REGIONAL CARBON CAPTURE DEPLOYMENT INITIATIVE

Utah

IMPLEMENTING CARBON CAPTURE AND STORAGE TECHNOLOGY

Carbon capture has significant potential to reduce carbon dioxide (CO_2) emissions in Utah through secure geologic storage. Seven facilities in Utah have been identified as likely economically feasible candidates for deployment of carbon capture technology, aided by the recently reformed and expanded federal 45Q tax credit. These seven facilities have the combined potential to capture over 10 million metric tons of CO_2 annually. As for CO_2 storage, the Energy and Geoscience Institute at the University of Utah, among others, is researching the capacity Utah holds. With both geological research and state-level policy initiatives on carbon capture utilization and storage (CCUS), Utah is taking steps to adopt this clean energy technology on a larger scale and advance innovative technologies for CCUS.

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**.

SOURCES BY INDUSTRY & VOLUME

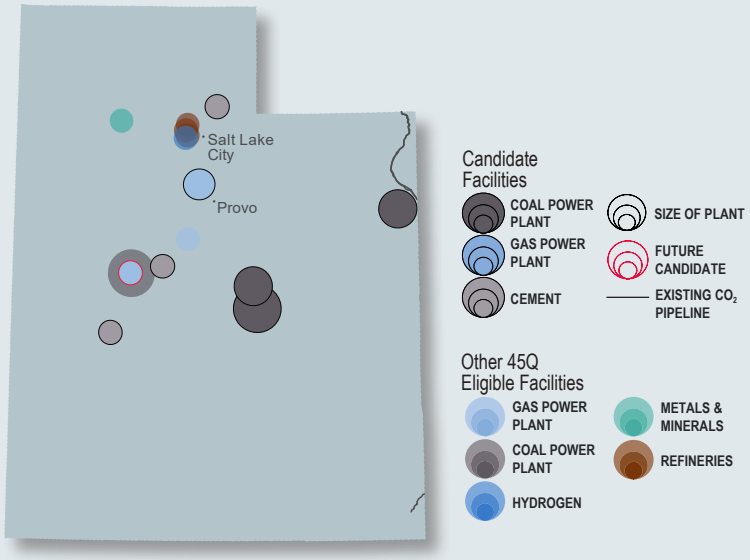


Figure 1: Utah has many facilities large enough to qualify for the 45Q carbon capture tax credit, including coal and gas power plants, cement plants, and petroleum refineries. Facilities identified by the Regional Carbon Capture Deployment Initiative as potential early candidates for capture retrofit based on emissions, equipment, and estimated capture cost, are shown with outlines and darker colors. Details on these facilities are listed below. Source: Great Plains Institute 2019; EPA 2018.

POTENTIAL CANDIDATE FACILITIES FOR CAPTURE WITH ANNUAL EMISSIONS

Facility Name	Location	Industry	Total Facility CO_2 Emissions thousand tons	CO_2 Captured Target thousand tons	Estimated Capture Cost $/ton
Hunter	Castle Dale	Coal Power Plant	8,202	4,800	$53
Huntington	Huntington	Coal Power Plant	5,145	1,600	$57
Bonanza	Vernal	Coal Power Plant	3,712	1,600	$46
Lake Side Power Plant	Vineyard	Gas Power Plant	1,355	800	$58
Ash Grove Leamington	Nephi	Cement	655	590	$55
Holcim Devil's Slide Plant	Morgan	Cement	645	584	$56
Graymont Cricket Mountain	Delta	Cement	878	465	$59
Intermountain Power	Delta	Gas Power Plant	A gas plant scheduled to come online at this location could be an economically feasible facility for carbon capture		

Table 1: 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 table lists likely economically feasible candidates based on estimated capture cost. This list is 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. Captured Emissions 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 2019; EPA 2018.

LEGISLATIVE CONTEXT

With the Concurrent Resolution on Climate Change (H.C.R. 7), the legislature and Governor will continue to base decisions regarding state energy policies on the best scientific evidence available. With the passage of Senate Bill 202: Energy Resource and Carbon Emission Reduction Initiative, CCUS qualifies in meeting low-carbon electricity standards and requires the state to design regulatory guidelines for CCUS. This bill clarifies the state's Renewable Portfolio Goal requiring at least 20% of adjusted electric retail sales to come from renewable or clean sources, including power generated using carbon capture technology, if it is cost effective to do so by 2025. Governor Gary Herbert has publicly displayed his support for CCUS by joining the Governors' Partnership for Carbon Capture in 2018, a bipartisan group of governors that provides leadership, focus, and a stronger state voice for carbon capture policy and technology deployment.

CO_2 pipeline infrastructure qualifies under the High Cost Infrastructure Tax Credit (HCITC). This tax credit encourages significant infrastructure investments within the State of Utah, supporting cost-effective and sustainable delivery of Utah's commodities to domestic and global markets.

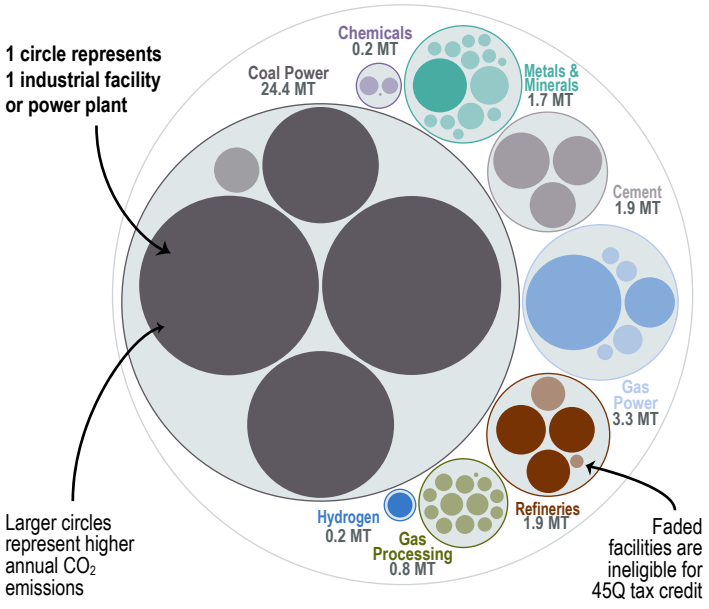
CAPTURE AND STORAGE POTENTIAL

Of the state's 14 facilities eligible for the federal 45Q tax credit, seven facilities have been identified as likely economically feasible for carbon capture (see Table 1). This list includes three coal power plants, with a capture potential of 8 million metric tons of emissions per year. Utah can look to large active oil fields that have a potential demand of 1.4 million tons of CO_2 annually for enhanced oil recovery (EOR), an effective pathway to geological storage of CO_2.

Utah also holds potential for storage in deep saline aquifers. The University of Utah and the Utah Geological Survey (UGS) have commenced multiple projects to identify the extent of Utah's potential for geological storage of CO_2. The US Department of Energy (DOE) has also proposed new regional partnerships to study CCUS with UGS. There is currently one CO_2 pipeline in Utah delivering CO_2 40 miles from McElmo Dome in Colorado to the Aneth EOR project in Utah (see Figure 2). Operation of pipelines provides jobs and economic investment within the state, and enables greater CCUS advancement.

Utah has found success in carbon-tech with companies such as Sustainable Energy Solutions working to implement their Cryogenic Carbon Capture technology that reduces nearly all CO_2 emissions while enhancing grid scale energy storage. Solid Carbon Products is another Utah-based company developing technology to convert waste CO_2 into materials for buildings and manufacturing. Houweling's 28-acre Tomatoes greenhouse uses innovative passive carbon capture to enhance plant growth by using waste heat and CO_2 from a nearby natural gas plant.

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 Utah. 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 Utah is listed for each industry. Source: GPI 2019; EPA 2018.

REGIONAL CAPTURE OPPORTUNITIES

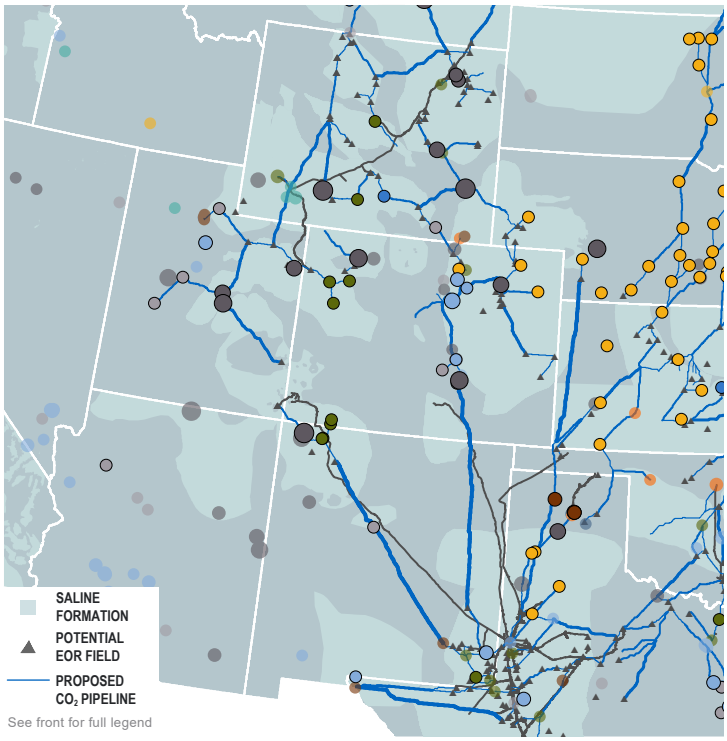


Figure 2: Potential regional CO_2 sources and pipeline corridors for transportation to utilization and storage sites as modeled by the Regional Carbon Capture Deployment Initiative.

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**.