

Large U.S. and Canadian Carbon Capture and Storage (CCS) Projects Have All Failed (Draft of Jan. 20, 2022)

Futuregen, Illinois

The Futuregen project in Mattoon, Illinois was to be the definitive demonstration of carbon capture and storage (CCS) in the U.S. Begun during the George W. Bush administration, the CCS machinery was tacked on to a 200 megawatt coal-burning power plant in Meredosia, Illinois.

<http://bit.ly/3F68Sf6>

The project was abandoned for the first time in 2008, but the U.S. federal government revived the project, subsidizing it heavily for a few more years until final abandonment in 2015. For more of that history, see Peter Folger, *The Futuregen Carbon Capture and Sequestration Project: A Brief History and Issues for Congress; Updated Feb. 10, 2014*. Washington, D.C.:

Congressional Research Service, Feb. 10, 2014. <http://bit.ly/315LQXV> See also this summary of the failed project: <https://bit.ly/3qePQPz>

Kemper, Mississippi

The Kemper CCS project in Kemper County, Mississippi was a 582-megawatt coal-burning power plant that was supposed to capture its CO₂ and send it via pipeline to a depleted oil field, where the CO₂ would be pumped into the ground to recover oil. In 2010, the cost of the project was initially estimated at \$2.4 billion; by 2016 the project had cost \$6.49 billion. In October 2021, the project was shut down. See <http://bit.ly/3Gf4Lie> and <https://bit.ly/331U9zy> and <https://bit.ly/3f98Us1>.

Petra Nova, Texas

The Petra Nova coal-burning power plant in Richmond, Texas (near Houston) operated for four years before being closed by NRG Energy in

February 2021. <http://bit.ly/34GKkNn> Carbon dioxide from the plant had been used to recover oil from a nearby depleted oil field.

The project failed because of unfavorable economics, technical problems, and suspicions that NRG Energy was incorrectly reporting the amount of carbon dioxide captured by the project. <http://bit.ly/3GiBhQr> See also this summary of the project: <https://bit.ly/3qbdgVK>]

After Petra Nova closed down, there remained only one large power plant in the world still capturing its carbon dioxide – Boundary Dam <http://bit.ly/3q9mNge> (see below).

Taylorville Energy Center, Illinois

In 2007, the Taylorville Energy Center was a proposed 720 megawatt coal-burning power plant to be built in Taylorville, Illinois at a cost \$3.5 billion. It was supposed to capture much of its carbon dioxide, which would be sequestered deep in the ground, though details about this aspect of the project remained sketchy. It was to be operated by Tenaska. The federal Department of Energy gave the project a loan guarantee of \$2.579 billion and a \$410 million tax credit. However, Tenaska abandoned the project in June 2013 without ever beginning construction. Cheap natural gas and falling costs for solar power had made the project uneconomic. <https://bit.ly/3K0oXqb> and <https://bit.ly/3F7eVjy>

Tenaska Trailblazer Energy Center, Texas

In 2008, Tenaska, Arch Coal, and Fluor Corporation sought air permits for this proposed 765-megawatt coal-burning power plant to be built in Sweetwater, Texas. Carbon dioxide captured from the plant was to be used for enhanced oil recovery (EOR) in the Permian Basin in Texas. Tenaska announced June 25, 2013 that the project had been canceled because of unfavorable economics. <https://bit.ly/3GcZ5oF> and <https://bit.ly/3fg7eNf>

Boundary Dam Power Station, Saskatchewan, Canada

Boundary Dam (near Estevan, Saskatchewan, Canada) initially consisted of six coal-burning power-producing units. When Unit #3 reached the end of its useful life, the owners (the Saskatchewan-government-owned utility, Saskpower) decided to replace Unit 3 with a new unit capable of producing 139 megawatts of electricity and to add on equipment (costing \$700 million U.S. dollars) intended to capture 90 percent of Unit 3's carbon dioxide emissions. The new Unit 3 began operation in the fall of 2014.

<https://bit.ly/3qcdYCr>

According to a detailed analysis of the costs of running Unit 3 by British businessman and author Chris Goodell [<http://bit.ly/3Fd6gMo>], the carbon-capture equipment uses 29 megawatts (or 21 percent) of Unit 3's power output, which is typical for a power plant fitted with carbon-capture equipment. This means that Unit 3 produces less electricity per invested dollar than a plant without carbon capture, and Unit 3 must buy and burn more fuel to power the carbon capture equipment, compared to a power plant without carbon capture. Therefore, Unit 3 also produces more "traditional" pollution (sulfur, nitrogen and ultra-fine particles) per unit of electricity it produces, compared to a plant without carbon capture. Because of these factors, the carbon capture equipment approximately doubled the cost of electricity to Saskatchewan customers, Goodall reported.

Boundary Dam Unit 3 was designed to capture 3200 metric tons of carbon dioxide every day. However, in April 2021 the Institute for Energy Economics and Financial Analysis (IEEFA) concluded that "it has barely achieved that goal on any single day and has never done so for any extended period." <http://bit.ly/3JPSJ0O> pg. 1.

In addition, the design goal of capturing 90 percent of Unit 3's carbon emissions has been dropped. The new goal is for Unit 3 to capture 65% of its carbon emissions. <http://bit.ly/3JPSJ0O> pg. 2.

SaskPower has now abandoned its earlier plans to retrofit Boundary Dam Units 4 and 5 with carbon capture equipment; instead, Unit 4 was shut down in December 2021 and Unit 5 faces the same fate.

Most recently Carlos Achondo of *E&E News* has reported that, during year 2021, Boundary Dam Unit 3 captured less than half as much carbon dioxide (43 percent) as it captured in 2020. <http://bit.ly/3q9mNge> The large decline in capture efficiency was caused by failure of a compressor motor, which powers the equipment to pressurize carbon dioxide gas into a liquid, so it can be sent through a pipeline for enhanced oil recovery or for permanent burial underground.

John Thompson of the Clean Air Task Force – a U.S. “environmental” group enthusiastic about carbon capture and storage – tried to put a good face on the failures at Boundary Dam Unit 3: he said future projects could learn from what happened by splitting captured carbon into multiple streams, each with its own compressor system, so if one failed, others could continue to operate. Joel Cherry, a spokesperson for Saskpower, dismissed Thompson’s idea: “additional compression trains would come at significant cost,” he said.

<http://bit.ly/3qcdYCr> Carbon dioxide compressors are large, custom-made machines and spare parts are not readily available, according to Mark Demchuk, national director of strategy and stakeholder relations at the [International CCS Knowledge Centre](#).

IEEFA’s director of resource planning analysis, David Schlissel, wrote recently, “If it is true that ‘continued operation of the [Boundary Dam 3] capture facility will be based on cost effectiveness and efficiency,’ as SaskPower’s recently claimed, then capturing carbon at Boundary Dam can be expected to soon be retired as well.” <http://bit.ly/3JPSJ0O> pg. 4.

Texas Clean Energy Project (TCEP)

In 2010, TCEP received a final air quality permit from the Texas Commission on Environmental Quality. This was the first real step in the plan to build a 400 megawatt coal-burning power plant that would capture 90 percent of its carbon dioxide emissions. The project was initially estimated to cost \$1.98 billion. The U.S. government agreed in 2010 and 2011 to chip in a total of \$811 million (40 percent).

Construction was supposed to begin in 2014, but in 2016 TCEP had not broken ground and the estimated cost of the project had doubled to \$3.98 billion. That year TCEP asked the federal Department of Energy (DOE) for an additional \$11 million. DOE refused because they were not sure the project would ever be built. Soon after DOE's refusal, the project was terminated. <https://bit.ly/3tnjT9x>

The Illinois Industrial Carbon Capture and Storage Project: Illinois

When it began operation in 2017, the carbon capture and storage project at the Archer Daniels Midland (ADM) ethanol plant in Decatur, Illinois was designed to capture one million tons of carbon dioxide per year and bury it 7000 feet below ground. However, in late 2020 Johnathan Hettinger of the Midwest Center for Investigative Reporting found that the project has been burying about half of what was promised -- 519,000 tons instead of one million. <http://bit.ly/33exk0K>

Furthermore, according to the Hettinger report, ADM's carbon dioxide emissions into the atmosphere increased from 4.2 million tons in 2016 to 4.4 million tons in 2019.

The federal Department of Energy funded 63 percent of the cost of the ADM project (\$281 million out of the \$441 million total project cost).

In addition, the federal government is paying ADM \$20 for every ton of CO₂ buried.

Hettinger reports that federal officials are enthusiastic about the ADM project despite its failure to meet its goal of storing a million tons of carbon dioxide per year.

However, ADM does not appear to share federal officials' enthusiasm for carbon capture and storage. Hettinger reports that ADM has completed a feasibility study for cutting its corporate greenhouse gas emissions by 25 percent – but the ADM study does not include the use of carbon capture and storage to achieve that goal. “The ability to capture stack emissions and sequester them is likely 10 years out,” the company wrote.

Nevertheless, in early 2022, ADM announced that it was partnering with Wolf Carbon Solutions to develop a pipeline to carry away carbon dioxide from ADM's facilities in Clinton and Cedar Rapids, Iowa. The pipeline will have a reported capacity of 12 million tons of liquified carbon dioxide per year, far more than ADM alone would need. <http://bit.ly/3nHPQ8Y>

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