Biomass Facilities and Energy Production

Biomass is organic material derived from living organisms. Most biomass contains stored chemical energy that was produced by plants through photosynthesis and animals through consumption of plants, creation and growth of bodily organs and tissues, as well as respiration and digestion (muscular and bone matter, fats, wastes and manures).

Many types of plant biomass have historically been burned directly for heat. These materials fueled almost all energy consumption from ancient times through the mid-1800s. Currently, the feedstock provides approximately 5% of our energy requirements. Biomass resources are used for on-site heating and cooking, electric generation, as well as creation of liquid and gaseous transportation fuels. Common biomass resources include:

- **Agriculture:** Crops and waste materials from corn, soybeans, sugar cane, switchgrass, woody plants, manure and algae.
- **Wood:** Firewood, pellets, chips, sawdust and black liquor from pulp and paper mills.
- **Food processing:** Plant residues, tissues, fats and oils.
- **Biogenics:** Materials including paper, cotton, wool, food, yard and wood wastes, as well as municipal sewage sludge.

Basic Digester Technology

Feedstocks undergo biodegradation under anaerobic conditions and in the presence of methanogenic bacteria. The result of the digestion process is production of methane-rich biogas and biologically inert biosolids. Basic digester technologies feature feedstock storage units (lagoons and tanks) and reactor chambers (surface and subsurface vessels, storage tanks and related mediums/cells/filters) where varying degrees of control (temperature, feedstock mix and bacterial culture concentration/placement) are performed. System types include:

- **Passive:** The most common passive system is a covered lagoon where materials are expected to be stored for eventual use or disposal. Breakdown of substances in the lagoon produces methane-rich biogas, which is collected and stored using a plastic cover (storage cell). Biogas is considered a secondary byproduct of this system.
- **Low Rate:** Controlled mixing and material flow provides a steady, balanced stream of materials going in and out of the system. The flow rate ensures that microorganisms feed on the materials. The biomethane produced is considered a primary, major product of this system.
- **High Rate:** Controlled mixing and material flow practices are increased and special filters and media are used to ensure specific microorganisms live and target feedstocks flowing through the system. As with low rate systems, the biomethane produced is considered a primary, major product of this process.

Operational Issues to Consider

There are a number of benefits to operating a biomass digester as part of an on-site manure and nutrient management system. These include creating fertilizers for crop production, soil health and conservation, protection of water resources, odor control and creation of gaseous fuels for electric generation, heating and transportation. These benefits need to be balanced with the following considerations:

Diversified operation planning

While manure and other biomass resources have been used on the farm as a fertilizer, additional products can be produced, creating new income opportunities. In many areas of Ohio, farmers are being approached by off-farm biomass feedstock and energy developers to create partnerships where larger, on-site facilities can be installed. On-site biomass feedstocks produced in the farming operation provide base feedstocks. Contracted partners and service providers supply off-farm biomass feedstocks from producers throughout the local area, region or state. Tipping fees, selling processed materials as organic nutrients, animal bedding, peat moss replacement, plant trays and other products are possible. Creating, refining and transporting biogas (biofuel) via pipeline or commercial carrier are part of the operation, too.

Another point to consider – For every ton of solid and/or liquid feedstock going into a system, biogas and an approximate ton of biologically inert materials are produced. Materials management is crucial. Farmers and their partners will need to create business plans to store and transport biogas and related byproducts, as well as identify new manufacturing and market outlets to address these management challenges.

Legal Agreements

Associated legal documents governing relationships between the landowner and other business partners could incorporate lease, easement and/or surface agreement provisions. A farmer and business partner(s) should consider addressing issues like who provides insurance, indemnification, facility maintenance, decommissioning and associated bonding, security, setbacks, aesthetics and conflict resolution procedures.

Repair and preservation of surface and subsurface farm infrastructure due to construction and soil compaction is another important consideration. Subsurface field tile, culverts, ditches, surface conservation practices, streambanks and crossings need to be identified. Noxious weed control, fencing, utility interconnection and electric load requirements, pipeline and storage facility installations should be considered for discussions as well.

Government and Regulatory Considerations

Generally recognized farming practices are exempt from many aspects of local government and regulatory authority. However, some practices associated with large-scale digester operations often go beyond farming. Landowners and developers will need to work with local governments and regulators to address zoning and community planning provisions, applicable business operation, health, safety and aesthetic requirements. Traffic control and road use maintenance agreements (RUMAs), as well as determining how taxes and CAUV provisions apply to the operation need to be addressed.

Employee and service provider training

Large facilities come with complex operational requirements. Regardless of the facility size and design, owners need to provide specialized employee instruction and collaborative training exercises for local first responders. Persons responsible for day-to-day operations should be able to identify and prevent risks leading to fires and explosions, leaks and pathogen exposure. Everyone involved with the site needs to know about specialized machinery operations and confined work space entry situations that could lead to asphyxiation and gas poisoning.

Neighbor relations

While many system operators focus on diversified farm income, employment, economic growth and sustainable production practices, other questions need to be answered, such as: How does the facility adhere to land use planning, enhance recycling and energy production, provide long-term community resources, address conflicts and enhance good neighbor relations? These considerations need to be incorporated into development plans early and not as an afterthought.