From Smokestacks to Your Tank

By MATTHEW L. WALD

IF the government regulates carbon dioxide emissions, power plants and other factories will probably start removing CO2 from their smokestacks and will have to pay to get rid of it. The conventional wisdom is that it will be sequestered underground.

But one audacious concept is to recycle the carbon by turning it into liquid hydrocarbon fuels.

Chemical plants, in this vision, could generate liquid hydrocarbons by taking hydrogen from natural gas or even water and combining it with CO2 to make fuels that would cut the demand for crude oil. In effect, each carbon atom would be used twice: the first time in a coal-fired power plant and the second in a car engine.

For the United States, such a system would also have a strategic benefit, substituting chemical processing here for oil imports from abroad. Its financial viability would depend on the cost of making new fuel from carbon, and on how much a company with surplus carbon would be willing to pay to get rid of it.
A crucial consideration, though, is how much energy it would take to recombine carbon with hydrogen to produce a fuel that could substitute for gasoline. Energy costs money, but it also comes with a cost in carbon emissions that could reduce or eliminate any environmental benefit to the process.

As unlikely as the concept may seem, chemists have been working on it for decades. Chemistry journal articles in the 1990s reported various approaches to the problem, with the target product often being methanol, which can be used as a vehicle fuel or as an intermediate product.

But it took so much energy that “the juice was not worth the squeeze,” said Byron H. Elton, president and chief operating officer of Carbon Sciences, a company in Santa Barbara, Calif., that believes it has what it calls a biocatalyst that will combine the hydrogen in water with the carbon dioxide, without the usual large expenditure of energy required to break the chemical bond between water’s hydrogen and oxygen.

The company has one patent and is applying for several more. It declined to provide details, except to say that a pilot plant produces methanol a few ounces at a time. Scaling up will be a challenge, Mr. Elton said.

“It’s drip, drip, drip, not gush, gush, gush,” he said.

A different group of scientists, at the University of Southern California, made a deal at the end of 2007 with Honeywell, which has a large chemical business, to work on making methanol from carbon dioxide.
The methanol is not so much a fuel as a carrier that incorporates energy from different sources, some of them clean, like wind. Electricity made from wind can be used to separate hydrogen, which can then be combined with the carbon dioxide to make liquid hydrocarbons like methanol.

“Earth does not have an energy problem; we have an energy carrier and distribution problem,” said G. K. Surya Prakash, one of the U.S.C. scientists, at a conference on the subject last year. “We have plenty of alternative energies.”

Dr. Prakash and two U.S.C. colleagues, George Olah, a Nobel laureate in chemistry, and Alain Goeppert, wrote a book called “Beyond Oil and Gas: The Methanol Economy,” which foresees a system built on turning carbon dioxide back into fuel.

Methanol has only about half the energy content of gasoline, per gallon, and like ethanol, it eats away at the seals and gaskets in cars and service station fueling systems. But it can run well in engines designed for it, and oil refineries already have experience in converting it into synthetic gasoline.

It can also be used directly in a fuel cell and converted to electricity, although fuel cells are today far too expensive to be practical for cars.