Global Thermostat
The Carbon Negative Solution

MIT Technology Review

How we'll invent the future, by Bill Gates

We asked Gates to choose this year's list of inventions that will change the world for the better.

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I was honored when MIT Technology Review invited me to be the first guest curator of its 10 Breakthrough Technologies. Narrowing down the list was difficult. I wanted to choose things that not only will create headlines in 2019 but captured this moment in technological history—which got me thinking about how innovation has evolved over time.

My mind went to—of all things—the plow. Plows are an excellent embodiment of the history of innovation. Humans have been using them since 4000 BCE, when Mesopotamian farmers aerated soil with sharpened sticks. We've been slowly tinkering with and improving them ever since, and today's plows are technological marvels.

Carbon dioxide catcher

Practical and affordable ways to capture carbon dioxide from the air can soak up excess greenhouse-gas emissions.

Even if we slow carbon dioxide emissions, the warming effect of the greenhouse gas can persist for thousands of years. To prevent a dangerous rise in temperatures, the UN's climate panel now concludes, the world will need to remove as much as 1 trillion tons of carbon dioxide from the atmosphere this century.

In a surprise finding last summer, Harvard climate scientist David Keith calculated that machines could, in theory, pull this off for less than $100 a ton, through an approach known as direct air capture. That's an order of magnitude cheaper than earlier estimates that led many scientists to dismiss the technology as far too expensive—though it will still take years for costs to fall to anywhere near that level.

But once you capture the carbon, you still need to figure out what to do with it.

Carbon Engineering, the Canadian startup Keith cofounded in 2009, plans to expand its pilot plant to ramp up production of its synthetic fuels, using the captured carbon dioxide as a key ingredient. (Bill Gates is an investor in Carbon Engineering.)

Zurich-based Climeworks's direct air capture plant in Italy will produce methane from captured carbon dioxide and hydrogen, while a second plant in Switzerland will sell carbon dioxide to the soft-drinks industry. So will Global Thermostat of New York, which finished constructing its first commercial plant in Alabama last year.

Still, if it's used in synthetic fuels or sodas, the carbon dioxide will mostly end up back in the atmosphere. The ultimate goal is to lock greenhouse gases away forever. Some could be nested within products like carbon fiber, polymers, or concrete, but far more will simply need to be buried underground, a costly job that no business model seems likely to support.

In fact, pulling CO_2 out of the air is, from an engineering perspective, one of the most difficult and expensive ways of dealing with climate change. But given how slowly we're reducing emissions, there are no good options left. —*James Temple*

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