Renewables or carbon removal: which is the better climate bet right now?

In a rare head-to-head test of returns on investment, renewables bested carbon capture in almost all scenarios across the U.S. through 2050

By Sarah DeWeerdt May 12, 2026

Dollar for dollar, investing in renewable energy provides greater benefits to society than technology to remove carbon dioxide from the atmosphere, according to a new analysis.

Most previous studies of direct air capture (DAC) have looked at whether it **removes more carbon dioxide than it produces**, or whether it costs society less to remove a ton of carbon from the atmosphere than it does to leave it there—in effect comparing carbon capture with doing nothing.

"Many analyses ask 'is direct air capture net-negative?' and leave it there, without acknowledging that there is an opportunity cost to investing in direct air capture," says study team member **Yannai Kashtan**, a researcher at PSE Healthy Energy, an Oakland, CA-based independent research institute.

Instead, Kashtan and his colleagues set a higher bar for DAC, comparing its return on investment to that of other climate-friendly technologies, namely renewable energy development.

"I was surprised how much the answer [to] 'is DAC worth it?' changes when you change your metric," Kashtan says.

The researchers modeled the health and climate benefits of investing $100 million in direct air capture versus investing the same amount in utility-scale solar or onshore wind in 22 regions across the United States through 2050.

The public health impact of DAC is often overlooked in studies of the technology. But if the electricity to power DAC comes even partially from a fossil-based grid, it results in sulfur dioxide, nitrogen oxide, and small particulate matter pollution—while renewables do not.

The researchers modeled four scenarios for the **development of DAC technology** and performance, analyzing each of these in the context of eight different hypothetical future grid scenarios developed by the U.S. Energy Information Administration.

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The results were stark. "Solar and wind beat direct air capture now and all the way through 2050, even if direct air capture gets substantially cheaper and more energy-efficient," says Kashtan.

If today's performance of DAC holds—the technology currently requires about 5,500 kilowatt hours of electricity and costs $1,000 to remove one ton of carbon dioxide from the atmosphere—it would have a net negative impact on society through 2050 due to **greenhouse gas emissions and harmful air pollution**, the researchers found.

Even if DAC energy use falls by more than two-thirds to 1,500 kilowatt hours and its cost by half to $500 per ton of carbon dioxide removed, the benefits of renewables are several-fold greater than those of DAC.

Only in the most optimistic scenario for DAC development—in which these figures fall to 800 kilowatt hours and $100 per ton of carbon dioxide removed—does the technology edge out renewables nationwide. Even then, solar and wind remain the better investment in some regions, such as across the Midwest.

"To be clear, direct air capture can do something solar and wind cannot: *reduce* atmospheric CO_2 concentrations, undoing past damage," Kashtan says. But **until carbon emissions are virtually zeroed out, DAC is highly unlikely to be cost-effective compared to investing in renewables**. Kashtan compares the situation to a **common-sense principle: "fix your broken faucet before you start mopping the floor."**

A future analysis could try to find the "tipping point" where the grid is sufficiently clean that DAC offers greater bang for the buck, says Kashtan.

Source: Kashtan Y. *et al.* "**Direct air capture has substantial health and climate opportunity costs**." *Communications Sustainability* 2026.