



Photograph by Audrey Juslin

A Time of Uncertainty

Can capturing and storing carbon curb climate change?

STORY BY MATT CIMITILE

White smoke billows from the T.B. Simon power plant at Michigan State University and slowly spreads into the sky above. Though the smoke disappears shortly, the carbon dioxide within it remains to cycle throughout the planet.

Earth's climate is already showing the effects from this overabundance. In 2007, humans witnessed the largest Arctic summer ice melt, the first outbreak of a tropical disease in modern Europe and the second highest recorded global average temperature.

Climate change is forcing societies to gamble on options that may curb carbon emissions. One of the most controversial is to use technology to capture and store carbon dioxide. The feasibility of this technology has yet to be determined, but the seriousness and immediacy of global warming means all possible solutions must be explored.

"Climate change is so big that we need to pursue every option, including carbon capture and storage technology, alternative energies and biomass," said Ted Parson, professor of law and natural resources and environment at the University of Michigan.



Photograph by Matt Cimitile

Top: Deforestation in the Amazon region of Brazil contributes to greenhouse gas emissions. Above: The T.B. Simon power plant at Michigan State University releases carbon dioxide emissions when burning coal for fuel.

"Policy response that signals one solution would be nuts. The problem is too big for any one technology."

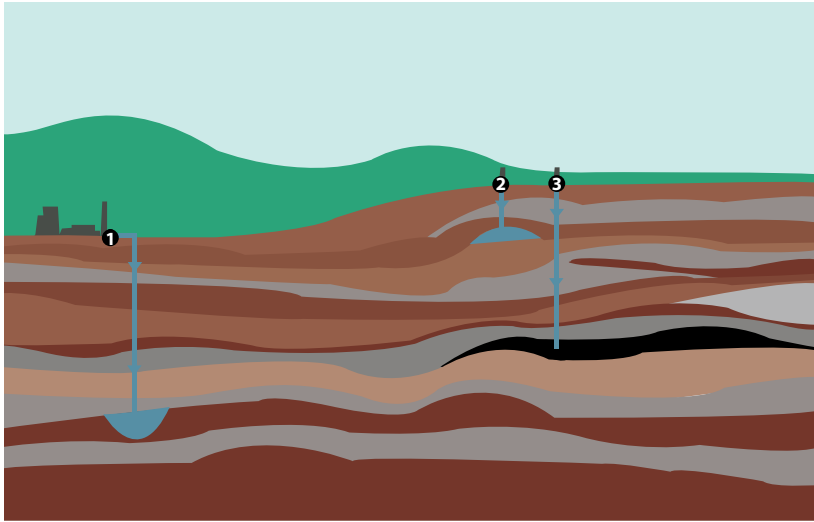
Capturing and storing carbon dioxide is not a new idea. Oceans, trees and soil trap and store more than half of carbon dioxide emissions. These natural systems are aptly named "carbon sinks."

The greatest of carbon sinks are oceans, which have stored about half of the carbon dioxide emitted since 1850, said Peggy Ostrom, a zoology professor at Michigan State University.

Oceans absorb carbon in two ways. Like many gases, carbon dissolves in water. The colder the water, the greater the absorption. Carbon is also captured by ocean plants such as phytoplankton. These plants take in carbon dioxide and release oxygen through photosynthesis. Carbon may find its way to the ocean bottom after the plants die.

Once there, it can be stored up to 500 years, Ostrom said.

Trees, plants and soil also absorb large amounts of carbon dioxide through photosynthesis. Eventually, most of the carbon in trees and plants decays into the soil, where it stays for up to thousands of years. ▶



Graphic by Summi Gambhir

Possible storage sites for captured carbon dioxide include:

- 1: Deep aquifers with contaminated water.
- 2: Depleted oil and natural gas reserves.
- 3: Coal seams incapable of being mined.

“CCS is a red herring,” Matt Leonard, campaigner at Rainforest Action Network.

CHANGING SURROUNDINGS

Carbon sinks have been crucial allies in combating climate change. But whether the same rate of sequestration will continue is debatable.

“A concern is that scientists believe our oceans are reaching their capacity for absorbing CO₂ from the atmosphere,” said Ostrom.

Two recent studies in *Science Magazine* and the *Journal of Geophysical Research* reported a decrease in carbon dioxide captured by the Southern and North Atlantic oceans. Increased winds and ocean temperatures have been cited as possible reasons.

While oceans are sequestering less carbon, forests are turning from carbon sinks to sources. As large tracts of forests are cleared and soils disturbed, carbon dioxide is released.

“Bottom line is that there is a lot of carbon in forests and if we don’t reduce deforestation, more will certainly be released and remain in the atmosphere,” said David Rothstein, a forestry professor at Michigan State University.

A NEW SOLUTION?

As emissions rise and natural sinks weaken, governments are considering carbon capture and storage (CCS) technology to fill the gap.

It works like this: physical plants are constructed to separate and capture carbon dioxide during production of gas and fuel at large industrial complexes, which produce about one-third of all U.S. emissions. Once captured, the carbon dioxide is compressed to an almost fluid-like state for storage efficiency, said Dave Barnes, professor of sedimentology at Western Michigan University.

The gas is then transported through pipes and pumped deep underground for long-term storage. Possible storage sites include depleted oil and natural gas reservoirs, aquifers with contaminated water, unmineable coal seams and beneath the ocean floor. These sites are well below any groundwater and have a large capacity and ability to store carbon dioxide for up to millions of years. The geologic sequestration of carbon would be a low risk activity, according to the United Nations Intergovernmental Panel on Climate Change.

Currently, there are several carbon capture and storage facilities in operation, located in the North Sea, Canada and Algeria. Construction is also underway for carbon capture projects in the U.S. and around the world.

The technology to capture, transport and store carbon has been available for some time.

“Already we have plants that separate and capture carbon, pipes that transport fuels and gas and have pumped CO₂ underground to enhance fuel,” said Ted Parson. “Really, it’s a matter of combining all these smaller parts.”

The technology is popular because its components are well understood and established and fossil fuels will continue to be the primary source of

energy for the foreseeable future.

“Eighty percent of our energy is derived from fossil fuels,” Barnes said. “There is currently no alternative energy to compete and take its place.”

Barnes and Western Michigan University are partnering with the Midwest Regional Carbon Sequestration Partnership to demonstrate a small-scale injection of carbon dioxide deep below the surface in Charlton Township, Mich.

An impassable rock surface that exerts sufficient pressure to safely trap and contain carbon makes Michigan an ideal location for carbon storage, explained Barnes. It also allows for a large quantity of carbon dioxide to be stored.

RED FLAGS

Although capturing and storing carbon could reduce global warming, many believe the costs are too high and the risks too great. Environmental organizations like the Rainforest Action Network and Greenpeace argue that using this technology to solve one problem will lead to others, including further dependence on a polluting energy.

“This technology ignores the massive environmental and social costs of where the carbon comes from,” said Matt Leonard, campaigner with the Global Finance Campaign at Rainforest Action Network.

The components of carbon capture and storage technology are already developed, say researchers, but it will take billions of dollars to construct an infrastructure that captures and stores enough carbon dioxide to affect climate change.

Recently, the U.S. Department of Energy pulled out of FutureGen, a CCS facility in Illinois that would produce the world’s first ever coal-fired power plant with near-zero emissions, citing rising costs of construction.

“The fact that the Department of Energy has already gotten cold feet on the FutureGen test project shows the uncertainty in both the costs and the technology behind CCS,” Leonard said.

CCS is also associated with a plethora of environmental and health risks, said Leonard. If the gas leaked, water contamination, ecological devastation to marine life and the rerelease of carbon dioxide into the atmosphere could occur.

If this doesn’t scare off investors, the possibility that their investments may only last a century could. Carbon capture and storage is useful now, but once fossil fuels are no longer the primary source of energy, the technology becomes obsolete.

“CCS is a red herring,” said Leonard. “It’s the last breath from a literal dinosaur—the fossil fuel industry.” 🌍

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