Technology Review
PUBLISHED BY MIT

Wednesday, July 02, 2008

Garbage In, Megawatts Out

Ottawa will build the first gasification facility in North America to make energy from waste.

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Easy viewing: Gasification plants that convert municipal waste into energy and by-products can be built squat and stackless, according to Canadian developer PlascoEnergy. This artist's rendering shows the 400-metric-ton-per-day facility that PlascoEnergy plans to build in Ottawa, Canada's capital. *Credit: PlascoEnergy*

This week, city counselors in Ottawa, Ontario, unanimously approved a new waste-to-energy facility that will turn 400 metric tons of garbage per day into 21 megawatts of net electricity--enough to power about 19,000 homes. Rather than burning trash to generate heat, as with an incinerator, the facility proposed by Ottawa-based PlascoEnergy Group employs electric-plasma torches to gasify the municipal waste and enlist the gas to generate electricity.

A few waste-to-energy gasification plants have been built in Europe and Asia, where landfilling is more difficult and energy has historically been more costly. But PlascoEnergy's plant would be the first large facility of its kind in North America. The company's profitability hinges on its ability to use a cooler gasification process to lower costs, as well as on rising energy and tipping fees to ensure strong revenues.

PlascoEnergy's approval marked the latest in a string of positive developments for waste gasification projects in recent weeks. Last month, Hawaii okayed $100 million in bonds to finance a waste-to-energy plant using plasma-torch technology from Westinghouse Plasma, based in Madison, PA, that is already employed in two large Japanese waste processing plants. Meanwhile, Boston-based competitor Ze-gen reported the successful ramp-up of a 10-metric-ton-per-day pilot plant in New Bedford, MA, that uses molten iron to break down waste.

Most gasification plants work by subjecting waste to extreme heat in the absence of oxygen. Under these conditions, the waste breaks down to yield a blend of hydrogen and carbon monoxide called syngas that can be burned in turbines and engines. What has held back the technology in North America is high operating costs. Plasma plants, using powerful electrical currents to produce a superhot plasma that catalyzes waste breakdown, tend to consume most of the energy they generate. As a result, the focus of plasma gasification plants has been to simply destroy hazardous wastes. "There was really no thought of being able to produce net power," says PlascoEnergy CEO Rod Bryden.

PlascoEnergy started looking at gasification for municipal solid waste five years ago, when it determined through simulation that cooler plasma torches could do the job. "The amount of heat required to separate gases from solids was much less than the amount being delivered when the purpose was simply to destroy the material," says Bryden. PlascoEnergy tested the models on its

five-metric-ton-per-day pilot plant in Castellgali, Spain (jointly operated with Hera Holdings, Spain's second largest waste handler). In January, the company began large-scale trials in a 100-metric-ton-per-day demonstration plant built in partnership with the city of Ottawa.

Here's how it works. First, bulk metals are removed, and the rest of the shredded waste is conveyed to a 700 ºC gasification chamber. Most of it volatilizes to a complex blend of gases and rises toward a plasma torch operating at 1200 ºC--well below the 3000 to 5000 ºC used with hazardous wastes. The plasma reduces the complex blend to a few simple gases, such as steam, carbon monoxide, and hydrogen, plus assorted contaminants such as mercury and sulfur; subsequent cleanup systems remove the steam and mercury and scrub out the soot before the syngas is sent to an internal combustion engine generator.

The waste that doesn't volatilize forms a solid slag and drops to the bottom of the gasification chamber. The slag is then pushed to another plasma torch, which drives off remaining carbon in the slag before the slag is cooled and vitrifies. The resulting glass can be blended into asphalt road surfacing or cement.

Under its deal with Ottawa, PlascoEnergy will cover the estimated $125 million that it takes to build the plant, which could be operating within three years, while the city will pay only standard tipping fees--on the order of $60 per metric ton.

Ze-gen plans to avoid the challenge of handling complex municipal wastes by focusing first on an easier-to-handle feedstock: construction and demolition wood wastes. The company has filed seven patents on its molten metal gasification technology and waste-to-syngas process, but the equipment itself is standard for the steel industry, which uses molten iron to catalytically drive off impurities from ore. Ze-gen's pilot plant processes wood waste using a standard electrically heated steel-industry crucible full of molten iron.

Ze-gen CEO Bill Davis estimates that a full-size plant just slightly bigger than PlascoEnergy's commercial plant will produce enough syngas to create 30 megawatts of electricity, but he says that the syngas is also of sufficient quality to be used in other applications. As examples, he cites synthetic gasoline, diesel production, and refinery applications.