

CO₂ Fracking: A Recipe for Disaster

Nearly ten years after New York State's historic ban on hydraulic fracking, a recently formed out-of-state company seeks to exploit vulnerabilities in the law^a to launch a dangerous, bizarre, and far-reaching plan to frack with liquid carbon dioxide (CO₂) in the Southern Tier region. The technology has many of the same climate and environmental problems of traditional fracking, as well as dangers unique to CO₂. Community and environmental advocates have correctly realized that this new scheme is little more than a desperate and dubious attempt to bring fracking to a region where traditional fracking is illegal. Rather than opening New York to a new, dangerous form of fossil fuel production, state leaders must close legal loopholes, reject carbon capture boondoggles, and commit to producing clean, affordable energy for all.

The Scheme

Southern Tier CO₂ to Clean Energy Solutions (Southern Tier Solutions)^b is owned by CO₂ to Clean Energy Solutions, LLC, a company registered in Wyoming in April 2023 using a business registration company out of Texas.¹ The company's president, Bryce Phillips, is the only employee listed on the website, and it is unclear how many other employees (if any) the company has.²

Phillips' plan for the Southern Tier is remarkably aggressive. His company seeks to lease hundreds of thousands of acres of land to frack with CO₂ in New York's Marcellus and Utica shale plays.³ Southern Tier Solutions imagines that it can build a number of "regional hubs" that would include carbon capture facilities to provide the CO₂ that it would use for its fracking operations. The company also proposes to build and operate as many as 12 new 300 megawatt natural gas-fired power plants.

To address the emissions of these new gas-burning plants, Southern Tier Solutions promises to employ proven-to-fail carbon capture and storage (CCS) technologies.⁴ In total, the company is proposing to build a closed-loop system of technologies that, practically speaking, do not exist (and have never existed) at anywhere near the scale envisioned.

^a New York State restricts fracking based on the volume of water used, not on the effect of well stimulation on underlying geology.

^b Its full legal name is "Southern Tier CO₂ to Clean Energy Solutions."

The Dangers

CO₂ fracking is less common than hydraulic fracking, and many of the environmental impacts are insufficiently studied, but the technology shares much in common with hydraulic fracturing.⁵ Experiments in using a combination of high-pressure liquid CO₂ (to fracture) and sand (for proppant) to extract natural gas from shale formations date back to at least 1982.⁶ The technique has been used internationally but is rarely done in the United States.⁷ Typically, once the high-pressure injection of sand and CO₂ slurry cracks the shale, a “flowback” returns fluid to the surface, lowering the pressure and leaving the sand or “proppant” in place to hold the rocks open.⁸ Like hydraulic fracking, this practice is fraught with environmental dangers.

Earthquakes

There is a well-established link between hydraulic fracking and earthquakes,⁹ as well as between underground injection of CO₂ in storage schemes and earthquakes.¹⁰ A wealth of evidence highlights that CO₂ fracking is even more likely to cause seismic activity than hydraulic fracking.¹¹ Fracking-linked earthquakes can also cause infrastructure and property damage.¹² Seismic events with a magnitude as high as 4.4 on the Richter scale have been recorded at CO₂ injection sites; this is near the levels that can damage buildings and infrastructure and contaminate drinking water.¹³

Technical literature, concerned primarily with maximizing production, enthusiastically announces that CO₂ fractures several times the volume of rock as hydraulic fracking,¹⁴ and creates larger and more complicated fractures.¹⁵ These complex cracks are more widely distributed from the drilled hole.¹⁶ CO₂ also induces more geological swelling, with potential for greater changing of the rock structures¹⁷ and additional fractures from the thermal shock.¹⁸ All of these factors increase earthquake risks.¹⁹ These complex changes to the geological structure also have the potential to damage boreholes and well casings,²⁰ which can lead to groundwater contamination.²¹

Mass poisonings

CO₂ injection infrastructure poses numerous health and safety risks because carbon dioxide is prone to leakage during transport, injection, and long-term storage.²² The health consequences are serious: Concentrated CO₂ is denser than air, meaning that when the gas is released into the air, it can displace oxygen and result in mass poisonings. Exposure to CO₂ concentrations higher than 10 percent is potentially fatal,²³ while concentrations of 17 percent or more are immediately fatal. Even trace amounts can have health effects. Well failure during injection or a blowout could release large amounts of CO₂. Extreme accidents could have impacts up to two miles away.²⁴ Injection pressure can also reactivate fracture networks or deform the sealing layer, allowing leaks to the surface.²⁵ Earthquakes further magnify the risk of leaks.²⁶

Pipeline ruptures

Historically, pipelines have been concentrated in areas of high social vulnerability, including rural areas lacking emergency response capacity.²⁷ When a CO₂ pipeline ruptured in rural Satartia, Mississippi in February 2020, it took 13 minutes for responders to be alerted, 30 minutes to recognize what was in the air, but mere minutes for residents to feel the effects. Fortunately, no one died, but some residents are still experiencing respiratory health effects today.²⁸

Fugitive climate emissions

Abandoned oil and gas wellbores provide a pathway for CO₂ leaking to the surface.²⁹ Any old, unsealed, or defectively sealed wells are essentially pipelines to the surface.³⁰ CO₂ can also slowly escape along well linings and has been shown to corrode materials used in well casings and seals.³¹ Over time, undetected leaks can allow all of the injected CO₂ to return to the surface.³² This risk is especially notable in the Southern Tier, which has a legacy of inadequately decommissioned wells dating back to the 1860s. Only a fraction of the wells drilled before 1950 have even been located, let alone plugged.³³

Water contamination

While Southern Tier Solutions tries to greenwash its operations by claiming that it will not use proppants or chemical additives,³⁴ this does nothing to eliminate threats to clean water. Pure CO₂ alone can have serious groundwater impacts. Injected CO₂ chemically reacts with rocks, potentially contaminating groundwater by unlocking previously stored elements such as strontium, zinc, cobalt, and barium.³⁵ Moreover, initial promises may mean little, as technical research suggests that adding chemicals to the injection slurry is necessary to overcome limitations inherent in CO₂ fracking.³⁶

Additionally, experiments with CO₂ fracking show that the majority of the gas is not retained in the rock, but returns to the surface as flowback.³⁷ Just like with hydraulic fracking, this upward movement also pulls to the surface contaminated formation water, often brine (a highly saline underground water mixture) mixed into the CO₂ fluid.³⁸ This phenomenon has been documented in CO₂ injection operations in the Utica shale, the same kind present in the Southern Tier.³⁹ Disposal of this wastewater (traditionally via reinjection) has serious environmental impacts.

While the precise constituents of the wastewater vary depending on the geology of the extraction site,⁴⁰ it all brings reason for concern. Wastewater can contain salts (chlorides, bromides, and sulfides of calcium, magnesium, and sodium), metals (barium, manganese, iron, and strontium), oil, grease, dissolved organics (benzene and toluene), and radioactive material (radium-226).⁴¹ These chemicals can cause cancer, disrupt the endocrine system, affect the nervous, immune, and cardiovascular systems, and affect sensory organs and the respiratory system.⁴² Underground injection of this wastewater can put aquifers and drinking water at risk,⁴³ and extensive research links fluid injection and disposal to further risk of earthquakes.⁴⁴

Reduced quality of life

If Southern Tier Solutions' proposed project unfolds as promised, it would have serious consequences for surrounding communities. The traditional fracking boom brought significant environmental, social, and infrastructure costs to states like Pennsylvania — for example, a large buildout of disruptively noisy compressor stations that emit local air pollutants.⁴⁵ CO₂ fracking is likely to have an even larger infrastructure footprint than hydraulic fracking. A Food & Water Watch (FWW) analysis of the hydraulic fracking boom in Pennsylvania found that heavy truck crashes increased in heavily fracked counties.⁴⁶ One life-cycle analysis found that CO₂ fracking requires twice as many truck trips as traditional fracking.⁴⁷

The Climate Consequences and CCS Boondoggles

While Southern Tier Solutions presents its scheme as “environmentally friendly,” there is no doubt that fracking is a climate catastrophe. The significant, persistent methane leakage associated with fracking is responsible for at least half of the practice’s life-cycle greenhouse gas emissions.⁴⁸ These emissions can in no way be mitigated through Southern Tier Solutions’ various carbon capture and storage (CCS) proposals, including direct air capture.⁴⁹

In theory, direct air capture pulls carbon dioxide from the atmosphere, but the technology is materially and energy intensive due to the low concentration of CO₂ in the air.⁵⁰ CO₂ fracking would require 44 percent more energy than hydraulic fracking, due to the increased separation, compression, and transportation requirements of managing CO₂.⁵¹

Carbon capture also relies on toxic solvents⁵² and consumes large quantities of water⁵³ and electricity.⁵⁴ FWW finds that powering direct air capture with natural gas is responsible for the equivalent of 3.1 tons of CO₂ worth of greenhouse gas emissions for every ton “captured” from the atmosphere.⁵⁵ To put it simply, the technology that Southern Tier Solutions would need for its CO₂ supply would create significant new climate pollution.

In another bid to bolster its green credentials, Southern Tier Solutions also proposes installing CCS technology to capture emissions from its power plants. However, no commercial-scale gas-fired power plant has ever successfully deployed CCS. In fact, the climate consequences of adopting natural gas CCS would be devastating.⁵⁶ A FWW analysis finds that the increased methane emissions from producing additional natural gas to meet the high energy requirements for capturing CO₂ from natural gas combustion undermines the benefit of capturing those emissions. In fact, equipping fracked gas power plants with 90 percent effective carbon capture would only lower their life-cycle emissions by 18 percent, even assuming that the captured carbon emissions remain underground, which is dubious as best.⁵⁷

Another CCS scheme floated by Southern Tier Solutions is employing oxyfuel natural gas power plants.⁵⁸ Oxyfuel gas power plants are another theoretical, unproven technology that uses pure oxygen and natural gas as fuel. In theory, recirculating the CO₂-laden exhaust back into the system would raise the concentration of CO₂ in the eventual waste stream, reducing the typically significant amount of power required to purify the CO₂ for capture.⁵⁹

There is a chasm between the promises and track record of this technology. The company NET Power announced plans to build a 50 megawatt pilot plant that demonstrates the technology by 2015.⁶⁰ NET Power then claimed that the plant would be fully commissioned in 2017, but the pilot plant did not achieve grid synchronization until 2021.⁶¹ The plant appears to also have been significantly over budget. When construction started, NET Power said that the pilot plant was a “\$140 million program,” but in a 2023 interview, the CEO described spending “a couple of hundred million dollars” on the project.⁶²

NET Power’s announcement in May 2023 of a commercial-scale Allam Cycle gas plant by 2026⁶³ is already behind schedule and over budget, with current estimates costing double what the company said in 2018 that a new plant would cost.⁶⁴ The plant’s technology is also significantly less efficient

than was described in early media promises.⁶⁵ The CEO of NET Power concedes that even after reaching mass production, these plants will be 2.5 to 3.3 times as expensive as traditional gas plants.⁶⁶

Conclusion

There is no magic combination of technologies capable of making fracking safe for people, the environment, or the climate. It is time to close the loopholes that allow for dangerous CO₂ fracking schemes, and to ban carbon capture in New York. Rather than searching for new ways to extract fossil fuel, New York needs to rapidly transition to 100 percent renewable energy and ensure affordable energy for all.

Endnotes

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