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THE ENERGY CHALLENGE

Gassing Up With Garbage

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After years of false starts, a new industry selling motor fuel made from waste is getting a big push in the United States, with the first commercial sales possible within months.

Many companies have announced plans to build plants that would take in material like wood chips, garbage or crop waste and turn out motor fuels. About 28 small plants are in advanced planning, under construction or, in a handful of cases, already up and running in test mode.

For decades scientists have known it was possible to convert waste to fuel, but in an era of cheap oil, it made little sense. With oil now trading around \$125 a barrel and gasoline above \$4 a gallon, the potential economics of a waste-to-fuel industry have shifted radically, setting off a frenzy to be first to market.

“I think American innovation is going to come up with the solution,” said Prabhakar Nair, research chief for UOP, a company working on the problem.

Success is far from assured, however. Some of the latest announcements come from small companies whose dreams may be bigger than their bank accounts. They are counting on billions in taxpayer subsidies. Big technological hurdles remain, and even if they can be solved, no one is sure what unintended consequences will emerge or what it will really cost to produce this type of fuel.

“We desperately need it, and I personally think it’s not there yet,” said Steven Chu, director of the Lawrence Berkeley National Laboratory and a [Nobel Prize](#)-winning physicist. “You have to look at starts with a grain of salt, especially starts where they say, ‘It’s around the corner, and by the way, can you pay half the bill?’ ”

Still, the incentive to make fuel from something, anything, besides oil and food is greater than ever. Moreover, the federal government is offering grants to help plants get off the ground and subsidies for one type of fuel of \$1.01 a gallon, twice the subsidy it historically offered to ethanol made from corn.

Potential controls on [global warming](#) gases would heighten the appeal of these fuels, since many of them would add little new carbon dioxide to the atmosphere.

Tellingly, the type of companies placing bets on the field has started to expand. The earliest were small start-ups founded by people with more technological vision than business experience. Now some of the giants of global business, including [Honeywell](#), [Dupont](#), [General Motors](#), Shell and [BP](#), are taking stakes in the nascent industry.

The dream of making fuel from plants is almost as old as the internal combustion engine. [Henry Ford](#) himself was fascinated by the idea, and it re-emerges in periods of fuel scarcity and high prices. These days, advancing technology has made the notion more plausible.

Virtually any material containing hydrogen, carbon and oxygen could potentially be turned into motor fuel. That includes plastics, construction debris, forest and lawn trimmings, wood chips, wheat straw and many other types of agricultural waste.

The potential fuels include ethanol, which can be blended with gasoline, or other liquids that could displace gasoline or diesel entirely. Government studies suggest the country could potentially replace half its gasoline supply in this way — even more if cars became more efficient.

The government is pushing to get the industry off the ground. Legislation passed last year mandates the use of 36 billion gallons of [biofuels](#) a year by 2022, less than half of it from corn ethanol. Almost all the rest is supposed to come from nonfood sources, though the requirement could be waived if the industry faltered.

“One has to say upfront that what Congress has done is remarkable in its bravery,” said David Morris, vice president of the Institute for Local Self Reliance, a group in Minneapolis that advocates biofuels.

Much of the new money flowing into the field is coming from Silicon Valley, where the venture capitalists who gave the world the Internet revolution see an opportunity to do something similar with the fuel supply.

At Solazyme, a start-up in South San Francisco that hopes to commercialize a process for making fuel from algae, President Harrison F. Dillon said, “When we founded the company in

2003, we couldn't find a venture capital firm that had heard of the concept of a biofuel." Now he is backed by two such firms.

Venture capital investment in the first half of this year hit \$612 million, up from \$375 million in all of 2007, according to a survey by Thomson Reuters. Every few days brings another announcement. PFC Energy, a Washington consulting firm, counts projects worth perhaps \$1.5 billion that will total more than 300 million gallons of capacity by 2011, if they all get built.

That is small in the scheme of American fuel demand, but it would presumably set the stage for substantial growth if those first projects prove that the economics can work.

One of the first companies to bring a plant online is KL Process Design Group, in Wyoming. With experience making corn ethanol plants, it has built a small plant meant to use pine wastes from a nearby national forest. The company is still testing its production line but hopes to begin commercial sales of ethanol late this year.

"We're still learning and tweaking, and hoping for a little bit of capital infusion," said Tom Slunecka, a vice president of the company.

Range Fuels, of Denver, is building a commercial-scale plant in Soperton, Ga., with help from the Energy Department. That plant will take pine chips and turn them into ethanol, with commercial sales expected by late 2009 or 2010.

Some companies want to use garbage. On Friday, a company called Fulcrum BioEnergy said it would start construction later this year on a \$120 million plant at the Tahoe-Reno Industrial Center, in Storey County, Nev., to make 10.5 million gallons of ethanol a year from 90,000 tons of garbage. Operation would begin in early 2010.

In Montreal, another firm, Enerkem, plans to use arsenic-contaminated utility poles from the provincial electric company. On Wednesday, the Los Angeles County Regional Planning Commission approved a plan by BlueFire Ethanol to build a \$30 million garbage-to-ethanol plant on 10 acres next to a landfill in Lancaster, Calif.; construction will start soon, the company said.

A handful of small companies has long made a diesel replacement from waste oil, or sold kits to individuals to do the same. One company in Carthage, Mo., even turns turkey guts into fuel. The

goal of the emerging waste-to-fuel industry is more elaborate, however: to take bulky, solid feedstocks and transform them into high-grade motor fuel.

History provides plenty of warning that it will not be easy. A company called [Verenium](#) in Lafayette, La., has cut ribbons three times in one locale since 1998 on plants that would supposedly make fuel from sugar cane waste, and has yet to sell a drop because of problems converting laboratory success into smooth, commercial-scale operation.

A bigger operation, Iogen, has been running a demonstration plant in Ottawa since 2004 that can turn wheat straw into ethanol. It was expected to build a plant in Idaho but has suspended work to focus attention on a plant in Saskatchewan. “It would be our view that there are substantial challenges in scaling up a big new biochemical process,” said Brian Foody, the president.

The Energy Department early last year picked six projects as most likely to succeed, and offered each of them tens of millions of dollars. Iogen’s Idaho project was among them; so was a plant in Kansas proposed by a Florida company, [Alico](#), that has also been abandoned. Still, increasing interest from big companies — ones with a track record of solving technical problems — suggests that a waste-to-fuel industry may not remain out of reach forever.

General Motors has invested an undisclosed sum in two companies, Coskata, of Warrenville, Ill., and Macoma, of Lebanon, N.H., that aim to turn crop wastes into ethanol.

DuPont, one of the world’s largest chemical companies, has joined forces with a company called Genencor, announcing plans to commercialize a process for making ethanol from the nonedible parts of corn and sugar cane. They plan to invest \$140 million over three years.

In making their announcement, the companies estimated the worldwide market for fuels made by methods like theirs would eventually reach \$75 billion, dwarfing the scale of today’s biofuels produced from food crops like corn and sugar cane.