Gasification Guru

Touting feedstock flexibility as the key to a lucrative biomass gasification operation, Heat Transfer International predicts 2010 will be an extraordinary year for business and the industry in general.

By Anna Austin

When Heat Transfer International President David Prouty met gasification veteran Robert Graham, he recognized a great, but also somewhat risky, opportunity. Historically, the development of a renewable energy industry in the U.S. had not been consistent. Hot streaks of interest erupted briefly, but generally faded away as quickly, Prouty tells *Biomass Magazine*. "In the '70s, people began to care about energy after the oil embargo and they spent some time in alternative energy, but interest was lost after awhile," he explains. "So they went back to doing what they did. In 1979 to '81, people became interested again. At that time, Bob's work revolved around improving gasifiers for the destruction of waste. No one cared about the extra energy so they threw away a great deal of energy, but interest in those areas soon died down again."

Robert Graham
chief scientist, HTI

David Prouty
president, HTI

When Prouty became acquainted and familiarized himself with Graham's work, he decided the third time just might be the charm. "Come 2003, I asked myself if the world would once again shy away from alternative energy and gasification and turn back to fossil fuels, or if interest would stick this time," he says. Prouty went with his gut feeling, which was indicating to him that this time the world was finally ready to forge ahead with alternative energy.

Graham had spent the bulk of his career working in the field of waste gasification and high-temperature combustion equipment, dealing with materials such as precious metals and army munitions—things which Prouty says nobody else in the world would touch—to develop the means to destroy the products or capture anything usable in the ash. Soon after Prouty purchased Graham's intellectual property and design rights, HTI emerged. The company moved Graham and his wife to Kentwood, Mich, where HTI is based.

At 78, senior application engineer Graham still comes into the office every day, Prouty says, and his 50 years of experience in the field has been invaluable to HTI's growth.

SALT System Benefits

HTI is a designer and manufacturer of starved-air/low-temperature (SALT) retorts, which are biomass gasification systems that convert biomass, through a thermal process, into synthesis gas.

By properly controlling the air injection arrangement the feedstock pile temperature is kept below the sublimation, vaporizing or melting temperatures of the noncombustible solids, and at the same time vaporizes the volatiles using the energy from partial combustion of the wastes. The resulting syngas is sent to

a chamber, or "low NOx (nitrogen oxide) oxidizer," where it is combusted much like natural gas or propane and is then used to make heat, which can be converted into steam, power or hot water.

Prouty says the key benefit of the SALT system is that a hot air turbine is used instead of water for power generation. The company has a partnership with Walled Lake, Mich.-based turbine manufacturer Williams International, and has spent the past three years working with Williams to optimize a biomass turbine. The companies' collaborative work was showcased in the fall of 2009 with the commissioning of a project at Sietsema Farm Feeds in Howard City, Mich., which now hosts the state's first gasification plant and the world's first hot air turbine powered by biomass.

Projects, Partners and Progress

Sietsema Farms Feeds owner, Harley Sietsema's goal is to completely remove his operation from the power grid, with a 90 percent reduction in energy costs

The Sietsema project utilizes about 70,000 pounds (two semi-truckloads) of turkey litter a day as the fuel source. Uniquely, electricity and steam are produced at the Sietsema plant, but none of the steam is used to generate electricity—instead, 100 percent is used to soften grain that is used in the feed mill to make turkey and hog feed.

HTI also has a partnership with Morbark Inc., a manufacturer of size-reduction equipment for organic materials, to provide chipper/grinder/shredder equipment for feedstock material preparation and handling, a logistic which Prouty describes as the "Achilles' heel" of gasification. "Feedstocks like industrial sludges, sewer sludges and municipal solid waste are complex because there is a wide variety of chemicals in them, typically a high ash content, and they are often not uniform in size, so you need to have a way to deal with those issues," he says.

For further testing, HTI is constructing a $3.5 million biomass development center, which Prouty says will house four differ-

PHOTO: HTI

HTI commissioned a project at Sietsema Farms Feeds in Howard City, Mich., which is the state's first gasification plant.

ent styles of gasifiers and different forms of power generation. The machines will be larger than pilot scale—big enough to prove formulas for a smooth transition to full-sized machines. "What we want to be able to do is, when a customer brings in a material, we can prove out exactly what the right recipe of waste should be, and determine which full-scale gasifier will work best with it," Prouty says. "We'll prove the process and the air emissions, so that as they move into their permitting and design phases they know exactly how the material will perform in the gasifier."

HTI has offered the center to Michigan State University, which will provide researchers to work on new gasification concepts and prove out any operational characteristics HTI may encounter. While the center is being built, Prouty says, interest in gasification projects continues to mount.

Feedstock Flexibility

Gasification may not be the right solution for every operation and several questions need to be addressed before making a decision, the first being whether an interested party has control over its waste stream. "You need to know if you'll have control over it for the next 10 to 20 years," Prouty says. "Do you have a need for power that you can use on the farm or at a nearby facility? If you don't, does your state have renewable portfolio laws that will allow you to distribute that power to the grid? Do you have or can you get financing? There are a lot of people who want to do things, who don't have access to capital."

The amount of waste is a factor too. SALT systems are designed for medium-sized operations. "At some point, if you're on the smaller side, you have to determine if it's economical," Prouty says. "If it's smaller, it's tougher to make the economics—and as you get larger it also gets tougher. We operate right in the middle from a half of a megawatt (MW) of power up to about 20 MW. If someone wanted to produce 300 MW, that wouldn't be for us. If someone said they wanted to build a gasifier for their shed in the back of their house, that wouldn't be us either."

Feedstock flexibility can't be overlooked when planning a project, Prouty says. "Guys who have built 40, 50, or 100 MW wood incinerator power plants, in watching and dealing with them over the past five years, all of them have told us that when they built those plants in the 1980s and '90s, they quickly discovered that the biomass they started out with initially always changed. As we work with customers, we also ask if they are certain they have a long-term feedstock, and what could happen if it goes away."

A gasifier must be robust enough to be able to handle different feedstocks. "History says it's probably going to change—and you should be capable of adapting to that new fuel because it's a very significant financial investment," Prouty says. "It wouldn't be good if five years down the road the only thing your gasifier can handle is woody biomass and your wood

source goes away. That's incredibly important for the end customer to understand." The feedstock issue is especially important as competition from new wood-fired power plants and cellulosic ethanol producers heats up, he adds. "As those guys get things rolling ... we need to understand that there's going to be competition and we'll need fuel sources with low costs. If you're using kiln-dried wood chips costing $80 per ton, you're plant isn't economically viable."

Global Interest

The breadth of the types of projects HTI is receiving inquires about is vast, according to Goutam Shahani, HTI chief revenue officer. "Different industrial segments have different needs and priorities for gasification utilization," he points out. "Some people want to destroy undesirable materials, some want to create energy, others want to become self-sufficient. Certainly, the driving force is different in Europe or Asia than it is in America, just because the economics are very different," Shahani says.

Though HTI is primarily focused on projects within the U.S., Shahani says the company has entertained enquiries from many different countries including Peru, China and India, and will soon engage in its first overseas project in Italy. He points out that there are strong environmental forces at play, not just energy needs or economics. "Right now, there is a very strong push to remove nutrients from waterways," he says. "There's extensive damage being caused in the Chesapeake Bay. Nitrogen and phosphorous are prevalent in manure and turkey litter that gets into waterways, and water contamination is a concern."

"This year is going to be a wonderful year as the economy rebounds and capital becomes a little more available," Shahani says. "Projects in gestation will be able to come to the forefront—many of which have been stalled because of the economic crisis. We're beginning to see the light at the end of the tunnel, and quite frankly, the biggest challenge for us as a smaller company is managing growth."

"I think we're going to have to say no to a lot of people because there's more opportunity and people who want to do things than we'll be able to handle," Prouty says. This interest isn't just beneficial to HTI, but also to the biomass gasification industry in general. "We'll find some projects that suit HTI well, and there'll be other gasification systems that fit better with other projects. We don't typically see all these other folks as competitors because we think, as we go forward over the next 15 to 20 years, there will be so much more than we or any one company could even begin to handle. We just all need to find our niches." BIO

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