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Converting Carbon Dioxide from Our Atmosphere into Synthetic Fuels

Scientists tell us that global warming is happening because of the ever-increasing amount of greenhouse gases that have been pumped into our atmosphere since the start of the industrial revolution. Greenhouses gases trap heat in our atmosphere in much the same way that the win-

dows of your car trap heat inside your vehicle on a sunny day.

Figure 1 shows the percentage of the different greenhouse gases that entered our atmosphere in the U.S. in 2016. To slow down global warming, it is important to reduce all greenhouse gases, as you can see from the

chart, especially carbon dioxide (CO₂). To reverse global warming we need to physically start removing greenhouse gases, especially CO₂, from our atmosphere.

A new technology that can convert carbon dioxide from our atmosphere into synthetic fuels has been developed under the leadership of David Keith, a professor of applied physics at Harvard's School of

Engineering and Applied Sciences. The engineering systems that were developed are a combined effort of teams from Carnegie Mellon University and the University of Calgary in Alberta, Canada. Bill Gates is one of the private investors that has helped fund this entire project.

The company that David Keith and his colleagues founded to take this beyond a university laboratory proof of concept is named Carbon Engineering and they have built a fully functional test facility in Squamish, British Columbia, Canada (Photo 1.)

Carbon Engineering's test facility has proven it is possible to capture CO₂ from the air and turn it into a fuel that can replace fossil fuels. They are recycling carbon dioxide back into different fuels thereby reducing the amount of this greenhouse gas in our atmosphere. The test facility has proven that their process can create fuels in mega quantities from water and air using electricity that only comes from renewable sources.

This is the first time that CO₂ has been captured and recycled back into a fuel on an industrial scale. Carbon Engineering has created an industrial life cycle for carbon dioxide that parallels the natural world's life cycle where photosynthesis is used by green plants to convert CO₂ into carbohydrates and oxygen, which

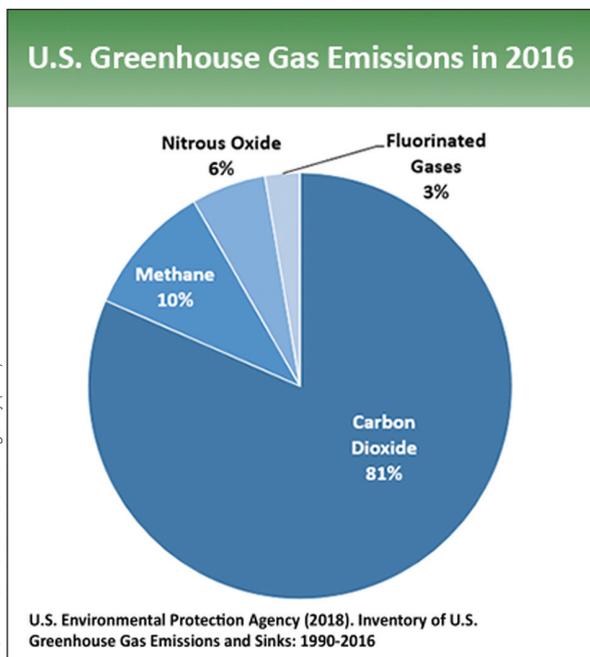


Fig. 1—Environmental Protection Agency graph shows that approximately 81% of the greenhouse gas in our atmosphere is carbon dioxide.



Photo 1—Carbon Engineering has built a fully functional pilot plant in Canada that is now converting CO₂ into synthetic fuels.



Photo 2—The giant fan in the center of the air contactor sucks in the air so other parts of the facility can separate out the CO₂ for processing into synthetic fuels.

in turn is used by animals to sustain their metabolic needs and produce CO₂ which the plants need to continue running the cycle.

Carbon Engineering's process begins with Direct Air Capture (DAC).



Carbon Engineering

Here the company uses giant fans to pull in the air (Photo 2), and then a special chemical solution to pull the CO₂ out of the air that they have captured. Once most of the CO₂ is removed from the air, the air is released back into the atmosphere. In a two-step process the CO₂ that they collected is made ready for easy storage for later conversion into synthetic fuels (Photo 3.) The different liquids they use in all the different processes are part of a closed loop system and they are never released into the environment. They perfected their CO₂ capturing process in 2015.

The next step in their conversion process combines hydrogen, which they create by the electrolysis of water, with the CO₂ to produce their synthetic fuels. Their process can produce fuels that match the needs of cars, buses, and even airplanes. The pilot proof of concept that it was possible for the company to create the different types of fuels that could meet the needs of different types of engines was completed in 2017.

What is most significant about their 2017 achievements is they have

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proven that their technology can pull a million tons of CO₂ out of the air a year and turn it into different fuels. Also, they can produce their synthetic fuels in the quantities needed to start weaning us off fossil fuels.

Photo 3—The reactor is one of the many machines that helps process and convert the CO₂ into a fuel.

For this to happen, this technology would need to be adopted and commercially deployed throughout the world. Their goal is to spend the next three years determining that the pilot facility can be scaled up into full-size production facilities. If they do reach all their targets, they hope to start building plants all over the world where each one can produce 2,000 barrels of fuel per day.

Exhaling or absorbing CO₂ is part of the life cycle of most living organisms that inhabit our planet. Carbon Engineering envisions a new life cycle for the carbon dioxide that our engines of industry release into our atmosphere, one where the CO₂ is captured and turned back into fuels. This Carbon Engineering YouTube video can further your understanding of their process. www.youtube.com/watch?v=mG9FZ9zqOdo.

Taking it a Step Further

1. What existing technologies are already in use that reduces the production of greenhouse gases?

2. Scientists and engineers are working on other methods to turn CO₂ into food (artificial leaf) or just scrub it from our atmosphere and sequester it somewhere safe. Working in teams, research the different possible solutions to global warming. 🌐

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