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Scientists Would Turn Greenhouse Gas Into Gasoline

By [KENNETH CHANG](#)

If two scientists at [Los Alamos National Laboratory](#) are correct, people will still be driving [gasoline](#)-powered cars 50 years from now, churning out heat-trapping carbon dioxide into the atmosphere — and yet that carbon dioxide will not contribute to [global warming](#).

The scientists, F. Jeffrey Martin and William L. Kubic Jr., are proposing a concept, which they have patriotically named Green Freedom, for removing carbon dioxide from the air and turning it back into gasoline.

The idea is simple. Air would be blown over a liquid solution of [potassium carbonate](#), which would absorb the carbon dioxide. The carbon dioxide would then be extracted and subjected to chemical reactions that would turn it into fuel: methanol, gasoline or jet fuel.

This process could transform carbon dioxide from an unwanted, climate-changing pollutant into a vast resource for renewable fuels. The closed cycle — equal amounts of carbon dioxide emitted and removed — would mean that cars, trucks and airplanes using the synthetic fuels would no longer be contributing to global warming.

Although they have not yet built a synthetic fuel factory, or even a small prototype, the scientists say it is all based on existing technology.

“Everything in the concept has been built, is operating or has a close cousin that is operating,” Dr. Martin said.

The Los Alamos proposal does not violate any laws of physics, and other scientists, like George A. Olah, a [Nobel Prize](#)-winning chemist at the [University of Southern California](#), and Klaus Lackner, a professor of geophysics at [Columbia University](#), have independently suggested similar ideas. Dr. Martin said he and Dr. Kubic had worked out their concept in

more detail than previous proposals.

There is, however, a major caveat that explains why no one has built a carbon-dioxide-to-gasoline factory: it requires a great deal of energy.

To deal with that problem, the Los Alamos scientists say they have developed a number of innovations, including a new electrochemical process for detaching the carbon dioxide after it has been absorbed into the potassium carbonate solution. The process has been tested in Dr. Kubic's garage, in a simple apparatus that looks like mutant Tupperware.

Even with those improvements, providing the energy to produce gasoline on a commercial scale — say, 750,000 gallons a day — would require a dedicated power plant, preferably a nuclear one, the scientists say.

According to their analysis, their concept, which would cost about \$5 billion to build, could produce gasoline at an operating cost of \$1.40 a gallon and would turn economically viable when the price at the pump hits \$4.60 a gallon, taking into account construction costs and other expenses in getting the gas to the consumer. With some additional technological advances, the break-even price would drop to \$3.40 a gallon, they said.

A nuclear reactor is not required technologically. The same chemical processes could also be powered by solar panels, for instance, but the economics become far less favorable.

Dr. Martin and Dr. Kubic will present their Green Freedom concept on Wednesday at the Alternative Energy Now conference in Lake Buena Vista, Fla. They plan a simple demonstration within a year and a larger prototype within a couple of years after that.

A commercial nuclear-powered gasoline factory would have to jump some high hurdles before it could be built, and thousands of them would be needed to fully replace petroleum, but this part of the global warming problem has no easy solutions.

In the efforts to reduce humanity's emissions of carbon dioxide, now nearing 30 billion metric tons a year, most of the attention so far has focused on large stationary sources, like power plants where, conceptually at least, one could imagine a shift from fuels that emit carbon dioxide — coal and natural gas — to those that do not — nuclear, solar and wind. Another strategy, known as carbon capture and storage, would continue the use of fossil fuels but trap the carbon dioxide and then pipe it underground where it would not affect the climate.

But to stabilize carbon dioxide levels in the atmosphere would require drastic cuts in emissions, and similar solutions do not exist for small, mobile sources of carbon dioxide. Nuclear and solar-powered cars do not seem plausible anytime soon.

Three solutions have been offered: hydrogen-powered fuel cells, electric cars and biofuels. Biofuels like ethanol are gasoline substitutes produced from plants like corn, sugar cane or switch grass, and the underlying idea is the same as Green Freedom. Plants absorb carbon dioxide as they grow, balancing out the carbon dioxide emitted when they are burned. But growing crops for fuel takes up wide swaths of land.

Hydrogen-powered cars emit no carbon dioxide, but producing hydrogen, by splitting water or some other chemical reaction, requires copious energy, and if that energy comes from coal-fired power plants, then the problem has not been solved. Hydrogen is also harder to store and move than gasoline and would require an overhaul of the world's energy infrastructure.

Electric cars also push the carbon dioxide problem to the power plant. And electric cars have typically been limited to a range of tens of miles as opposed to the hundreds of miles that can be driven on a tank of gas.

Gasoline, it turns out, is an almost ideal fuel (except that it produces 19.4 pounds of carbon dioxide per gallon). It is easily transported, and it generates more energy per volume than most alternatives. If it can be made out of carbon dioxide in the air, the Los Alamos concept may mean there is little reason to switch, after all. The concept can also be adapted for jet fuel; for jetliners, neither hydrogen nor batteries seem plausible alternatives.

"This is the only one that I have seen that addresses all of the concerns that are out there right now," Dr. Martin said.

Other scientists said the Los Alamos proposal perhaps looked promising but could not evaluate it fully because the details had not been published.

"It's definitely worth pursuing," said Martin I. Hoffert, a professor of physics at [New York University](#). "It's not that new an idea. It has a couple of pieces to it that are interesting."

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