

# Biomass Products & Technology

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## Turning solid waste into energy

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### Turkey as a way of life and fuel source

For [Sietsema Farm Feeds](#) of Howard City, Mich., turkey is not a word that brings once-a-year memories. Turkeys are a way of life and an entrance into the leading edge of alternative energy initiatives.

An agricultural entrepreneur, Sietsema raises nearly 1.1 million turkeys on five separate farms. Those turkeys produce more than 70,000 lbs. of litter daily, which raises the question of what to do with so much waste. For years, Sietsema sold the turkey litter as fertilizer, but rising energy costs and an entrepreneurial spirit recently prompted a search for other options.

### Investigating alternative energies

In 2003, Sietsema partnered with Phase 3 Renewables to investigate biomass gasification as a solution that would both dispose of the turkey litter and help to reduce energy expenses at the feed mill plant, which currently total more than \$500,000 annually. The original plant is powered by purchased natural gas and electricity, leading to increased charges during peak hours. Sietsema hoped to find an option that would allow the plant to utilize 2nd shift hours as well as 1st and 3rd. The solution to both the litter and alternative energy need was with Heat Transfer International in Dutton, Mich.

### Selecting a SALT biomass gasification system

Specializing in custom designed, Starved Air-Low Temperature (SALT) biomass gasification systems, HTI has worked closely with Sietsema to design a plant that intimately addresses the feedstock to be used, local codes and energy needs. A “one size does not fit all” motto called for detailed analyses of turkey litter and ultimately led to the selection of a retort style gasifier. This gasifier will be housed in a newly erected 15,000 sq. ft. building, separate from the feed mill that will also serve as storage for up to 3 days worth of turkey litter, which is approximately 215,000 lbs. of solid waste.

The SALT gasification equipment that HTI is installing at Sietsema Farm Feeds will include the retort style gasifier, low NOX oxidizer, heat exchangers, a waste heat boiler and a biomass turbine/electric generator.

The gasifier heats the turkey litter to a temperature that breaks it up into combustible molecules. This mix of molecules results in combustible gas, called syngas, short for synthesis gas. Compared to natural gas, syngas has a low Btu/lb of energy; syngas is approximately 150 Btu/lb, compared to the 1,000 Btu/lb associated with natural gas. The system recovers energy using a patented all-ceramic, air-to-air heat exchanger. The energy is then sent to a biomass turbine to generate power, and to a waste heat boiler. The biomass turbine alone will produce 500 kwh of electricity. This installation will be the site of the world’s first hot air “biomass” turbine.

The 8,600 lb/hr, 150 psig waste heat boiler replaces an existing natural gas-fired machine of the same size. The waste

heat boiler has no relationship to the biomass turbine since it is strictly used for process steam used in the feed mill. The same process can be adapted to many other uses, including agricultural products, sewage sludges, industrial sludges, municipal solid waste and industrial wastes.

In addition to energy and disposal needs, a strong focus on “clean” technology has been a driving force in the design process. The employment of an air turbine eliminates the necessity of steam or a combustion engine in the energy production process. Lack of a waste water discharge has made permitting with the Department of Environmental Quality much less complicated. By eliminating the need of a boiler, economizer, high-pressure piping, condensate recovery and water treatment found in many gasification plants, the air turbine design promotes streamlined efficiency and environmental safety.

Anticipation of concern from neighbors led air quality to also become a driving factor. Airflow in the plant was engineered to move from the outdoors in, and all odors will be eliminated in the gasification process. No scrubbers or processors will be needed to transition from the gasification stage to steam and energy production. External emissions are expected to be so clean that the Michigan Department of Environmental Quality is not requiring any additional pollution control equipment.

### **Conclusion**

In August of 2009, the plant will be fully operational; producing 552 million BTU's of energy daily - the equivalent of 156 gallons of gasoline each hour. The full steam and power needs of the feed mill will be met, with excess energy being sold to the local power company. For Sietsema, HTI and Phase 3 Renewables, the partnership is making what was once a vision into a reality.

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