FOOD & WATER ACTION EUROPE

Rue d'Edimbourg 26
Brussels 1050
Belgium
T +32(0)2893 1045
foodandwatereurope.org

Carbon Capture and Storage: An Expensive and Unproven False Solution

We must take bold and uncompromising action to stave off the worst effects of climate change. If the planet warms more than 1.5 degrees Celsius, increased temperatures could cause irreversible damage, potentially making parts of the world uninhabitable this century. A central false solution to climate change is Carbon Capture and Storage (CCS), which describes a set of technologies for fossil fuel companies to capture carbon dioxide either at the smokestack or in the atmosphere, then transport the CO_2 in pipelines and inject it underground. CCS is popular with energy giants because it enables corporations to keep doing business as usual, while pretending to fight climate change. In reality, CCS is unproven and faces insurmountable technical, financial and environmental barriers. It has also faced public opposition and concerns about efficacy.

CCS is a high-priced flop

Despite billions in government handouts, power plant CCS technology remains expensive and has not lived up to the hype. Even with decades of support, cost estimates for power plants with CCS remain substantially higher than they were in 2005.[1] Prohibitive investment costs have hindered large-scale implementation across Europe.[2]

In 2013, Norway's government terminated a full-scale CCS project that would have been located at Statoil's Mongstad refinery. Statoil called the CCS project "extensive and demanding."[3] In 2015, the UK government scrapped a £1 billion grant to fund two commercial CCS projects.[4] A couple year later in 2018 European Court of Auditors report found that the European Commission dished out over €258 million for failed commercial CCS projects.[5] The failed projects were a part of two funding programs formed in 2009 to support CCS and renewable energy, with a combined €3.7 billion budget.[6] None of the 12 proposed commercial CCS projects came to fruition.[7]

From the UK through Spain to Poland and Italy and Germany, expensive CCS projects under this agenda fizzled out.[8] Notoriously, the Dutch demonstration project, Rotterdam Capture and Storage Demonstration (ROAD), was mothballed in 2017 after 8 years citing fallen carbon prices and funding problems.[9] The European Commission doled out €180 million to the project and the Dutch government handed over another €150 million. It also received €4.3 million in funding from the Global CCS Institute.[10] ROAD was the largest CCS project in the world and "widely recognized as the most promising" in Europe."[11]

CCS is not a climate solution

CCS can only reduce a fraction of the emissions from electricity generation. The most ambitious forms of CCS capture only 90 percent of emitted carbon; however, when emissions associated with the operation of capture facilities are considered, reductions fall to near 80 percent.[12] Moreover, both coal mining and natural gas production emit large quantities of methane, a greenhouse gas 86 times as potent as CO_2 over 20 years.[13] U.S. modeling suggests that when methane emissions from increased production are factored in, CCS can only reduce electricity sector emissions by 39 percent.[14]

There is a lot of greenwashing about CCS plants, but in reality, they have to burn more fuel to power the equipment to capture the carbon in the first place. From transportation to injection, CCS requires huge amounts of electricity.[15] A fraction of the fuel must be dedicated to CCS operations, which reduces a power plant's electric output (otherwise

referred to as the "energy penalty").[16] To compensate for decreased efficiency, generators must expand and burn more fossil fuels to produce the same amount of electricity.[17]

CCS means continued fossil fuel pollution

Power plants and their supply chains are responsible for ongoing, large-scale pollution, and CCS will keep these plants open. Estimates suggest that if all U.S. power plants used CCS, they would burn 39 percent more natural gas and 43 percent more coal.[18] Without new scrubbers, additional fuel consumption will increase emissions.[19] Power plant emissions of SO_2, NO_x and particulate matter contribute to respiratory health problems, like chronic bronchitis and emphysema, and worsens existing heart disease, causes labored breathing and reduces life expectancy.[20] In Europe, particulate matter pollution primarily originates from fossil fuel combustion, which was responsible for 422,000 premature deaths across the continent in 2015.[21] Top coal user Germany had the most premature deaths (62,300).[22]

The continued use of fossil fuel power plants also means continued production of fossil fuels and the inevitable leaks of greenhouse gases during the extraction, transportation and end uses.

"Negative emissions" technologies and reuse

Beyond the notion of CCS-equipped power plants, there are "negative emissions" technologies which promise to remove atmospheric carbon in the future. When CCS is combined with bioenergy (like biomass, biogas or biomethane) or direct air capture (catching CO_2 dispersed in the atmosphere), it unlocks dangerous and speculative "negative emissions" narratives — fables that delay real climate action with the promise of a super technology that will stop the climate crisis.[23]

Bioenergy is allegedly carbon neutral because crops and trees pull carbon from the atmosphere, and when equipped with carbon capture these facilities are supposedly "carbon negative." But this doesn't factor in the energy-heavy agricultural inputs and land use trade-offs. (Bioenergy/biomass production competes with land uses for habitation, conservation and food production.[24]) Also, while capture of carbon emissions from the refining of biomass to liquid fuel is possible, the resultant biofuel emits CO_2 when burned (ex: at the tailpipe).[25]

One of the most speculative carbon capture schemes is direct air capture (DAC), which involves pulling carbon directly out of the atmosphere.[26] This process is incredibly inefficient because CO_2 in ambient air is 100 to 300 times more diluted than typical smokestack emissions.[27] DAC plants are massive, land intensive and require colossal amounts of energy to operate.[28] Functional DAC is essentially bad energy storage that requires a fully renewable grid; if powered with natural gas or coal, the process releases more CO_2 than it captures.[29]

On the other hand, some corporations are touting the reinjection of captured oil CO_2 underground to stimulate oil well production. Known as CO_2 enhanced oil recovery (EOR), the method injects captured carbon CO_2 into mature, low-pressure oil reservoirs to drive the remaining oil to the surface. EOR operations often mix CO_2 with hundreds to thousands of tons of dangerous surfactants and nanoparticles underground to increase oil output.[30] The primary goal of EOR is maximizing oil production, not storing carbon,[31] which naturally results in more carbon emissions.

Conclusion and recommendations

We need a radical change in the way we produce energy. But decisionmakers are seduced by technological band-aid fixes promoted by corporations that will keep us locked into a fossil-fueled future. To avoid the 1.5-degree Celsius tipping point, we must rapidly decarbonize our grid and hit net-zero global emissions by 2050.[32] This requires a transition to 100 percent renewable energy,[33] which is also the cheaper energy option. A 2014 analysis of new CCS, nuclear, wind and solar projects in Germany and the UK found "new wind and solar can provide carbon-free power at up to 50 percent lower generation costs than new nuclear and [CCS]."[34]

Despite what naysayers proclaim, technology exists to support a transition to 100 percent clean, renewable energy backed up by storage and transmission.[35] And a variety of energy storage technologies can provide cost-effective, reliable, long-term back up, obviating the need for dispatchable power plants.[36] The only real solution is a systemic shift to a renewable energy future.

- For more information on CCS go to https://fwwat.ch/2xuOZBK, our sister organization Food & Water Watch's publication *The Case Against Carbon Capture: False Claims and New Pollution*.

Endnotes

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