their electricity from renewable sources by 2025. The state continues to build on its clean energy legislation with various proposals to move beyond existing clean energy requirements, some of which recognize the role of carbon capture in achieving 100 percent decarbonization of the electricity sector. Major Minnesota electric utilities have set emission reduction goals to serve their customers 100 percent carbon-free electricity by 2050. Adopting clean energy policy and regulations that guide energy sectors towards reliable and economically feasible decarbonization by capitalizing on currently established federal programs and incentives like the 45Q tax credit is necessary for Minnesota to meet its ambitious clean energy goals.

CAPTURE AND STORAGE POTENTIAL

Thirty-three Minnesota facilities qualify for the reformed and extended 45Q tax credit. With 18 of those facilities identified as economically feasible candidates for capture, the state holds near-term potential to capture 5.2 million MT of CO_2 annually. Minnesota is among the top five ethanol producing states in the nation and is home to 16 ethanol facilities identified as economically feasible candidates for capture. These ethanol facilities hold the combined potential to capture 3.8 million MT of CO_2 per year. The ethanol industry contributes $2 billion annually to the state's economy and is positioned to become one of Minnesota's most prominent emission-reducing industrial sectors.

Additionally, Minnesota holds strategic decarbonization opportunities at pulp and paper facilities and anaerobic digestion (AD) plants. Minnesota's pulp and paper industry emits over 400,000 MT of CO_2 per year and has the capability to sequester and utilize biogenic carbon emissions in the near-term with bioenergy carbon capture technology (BECCS). Other decarbonization opportunities lie in AD plants throughout Minnesota, which break down organic waste molecules into biogas consisting of methane and CO_2. Capturing this CO_2 by-product could result in a carbon-neutral waste management process – a strategic step toward meeting US climate goals and supporting Minnesota's bioeconomy market.

Minnesota also has potential to garner considerable economic benefits from carbon capture and utilization through establishing CO_2 transport infrastructure. Near-term modeling suggests over 750 miles of transport infrastructure capable of transporting 4.4 million MT of CO_2 a year to out-of-state storage and utilization CO_2. With numerous low-cost opportunities for capture from sources of highly concentrated CO_2, Minnesota is uniquely positioned to establish itself as a biogenic CO_2 corridor for carbon capture in the United States.

REGIONAL CAPTURE OPPORTUNITIES

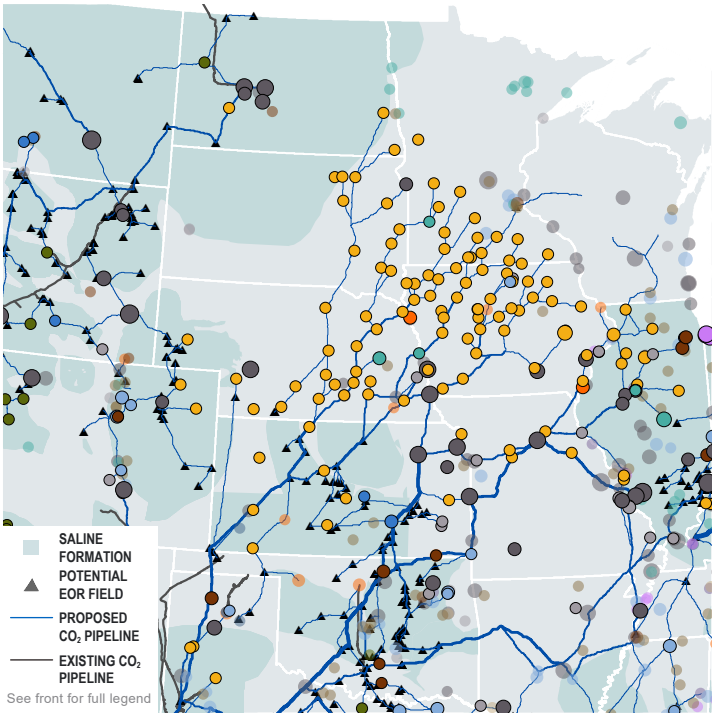
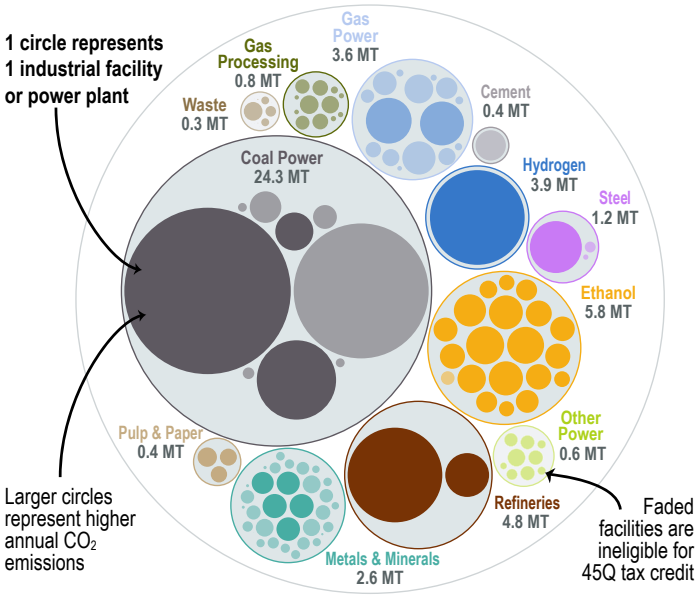


Figure 2: Potential regional CO_2 sources and pipeline corridors for transportation to utilization and storage sites as modeled by the Regional Carbon Capture Deployment Initiative.

FACILITIES AND EMISSIONS BY INDUSTRY



MT: Million metric tons CO_2

Figure 3: This bubble diagram visualizes the number of facilities and corresponding annual CO_2 emissions for each industry in Minnesota. 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_2 emissions in Minnesota is listed for each industry. Source: GPI 2020; EPA 2018.

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_2 pipelines, enhanced oil recovery (EOR), other forms of geologic storage, and beneficial utilization of CO_2 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 or contact Patrice Lahlum at **plahlum@gpisd.net**.