Trash Into Gas, Efficiently? An Army Test May Tell

Max Whittaker for The New York Times

Garbage is fed into a Sierra Energy gasifier. The company has spent years on its system to turn all kinds of waste into fuel, and the Army is its first customer.

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THERE is an indisputable elegance to the idea of transforming garbage into fuel, of turning icky, smelly detritus into something valuable.

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The size of a shower stall, the gasifier is essentially a modified blast furnace. Don Powers monitored its settings.

But big drawbacks have prevented the wholesale adoption of trash-to-gas technology in the United States: incineration is polluting, and the capital costs of new plants are enormous. Gasification systems can expend a tremendous amount of energy to produce a tiny amount of electricity. Up to this point, it hasn't seemed worth the trouble.

Mike Hart thinks that he has solved those problems. In a former Air Force hangar outside Sacramento, his company, Sierra Energy, has spent the last several years testing a waste-to-energy system called the FastOx Pathfinder. The centerpiece, a waste gasifier that's about the size of a shower stall, is essentially a modified blast furnace. A chemical reaction inside the gasifier heats any kind of trash — whether banana peels, used syringes, old iPods, even raw sewage — to extreme

temperatures without combustion. The output includes hydrogen and synthetic natural gas that can be burned to generate electricity or made into ethanol or diesel fuel. The FastOx is now being prepared for delivery to Sierra Energy's first customer: the United States Army.

Ethanol has long been promoted as an alternative fuel that increases energy independence, and federal law requires the use of greater amounts of it. But most ethanol in this country is produced from corn or soybeans, and many people worry that the mandate is pushing up food prices. Ethanol produced from trash — or agricultural waste, as others are trying — would allay such concerns.

Ineos Bio, a Florida company, announced last month that it had produced ethanol from gasified wood waste, using a method that it expects to be commercially viable, and KiOR Inc. will make one million to two million gallons of diesel and gasoline this year from wood waste at its plant in Columbus, Miss., according to Michael McAdams, president of the Advanced Biofuels Association. Mr. Hart said Sierra Energy's technology should be complementary with the Florida company's; the FastOx turns all municipal waste, not just wood scraps, into a gas that Ineos Bio could then transform into ethanol.

The FastOx gasifier is the brainchild of two former engineers at Kaiser Steel, patented by the grandson of one of them and commercialized by Mr. Hart. "It's a modular system that can be dropped into any area," Mr. Hart said, "using waste where it's produced to make electricity where it's used." Once it's off the ground, he said, "garbage will be a commodity."

From concept to construction, the story of the FastOx is of one fortuitous accident after another. And while Sierra Energy has not yet proved to be a successful company — it will be a long while before your garbage is shoveled into a FastOx — its system has become the first waste-to-energy technology acquired by the Defense Department, which paid $3 million for it through an environmental technology program. (The California Energy Commission, which supports renewable energy development in the state, also gave Sierra $5 million, to cover the portion of Sierra's costs that the Pentagon couldn't.)

The military is looking for ways to reduce its oil consumption, and to make it easier to supply the front lines with the fuel it uses in all its vehicles and generators. "These days, the supply lines are in the battlefield," said Sharon E. Burke, the assistant secretary of defense for operational efficiency plans and programs. "And we consume a lot of fuel, which makes us a big target."

MIKE HART got into the energy business by way of a train. In 1993, he bought the Sierra Railroad, a small freight and tourism line in Northern California. During the California blackouts of 2001, he had an idea: "As the lights were going out, I realized every one of my locomotives creates 2.1 megawatts of electricity," he said — enough to power many hundred homes. "It's a rolling generator, and inexpensive."

The train-as-power-generator idea never really left the station, but it got Mr. Hart thinking about alternative energy. Then, as part of a settlement after a fuel spill from one of his trains, he promised to convert his trains to nonpolluting biodiesel.

Biodiesel, however, proved hard to find, and Mr. Hart started looking for new ways to source it. In 2002, he was asked to judge an annual business plan competition called the Big Bang, at the University of California, Davis. That's where he met Chris Kasten.

Mr. Kasten came to the competition with an idea to use a modified blast furnace to turn waste into fuel. His grandfather, Bruce Claflin, a retired chief industrial engineer at Kaiser Steel in Fontana, Calif., had given him the idea.

Kaiser used blast furnaces to make steel, and Mr. Claflin and a colleague, John Jasbinsek, were tasked with finding "a way to make the blast furnace more efficient and less polluting," said Mr. Jasbinsek, who is now 86.

Like all blast furnaces, Kaiser's emitted a flue gas out of the top. It occurred to Mr. Clafin and Mr. Jasbinsek that this gas might have value. The two came up with the idea of injecting oxygen, instead of the atmospheric air that steel makers had always used, to create the chemical reaction that heats the inside of the furnace. This would cut pollution while raising the energy content of the flue gas — in essence, giving the steel maker a second product. But pure oxygen made the system too hot, so they added steam. This gave the furnace a third product: hydrogen, which can be used to produce electricity in fuel cells.

After Kaiser decided to close the Fontana plant in 1983, workers were told to toss all demolition debris into the blast furnace. It was then that Mr. Jasbinsek and Mr. Claflin realized that the furnace could take garbage, too. "No matter what they put in, the furnace melted and gasified it," Mr. Kasten said. This meant a potential fourth revenue stream — from taking municipal waste that would otherwise go to landfills.

When Kaiser wasn't interested, Mr. Jasbinsek recalled, "we took the idea to other steel companies, too." But "nobody gave a damn!" he said. "Now there are hardly any steel companies left in the U.S."

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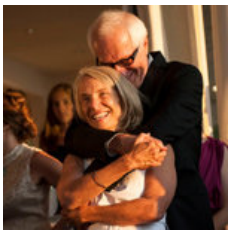

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