Institute for Energy Economics and Financial Analysis

Carbon Capture & Sequestration Is Not An Effective Tool for Decarbonization

Fifth Meeting of the New Mexico Legislature's Water and Natural Resources Committee

David Schlissel, Director of Resource Planning Analysis

October 28, 2024

Institute for Energy Economics and Financial Analysis

My Background

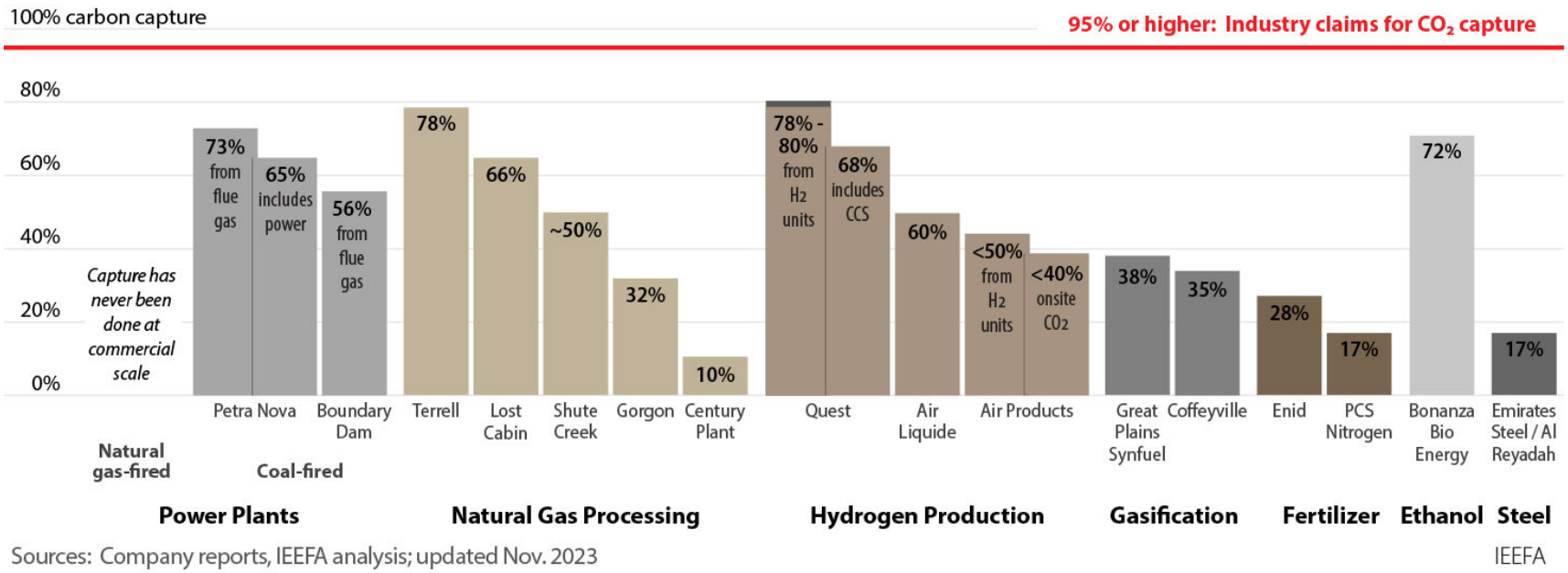
- Engineering Degrees from the Massachusetts Institute of Technology (MIT) and Stanford University.
- Law Degree from Stanford School of Law.
- Studied nuclear engineering & project management courses in non-degree program at MIT.
- Worked on energy, utility and environmental issues for over five decades.
- Testified as an expert witness in state regulatory commissions in over 35 U.S. states, before the U.S. Nuclear Regulatory Commission (NRC) and the Federal Energy Regulatory Commission (FERC), and in state and federal court proceedings.
- Filed expert testimony in over 130 proceedings.
- Have written and testified about carbon capture for 17 years.
- My work is available at www.ieefa.org and www.Schlissel-technical.com.

Key Messages

1. Yes, carbon capture has been done for decades. But there have been significant failures and waste of resources. *Most importantly, there is no evidence that the existing and proposed technologies for capturing CO_2 at commercial scale will do so year-in and year-out for decades and that is what CCS must do to be an effective tool for decarbonization.*
2. The history of carbon capture began with the processing of natural gases which had high concentrations of CO_2 (~18%-53%). This made it easier to capture and less energy was needed. Today, new technologies attempt to capture CO_2 from much less concentrated streams in other industries. For example, flue gases from an NGCC contain only 4%-7% CO_2.
3. It is a myth that using captured CO_2 for enhanced oil recovery can be an effective means of decarbonization. EOR produces additional oil which, when burned, creates more CO_2.
4. Retrofitting fossil-fired generators and making hydrogen from methane (natural gas) will consume large amounts of additional water.
5. The actual cost of capturing CO_2 will be far far higher than most proponents now admit.

Real-World CO_2 Capture

There's no evidence that existing commercial-scale CCS projects have captured anywhere close to 95% of the CO_2 they create year-in and year-out for decades.



Sources: Company reports, IEEFA analysis; updated Nov. 2023

IEEFA

Originally appeared in IEEFA report [Blue Hydrogen: Not clean, not low carbon, not a solution.]

Capture Data Highlights: Reality vs Hype

On what evidence then do the government and CCS promoters decide that carbon capture facilities will achieve CO_2 capture rates ≤95%?

1. Literature reviews and discussions with project developers and capture technology vendors.

2. The results of small-scale testing of new and evolving capture technologies – on the order of 1%-5% of the CO_2 emissions from commercial-scale projects. *Actual experience has shown that scaling up is a significant risk.*

W.A. Parish coal-fired power plant with Petra Nova carbon capture project; Wikipedia.com

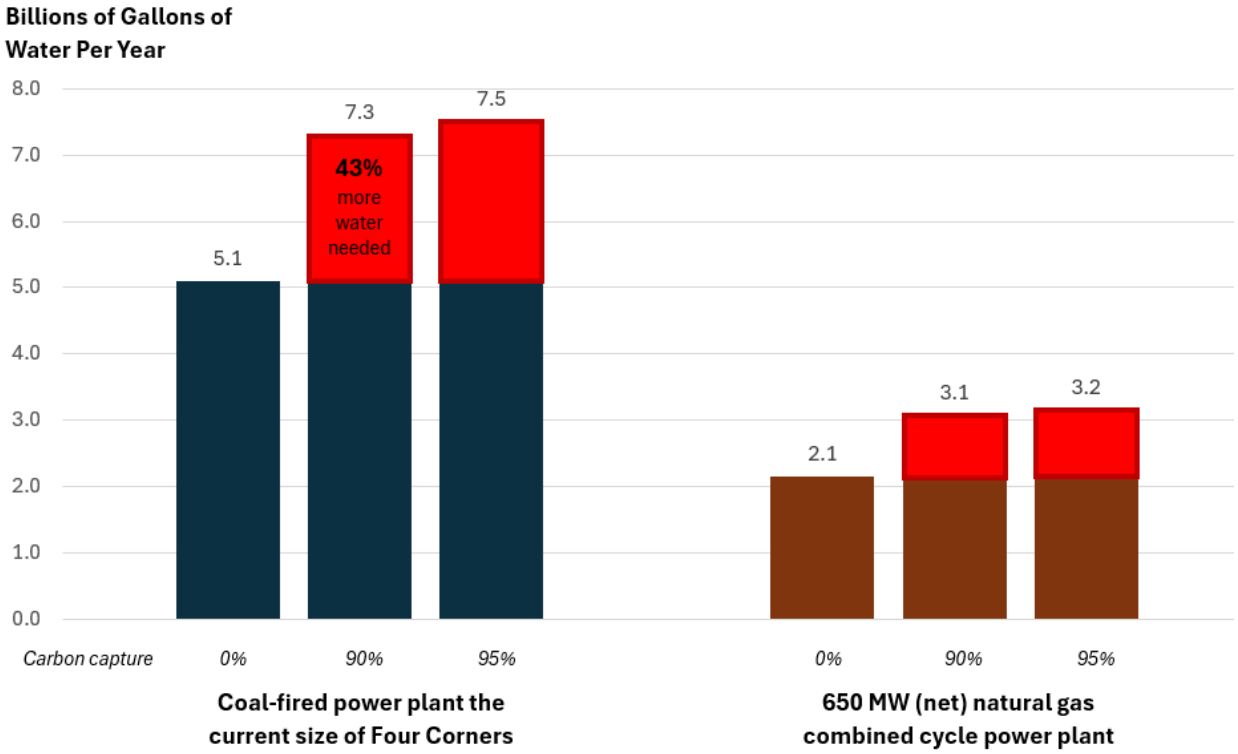
Increased Water Demand with Carbon Capture – Coal & Gas-Fired Power Plants

Adding carbon capture to a power plant increases the amount of water required.

A coal-fired power plant capturing ≥90% of its CO_2 emissions would need ~43% more water.

Natural Gas Combined Cycle (NGCC) plants with ≥90% carbon capture would require almost 50% more water.

Source: Cost and Performance Baseline for Fossil Energy Plants – Volume 1: Revision 4A: Bituminous Coal and Natural Gas to Electricity, DOE/NETL 2023-4320, October 2022.



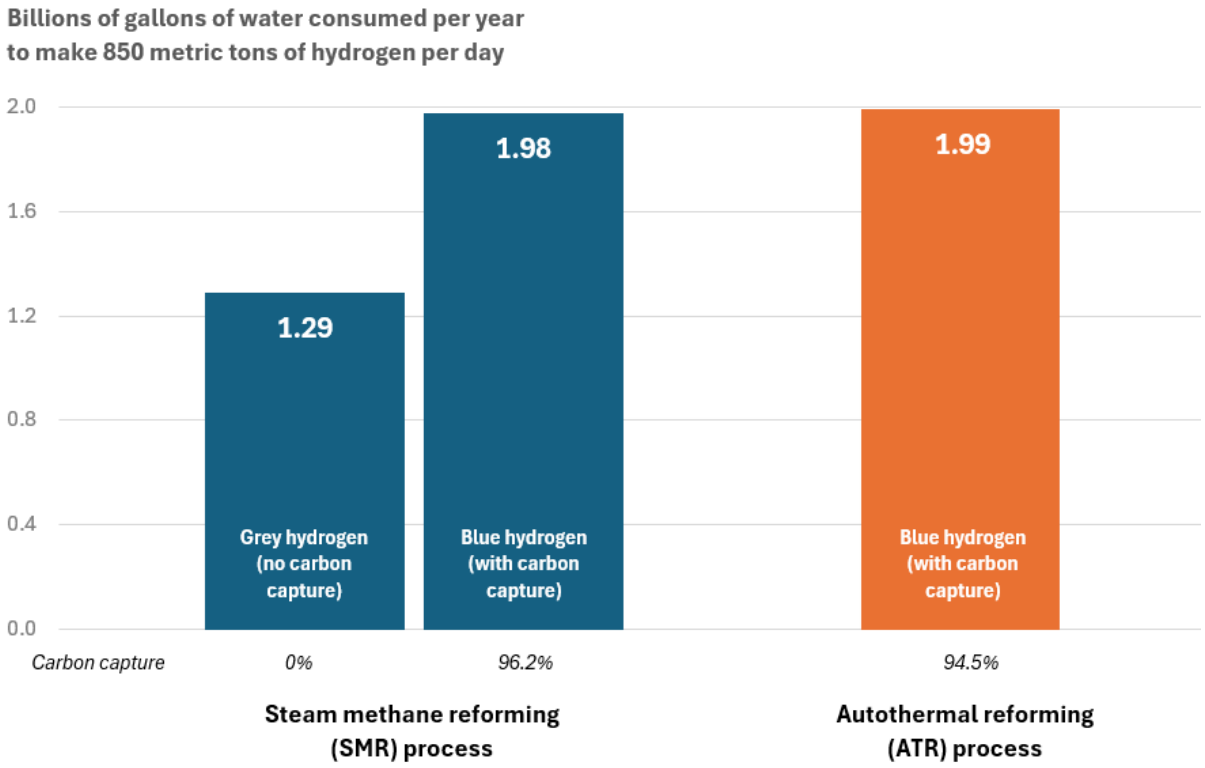
Increased Water Demand with Carbon Capture – Production of Hydrogen from Methane

Water demand for hydrogen production is substantial.

Including carbon capture in a hydrogen production system increases the water demand by 35% compared to grey hydrogen.

A large blue hydrogen production facility with carbon capture (producing 850 metric tons of hydrogen from methane per day) would use nearly 2 billion tons of water in a year.

Source: Comparison of Commercial State-of-the-Art, Fossil-Based Hydrogen Production Technologies, NETL- DOE, April 2022

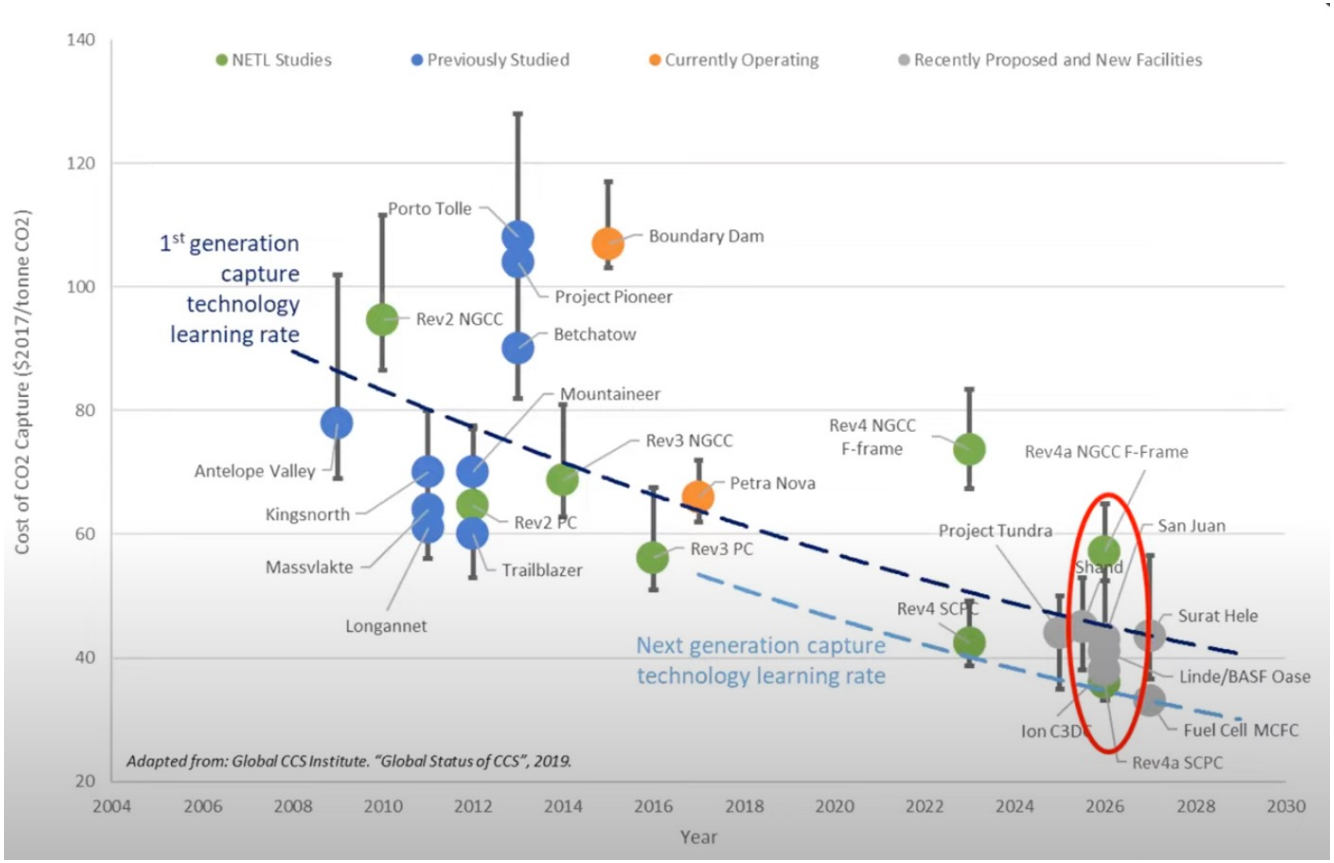


Early 2023 U.S. DOE CO_2 Capture Cost Projections

According to DOE:

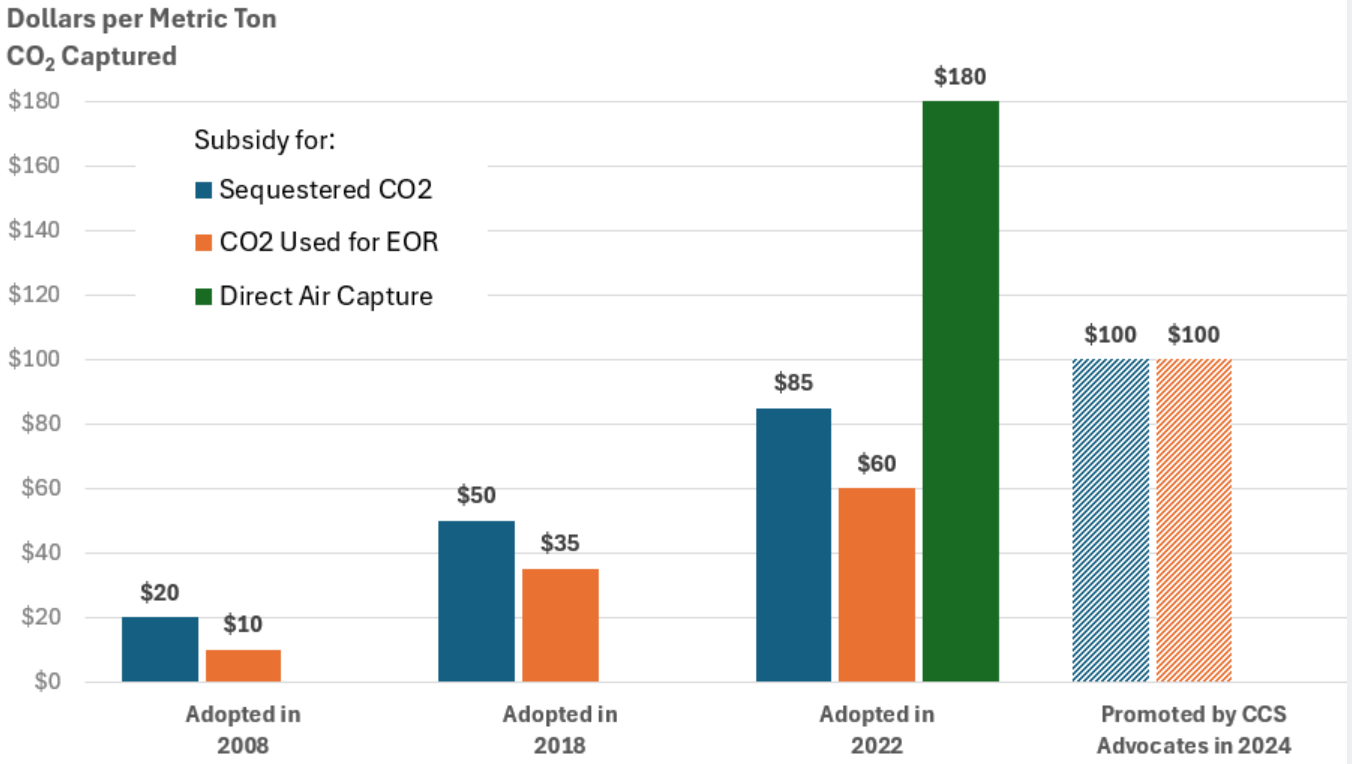
1st generation capture projects (blue) had actual capture costs between $60 and $110 per tonne, in 2017 dollars.

Next generation projects (grey) anticipated to have capture costs about 50% lower than those 1st generation projects.



Source: US DOE Office of Fossil Energy and Carbon Management – NETL's Updated Performance & Cost Estimates, Power Generation Facilities Equipped w/Carbon Capture, February 2, 2023

Rising Federal 45Q CCS Tax Subsidies

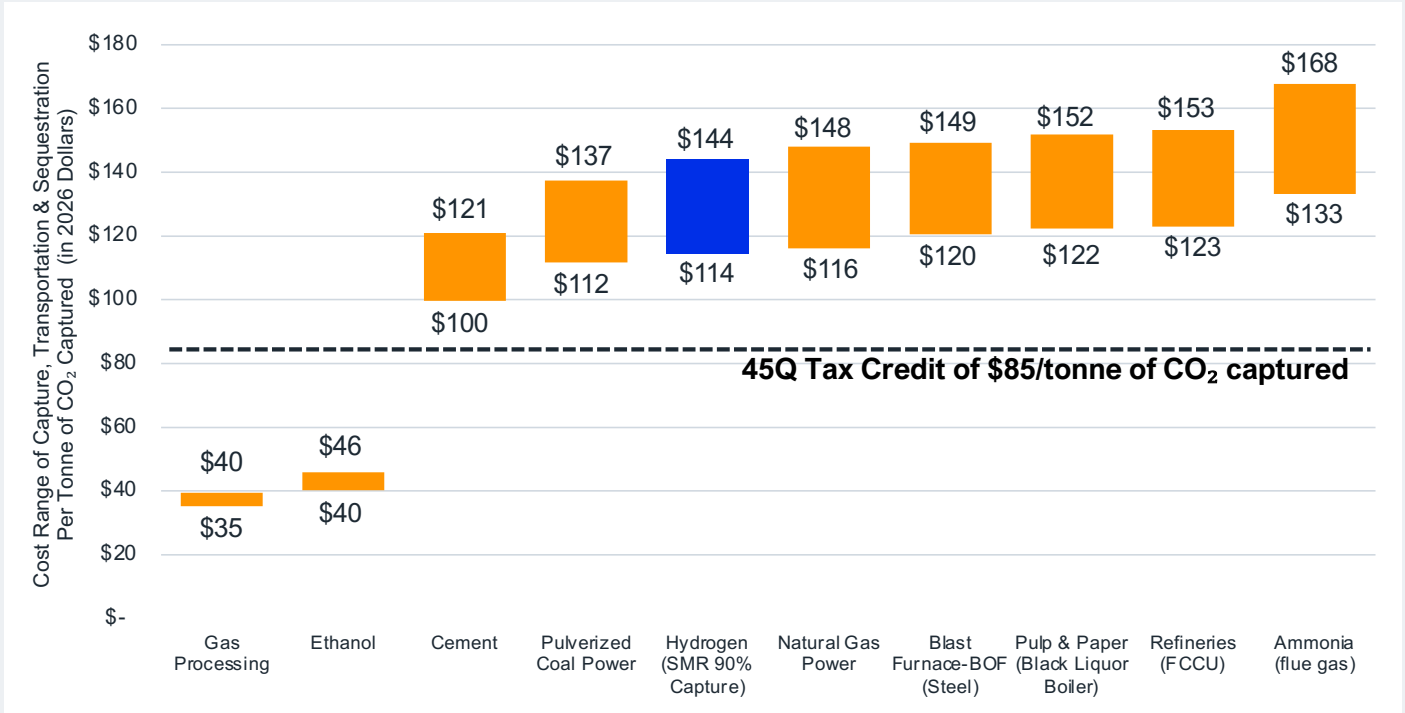


The Inflation Reduction Act (2022) increased 45Q tax credits significantly.

Despite huge increases, industry and advocates still think the subsidies for carbon sequestration and EOR are not enough to make it feasible financially.

CCS proponents are pushing for further increases in 45Q funding and parity between credits for permanently storing CO_2 and using it to extract more oil and gas.

Recently Estimated CO_2 Capture Costs



These estimates are consistent with actual costs of CO_2 capture at projects in Canada and the results of front-end engineering design (FEED) studies funded by the Department of Energy.

Data Source: Energy Futures Initiative (EFI), *Turning CCS projects in heavy industry & power into blue chip financial investments.* February 2023.

Note: The annual capture costs in the EFI study have been converted from year 2022 to year 2026 dollars to be consistent with the $85/tonne 45Q tax credit.

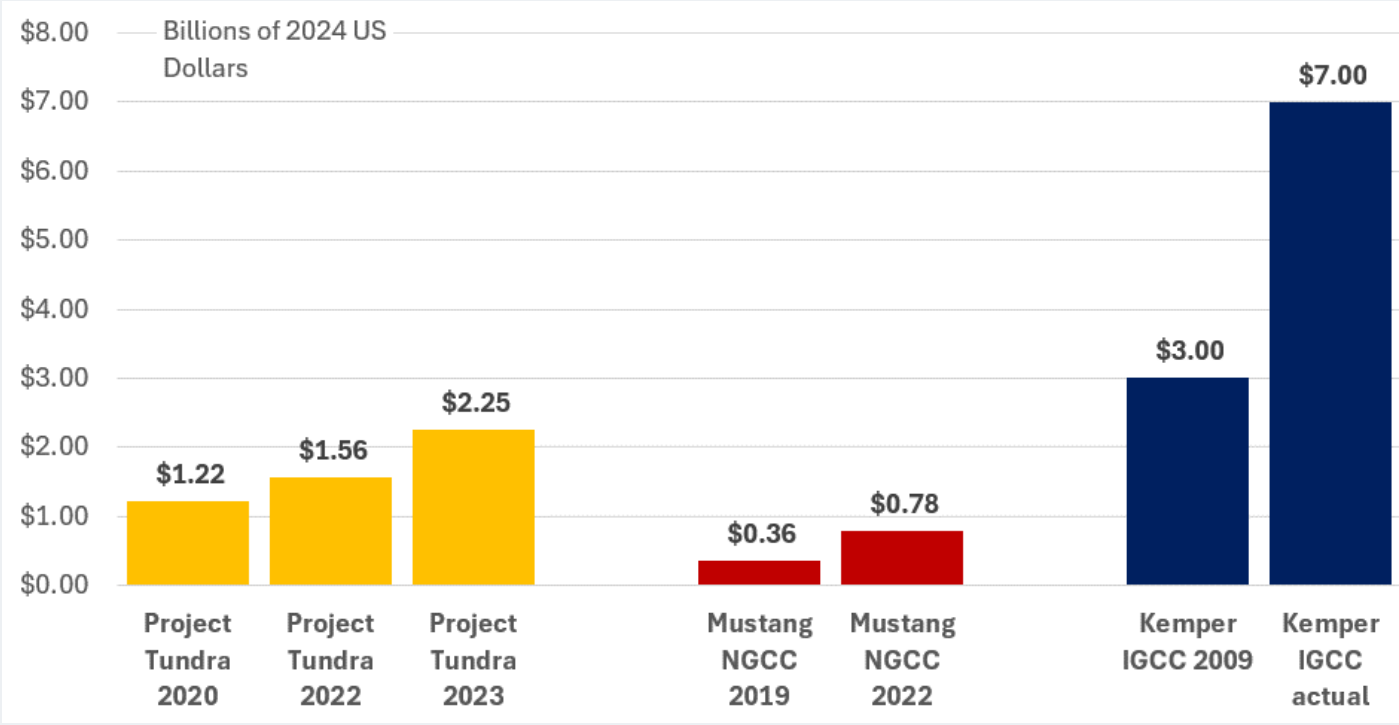
Carbon Capture's Soaring Estimated Capital Costs

Examples:

Project Tundra: coal-fired power plant with proposed post-combustion CO_2 capture.

Mustang: natural gas-fired combined cycle power plant which studied adding post-combustion CO_2 capture.

Kemper: coal-fired internal gasification combined cycle power plant with pre-combustion CO_2 capture; not capturing any CO_2.



For More Information

→ Contact: David Schlissel at dschlissel@IEEFA.org

→ Sign up to hear about new research from IEEFA: https://ieefa.org/subscribe

IEEFA Reports on Hydrogen
www.ieefa.org/topic/hydrogen