Carbon Capture and Sequestration: Fossil Fuels' Billion-Dollar Bailout

Fossil fuel corporations are asking for and receiving billions in federal support for carbon capture and sequestration (CCS) in lieu of shutting down their highly profitable dirty operations. Without hard limits on fossil fuel use, these dirty facilities could operate for their economic and technical lifetimes, pushing us over the brink of climate chaos. CCS technologies, repurposed from earlier promises of "clean coal," offer no real hope of avoiding climate chaos but allow the same companies responsible for climate change to make billions building unproven and ineffective infrastructure.

CCS: Oil Drilling Subsidy Masquerading as a Climate Solution

CCS proposes to capture carbon dioxide (CO_2) at smokestacks or from the atmosphere, then compress, transport, and inject the CO_2 either to extract more oil or to store the CO_2 in underground reservoirs. Around 95 percent of all captured carbon in the United States is used for enhanced oil recovery (EOR), a process of producing oil by injecting CO_2 mixed with other chemicals to flush out the oil.[1] EOR results in more carbon emissions than it stores. A ton of CO_2 produces 2 to 3 barrels of oil when injected; when burned, that oil emits around 1.2 tons of CO_2.[2] More than 119,500 wells inject CO_2 to produce oil. California, Kansas, Illinois, Oklahoma and Texas have the most of these wells.[3]

Of the 12 active CCS projects in the United States, only one sequesters the CO_2; the rest use the CO_2 for EOR.[4] The sole large-scale sequestration project is part of a U.S. Department of Energy (DOE) demonstration initiative where commercial projects engage in geological storage of CO_2.[5] As of August 2022, no additional geological storage CCS projects were under construction.[6]

To ensure climate safety, polluters must guarantee that carbon can be stored for thousands of years, but long-term stable storage of CO_2 remains largely unproven.[7] CO_2 must be injected under sufficient pressure to displace existing fluids. In small spaces, this can create rapid pressure increases that fracture containment layers.[8] Earthquakes from injection can also rupture storage seals, allowing CO_2 to leak.[9] The increased pressure is compounded by chemical reactions between the brine, CO_2, and minerals that can increase the permeability of the sealant layer.[10]

Natural variations in subsurface geology potentially allow CO_2 to rise to the surface unless trapped by sealing layers of rock.[11] For example, CO_2 can flow through water channels that may be connected to the surface.[12] Since many storage locations are in and around fossil fuel reservoirs, abandoned oil and gas wellbores provide a pathway for CO_2 leaking to the surface.[13] Any old, unsealed, or defectively sealed wells are essentially pipelines to the surface.[14] CO_2 can also slowly escape along well linings and has been shown to corrode materials used in well casings and seals.[15]

The U.S. Government Spends Billions to Save Fossil Fuels From an Early Exit

CCS grew out of federal "clean coal" efforts, which received $2.6 billion from the program's inception in 1984 to 1990, producing few technologies that could survive without government subsidies.[16] In 2003, President George W. Bush proposed reviving the clean coal program with a $1 billion coal power plant focused on capturing carbon emissions under the FutureGen program.[17] By 2008, "new market realities" forced the DOE to restructure the program into three smaller demonstration projects.[18]

In 2009, the American Recovery and Reinvestment Act (ARRA) provided an additional $3.4 billion for the research and development of CCS projects.[19] Out of nine large-scale demonstration projects funded by the ARRA, only two remain operational.[20] Of the five commercial power plant projects, only one (Petra Nova in Texas) ever reached operation, and it faced serious challenges that forced the plant to close after fewer than four years.[21]

Support for subsidies continues to grow despite lackluster results. The 2021 Infrastructure Investment and Jobs Act (IIJA) created billions in subsidies for carbon capture, such as $2.1 billion to provide low-interest loans and grants for CO_2 pipelines, $2.5 billion for "commercial large-scale" carbon storage projects, and $2.5 billion to develop four direct air capture hubs.[22] Despite billions in funding, some polluters remain unsatisfied with the level of support. ExxonMobil wants the government to provide an additional $10 billion grant for a carbon capture hub in Houston, the same amount the company committed to spend on buybacks of its shares in 2021.[23]

In addition to large infusions of support for CCS, from 2009 to 2021 Congress provided $2.7 billion in regular appropriations for the DOE to research and develop CCS.[24] Despite billions of dollars to fund decades of research and development, there remains "broad consensus" that CCS is too expensive for widespread deployment.[25] Even with exorbitant financial support, without scientific breakthroughs CCS may perpetually remain "one decade away."[26] For example,

continued optimism around natural gas CCS is remarkable since no commercial-scale gas-fired power plants have successfully adopted carbon capture, and capturing the diluted CO_2 from gas-fired power plants may be harder than capturing CO_2 from coal plants.[27]

CCS is dependent on increasingly extravagant tax credits

In 2008, Congress created the 45Q carbon capture tax credit for the first 75 million metric tons of CO_2 captured by a company. By 2020, around 72 million tons' worth of credits, or 96 percent of the available credit, had been claimed — worth an estimated $886 million in 2020 dollars.[28] 45Q suffers from serious oversight deficiencies. A 2020 Treasury Department Inspector General investigation found that nearly $1 billion in 45Q credits had been improperly claimed without meeting the U.S. Environmental Protection Agency's requirements for storage and monitoring. In other words, companies claimed the credits without proof that the CO_2 was effectively stored.[29]

The Joint Committee on Taxation estimates that the 45Q tax credit will cost the government only $689 million from 2018 to 2027, but this estimate assumes very low deployment of CCS technology, reflecting less than 20 million tons of carbon captured — less than 0.4 percent of total U.S. CO_2 emissions in 2020.[30] The Congressional Budget Office estimates that the changes to the 45Q credit in the 2022 Inflation Reduction Act (IRA) will cost only $3.2 billion over 10 years, reflecting between 9 and 13 million metric tons of CO_2 captured each year.[31]

That's a starkly different picture from that painted in some models such as the REPEAT Project model of the IRA, which predicts that 200 million metric tons of CO_2 will be captured each year by 2030.[32] If all U.S. CO_2 emissions were captured at the source with 45Q-compliant CCS projects, this would cost between $283 billion and $401 billion per year (before accounting for inflation).[33] Over a 12-year period, this amounts to between $3.4 trillion and $4.8 trillion. Capturing all U.S. CO_2 emissions from the atmosphere would cost between $613 billion and $850 billion per year.[34]

Legislation passed in 2018 lifted the cap and more than doubled the per metric ton value of the credit.[35] 45Q is currently worth $50 per metric ton of sequestered carbon and $35 for EOR. The 2022 IRA raised the credit to $85 for sequestered carbon and $60 for EOR for projects that meet certain wage requirements during construction and operation. Direct air capture facilities that meet these requirements are now eligible for $180 per metric ton for sequestered CO_2 and $130 per metric ton for EOR.[36] Other proposals include creating a direct pay option for 45Q, which would make companies that do not pay taxes eligible for the subsidy, further enriching CCS companies.[37] ExxonMobil claimed that the 45Q tax credit needed to be doubled (from $50) in order to scale up CCS.[38] The new 45Q credit is no longer quantity-capped but is available for the first 12 years of a project's lifetime.[39]

In addition to 45Q, many CCS projects could benefit from California's Low Carbon Fuel Standard, which allows out-of-state facilities to generate credits that are then sold, often at high prices, into California's marketplace.[40] These credits can stack with 45Q, allowing direct air capture facilities and fuel production facilities in California's fuel supply chain to receive as much as a combined $250 per metric ton of CO_2 sequestered.[41]

CCS Is a Huge Payday for Fossil Fuel Corporations and Wall Street

Carbon capture benefits fossil fuel interests beyond allowing their operations to continue unimpeded, through increased energy demand and revenues from building new infrastructure. The "energy penalty" — or inherent energy inefficiency associated with CCS — would supercharge demand for fossil fuels, requiring substantially more coal and natural gas to produce the same amount of energy. Food & Water Watch found that if all power plants used CCS, they would burn 43 percent more coal and 39 percent more natural gas.[42] Additionally, the same companies responsible for climate change are well positioned to receive subsidies for investing in carbon capture infrastructure.

A 2021 White House report estimated that 65,000 additional miles of CO_2 pipelines are needed by 2050 under the Biden administration's climate vision.[43] Pipeline companies are already rushing to cash in on the new subsidies. Oil refiner Valero and Blackrock teamed up to back the Heartland Greenway, a 1,300-mile CO_2 pipeline.[44] Canadian Energy company Wolf Midstream is building a 350-mile CO_2 pipeline, and Continental Resources invested $250 million in the Summit Carbon Solutions CO_2 pipeline.[45] These pipeline companies will be able to cash in by carrying lucrative CO_2 cargo from capture sites to oil and sequestration fields. Three proposed midwestern pipelines would transport CO_2 worth as much as $23 billion in 45Q tax credits over 12 years.[46] These projects stand to transport CO_2 worth up to $40 billion from the new IRA-increased 45Q credits.[47]

Several oil majors have announced CCS projects at petrochemical plants in the Gulf Coast region. A BP-Linde joint venture aims to store 15 million metric tons of CO_2 from Linde's hydrogen plants.[48] An ExxonMobil project anticipates capturing 100 million metric tons of CO_2 annually, worth up to $5 billion per year in 45Q credits.[49] The Chevron-Talos joint venture plans on buying 250 million metric tons of CO_2 per year for use offshore.[50] Sempra announced plans to capture 2 million metric tons of CO_2 annually for permanent storage from liquefied natural gas (LNG) export facilities.[51] Together these projects could receive $372 billion worth of 45Q tax credits.[52]

Oil companies are also investing in direct air capture operations, which can greenwash fossil fuel projects and potentially access lucrative government subsidies. ExxonMobil plans to invest $3 billion in carbon capture including direct air capture projects.[53] Chevron invests in several carbon capture companies such as Blue Planet Systems.[54] Occidental Petroleum and Chevron back Carbon Engineering Ltd., a Canadian company that aims to capture 1 million metric tons per year — a project that would be worth up to $1 billion in 45Q tax credits.[55]

Direct air capture is incredibly inefficient because CO_2 in ambient air is 100 to 300 times more diluted than typical smokestack emissions.[56] Direct air capture plants are massive and require colossal amounts of energy to operate.[57] If powered with natural gas or coal, the process releases more CO_2 than it captures.[58] In other words, closing fossil fuel-powered facilities is a better use of electricity than direct air capture.

Wall Street takes a cut of CCS subsidies

The complicated subsidization of CCS through tax credits provides numerous ways for investment companies to profit from swaps, hedges, and tax equity deals.[59] Private equity companies are increasingly involved in these tax credit deals.[60] For example, private equity firm Cresta Fund Management created Lapis Energy to invest in hydrogen and CCS.[61] Consultants think that, globally, direct air capture and bioenergy CCS could produce up to $625 billion in revenue annually by 2050, partly because investors are eager to buy credits to "offset" their carbon emissions.[62]

CCS Is a Lifeline to Fossil Fuel Investors

Carbon capture appeals to fossil fuel interests because it proports to allow continued fossil fuel use without carbon emissions. Limits on the burning of fossil fuels would immediately erase as much as trillions of dollars in fossil wealth in power plants and untapped reserves held by oil, gas, and coal companies and utilities.[63] By some estimates, global anticipated profits from fossil fuels total over $30 trillion by 2100.[64] Despite the growing urgency of climate change, investors continue to flock to fossil fuels. From 2016 to 2020, the 60 largest banks invested $3.8 trillion in fossil fuels.[65]

For even modest climate targets, CCS is one of the only ways to avoid early closure (and write downs) for these investments.[66] The Intergovernmental Panel on Climate Change (IPCC) estimates that without CCS, fossil-fueled power plants will have to close an average of 23 years early. Even with CCS, trillions of dollars' worth of fossil fuel infrastructure must be stranded to avert climate chaos.[67]

CCS is unlikely to save old, dirty investments. Despite many failures, proponents misguidedly advocate for retrofitting old plants with CCS. Even if the technology worked, the buildout would likely be too slow to meet climate needs.[68] Old power plants tend to inefficiently convert fuel to power, which means increasing fuel use substantially to run the capture system, and the site may not have room.[69] Adding carbon capture to older plants approaches the cost of building power plants from scratch.[70]

Conclusion

While progress to demonstrate technologically feasible CCS has stalled, scientific advances now mean that off-the-shelf, commercially available technologies such as wind, solar and storage could support a power grid without any fossil fuels.[71] For example, Petra Nova's CCS project was three times as expensive as achieving a similar emissions reduction with wind energy.[72] Instead of pouring billions of dollars into false solutions and the pockets of fossil fuel corporations, it is time to rapidly transition to a 100 percent renewable energy system.

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