OPINION

Biden's Carbon Capture Funding Actually Incentivizes More Emissions and Higher Costs

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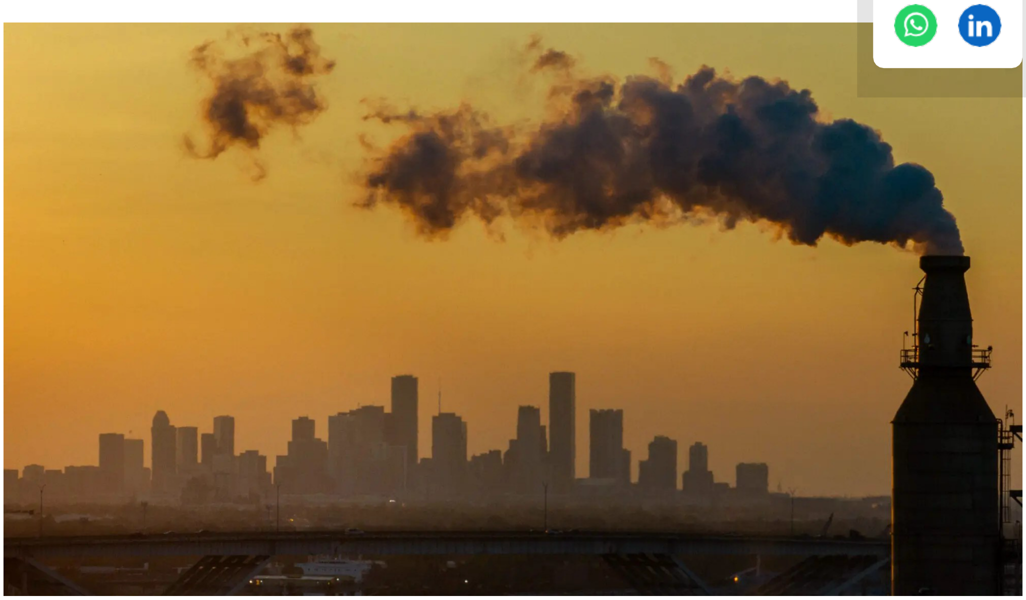

In an aerial view, the Houston skyline is seen from the Valero Houston refinery on Aug. 28, 2023 in Houston, Texas. Brandon Bell/Getty Images

Global warming, air pollution and energy insecurity are three of the biggest problems facing the world today. The primary solution to these problems is to transition nearly all energy for transportation, buildings and industry to electricity, then to provide the electricity from clean, renewable sources — like wind, solar, geothermal and hydroelectricity — combined with storage, while simultaneously addressing non-energy emissions such as biomass burning, halogens, methane and nitrous oxide from agriculture. Given that 7.4 million people die and billions more become ill each year from air pollution — and that it would be necessary to eliminate 80% of all emissions by 2030 and 100% by 2035-2050 to avoid more than 1.5 degrees Celsius (2.7 Fahrenheit) global warming above pre-industrial levels — the problem is overwhelming, and the solution must be implemented rapidly and effectively. The world cannot afford to spend time on solutions that do not work well or at all.

Many organizations, including the International Energy Agency and fossil-fuel companies, like Exxon-Mobil, have argued that carbon capture storage or use (CCSU) is needed to help solve the climate problem. Carbon capture is the extraction of carbon dioxide (CO_2) from an exhaust stream, such as from a coal-fired power plant, a fossil gas-fired boiler, an ethanol refinery or a cement factory. CCSU differs slightly from synthetic direct air carbon capture and storage or use (SDACCSU), which is the process by which CO_2 is extracted by equipment from the air, instead of from an exhaust stream. A third type of carbon capture is natural direct air capture, which is the process by which trees and other vegetation extract both CO_2 and water vapor from the air to grow, expelling oxygen.

Natural carbon capture faces little objection. The other types, though, face objection because they require equipment and energy while they permit the continuation of fossil fuel mining, combustion and infrastructure, as well as bioenergy land use, combustion and infrastructure.

After the CO_2 is captured during CCSU and SDACCSU, it is piped either to a location where the CO_2 is used for industry or stored underground. Today, 73% of CO_2 captured is used for enhanced oil recovery, where the CO_2 binds with oil to make it less dense to enable the oil to float to the surface faster. During that process, about 40% of the CO_2 captured is released back to the air. The remaining CO_2 is either used for other industrial applications (such as electro-fuels that displace gasoline, diesel or jet fuel) or stored underground.

The Biden administration has poured billions of dollars into carbon capture and direct air capture, through the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, with the hope that it will help solve the climate problem. Universities worldwide are also investing billions of dollars in researching carbon capture. The Inflation Reduction Act incentivizes CO_2 capture from all possible sources. In particular, it has incentivized proposals to capture CO_2 from the fermentation process of up to 34 ethanol refineries in the upper Midwest United States and pipe the CO_2 to an underground storage facility in North Dakota. The CO_2 from fermentation is extremely pure, so no energy is needed to separate the CO_2 from the rest of the exhaust, unlike with carbon capture from a coal plant or with direct air capture. However, energy is still needed to compress the CO_2 for transport through pipes. Despite the incentive provided by the U.S. government and the proposals submitted to build such carbon capture and pipe infrastructure for ethanol, no study has evaluated whether the infrastructure may even reduce CO_2 or how it will affect consumer cost, air pollution or land requirements.

In a recent study published in *Environmental Science and Technology*, I carried out such an evaluation. In this study, I first evaluated the CO_2 emission savings and cost of a proposal, submitted by Summit Carbon Solutions, to add carbon capture equipment to each of 34 refineries in Iowa, Nebraska, South Dakota, Minnesota and North Dakota, then to build 2,000 miles of pipes connecting the refineries. The ethanol from the refineries is currently blended with gasoline for use in flex-fuel vehicles, which are vehicles that run on either gasoline or ethanol-gasoline blends.

I then compared this “ethanol plan” with using the same money to purchase wind farms to power battery-electric vehicles. To do this, I compared the use of a 2023 Ford F-150 four-wheel drive, eight-cylinder flex-fuel vehicle running on a blend of E85 (85% ethanol and 15% gasoline) with a 2023 Ford F-150 four-wheel drive extended range battery-electric vehicle.

Results suggest that, compared with using ethanol with carbon capture and pipes to power F-150 flex-fuel vehicles (the ethanol plan), this wind plan (using wind turbines to power F-150 battery-electric vehicles) may reduce 2.4 to four times the CO2 and may save drivers in these five states $40 billion to $66 billion (USD 2023) over 30 years even when each battery-electric vehicle initially costs $21,700 more than each flex fuel vehicle (as it does today). The wind plan may also require only 1/400,000 of the land footprint and 1/10 to 1/20 the spacing area, and it may decrease air pollution, compared with the ethanol plan.

The large CO2 and cost savings due to the wind plan result from the fact that the F-150 battery-electric vehicle uses only about one-fourth the energy as the flex-fuel vehicle to go the same distance. Despite the $21,700 higher up-front cost of the electric vehicle, the fuel cost savings are so enormous, when projected over 30 years, that they save consumers billions of dollars. In addition, the wind plan eliminates almost all CO2, whereas the ethanol plan still results in significant CO2 emissions.

Even building wind farms to replace coal-fired electricity generation (instead of powering battery-electric vehicles) may avoid 1.5 to 2.5 times the CO2 as the ethanol plan. Thus, ethanol with carbon capture appears to be an opportunity cost that may damage climate and air quality, occupy land and saddle consumers with high fuel costs for decades.

Thus, instead of incentivizing a CO2 reduction, the Inflation Reduction Act, along with the Infrastructure Investment and Jobs Act, through their funding of carbon capture, actually incentivize net increases in CO2, air pollution, land use and consumer costs. This study concludes that it is far better to close the ethanol refineries and stop selling flex-fuel vehicles, but instead sell more battery electric vehicles powered by wind (or solar) electricity. As such, incentivizing carbon capture is an opportunity cost. This same result applies for all other carbon capture and direct air capture applications, as illustrated as well in other studies. The reason is that all carbon capture and non-natural direct air capture require energy and equipment and never reduce air pollution, mining or infrastructure. Even using renewable energy to power CCSU or SDACCSU prevents the renewable energy from replacing a fossil or bioenergy source of combustion, thereby preventing the renewables from reducing more CO2 in addition to reducing air pollution, mining and infrastructure, which CCSU and SDACCSU never do.

Mark Z. Jacobson is a professor of civil and environmental engineering at Stanford University and the author of the book "No Miracles Needed: How Today's Technology can Save our Climate and Clean our Air," and the recent study, "Should Transportation Be Transitioned to Ethanol with Carbon Capture and Pipelines or Electricity? A Case Study."
