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What is Symbiosys?

Belmont BioAg process detailed

At a public informational meeting to be held December 6, area residents will get a formal unveiling of the recently announced Belmont BioAg project. Last week, the newspaper detailed the history of the project, from a simple feedlot into the multi-million dollar operation now planned. This week the paper will take a look at Symbiosys, the integration of project components that make this design unique.

Developed by Lafayette BioAg (LBA), the parent company that will market Belmont BioAg (BBA) as well as this system in future ventures, Symbiosys integrates ethanol production, cattle finishing, greenhouse production, and electricity generation into a first-of-its-kind, environmentally friendly agricultural campus in rural Belmont.

While all of these components exist as stand-alone installations, the Belmont BioAg project will be the first example of how wastes from parts of the project can be utilized by other processes within the complex, or packaged as products for the market. The idea is two-fold - to reduce the impact on the environment and to utilize what would be waste for a stand-alone operation.

Beef finishing and anaerobic digester

The original idea behind Belmont BioAg was a feedlot where cattle would spend their final months, before going to market, gaining weight through a nutritionally-balanced diet. With most area cattle being shipped out of state for finishing, there has been an economic loss for Wisconsin. Belmont BioAg hopes to stem that exodus by utilizing cattle raised in local operations, farms that meet the high standards of LBA for environmental practices and humane treatment of livestock, 20,000 head in total. That cattle will be split into eight finishing barns, with a capacity of 2,500 each.

With a feedlot comes the issue of cattle waste, a main reason why the project grew. Twenty thousand head of cattle, far from the initial numbers of the project, will produce a large amount of waste, although Belmont BioAg engineers point out that waste from finishing cattle cannot be compared to waste from a dairy herd.

The solution of removing the animal waste from the finishing barns came in the answer of flumes in the barn floors. The flumes allow rapid removal of the waste from the barns via a continuous flow of water, in addition to a daily spray-down of the barn floors. The liquid manure goes to one of the 10 1-million-gallon anaerobic digesters that will be on site at Belmont BioAg, utilizing that waste into fuel.

Based on Danish technology developed by the firm Bioscan A/S, the anaerobic digester process planned uses thermophilic bacteria. This bacteria lives in high temperatures, with the process typically generating a more complete breakdown of organic matter, increasing the production of biogas. Biogas produced by the digesters will fuel the power and heat operation for Belmont BioAg.

Manure digesters are common in Europe, but their adoption in the United States has been slow despite examples being around for decades. In the Midwest, there are more than twenty farms with manure digesters. In 2001, a manure digester opened in Wrightstown, handling the waste of 1,500 head of cattle; the methane produced by that digester could power the entire farm, as well as 250 homes. While most of these digesters (18) are used in conjunction with dairy operations, they can also break down swine, poultry, or even duck waste. According to the Great Lakes Council of Governors, only two of the digesters currently in operation use the thermophilic, or high temperature, method and none even come close to handling the amount of waste Belmont BioAg plans to handle.

Combined heat, power, and combustion

Biogas from the digesters will be routed to the combined heat and power component to generate enough electrical energy for all other parts of the operation as well as some for the power grid. Eight megawatts of electricity will be generated by five engines at Belmont BioAg. By comparison, the 21 biogas operations in the Midwest only generate 5.325 megawatts.

Heat will be captured from the engine jacket water and diverted to heat the digesters and the campus greenhouse. To reduce emissions, engine exhaust will be burned in another component, the high temperature combustion system.

The combustion system utilizes technology that not only is capable of handling numerous types of feedstock, but also operates at a high temperature range that oxidizes many of the undesirable pollutants, eliminating their environmental impact. This component will be fueled primarily by the by-products of other parts of Belmont BioAg. The plan is for this combustion system to provide nearly all the heat required by the entire Belmont complex.

The combustion component will provide the steam needs of the ethanol plant by combusting some distillers wet grains, digester solids, and greenhouse wastes from the complex, as well as biomass recruited from area farmers. It will also utilize other waste, like the exhaust from the power generation system. The extremely high operating temperatures, coupled with the air flow design, converts most undesirable fuel characteristics into a relatively benign ash that is rich in nutrients. That, along with the by-products of nitrogen, phosphorus, and potassium will be sold.

Ethanol plant

Long rumored, for many years, the dream of an ethanol plant being established in northwest Lafayette County will occur with Belmont BioAg's construction. This plant will be the sixth in the state. The Belmont project will produce 50 million gallons of ethanol per year. The planned use of onsite-generated biofuel as a primary energy source will reduce fossil fuel usage and further decrease environmental impacts, creating a significantly lower environmental impact as well as improved energy conversion than any of the other plants in Wisconsin. The plant expects to utilize about 18 million bushels of corn per year, and will use technology developed by Delta-T, a firm that specializes in ethanol refining.

Ethanol production begins with corn, water, and yeast enzymes that break down the corn and turn its starch into glucose, or sugar. The mash ferments two gases, ethanol and carbon dioxide. The CO2 bubbles off and the remaining solution is distilled, meaning the ethanol is separated from the whole stillage, a waste product. The whole stillage is a mix of thin stillage, mostly oils from the corn, and distillers wet grain, a high-protein fiber liked by beef, which will be separated through centrifuge action. Many ethanol plants dry the distillers grain, an energy-demanding process, but Belmont BioAg does not intend to do so, reducing the amount of energy in the process.

Belmont BioAg will capture the CO2 from the ethanol production and market food-grade CO2. The ethanol will be concentrated and blended with 5 percent gasoline as denatured ethanol, then sold to a regional wholesaler.

Part of the distillers grain, along with the thin stillage, will be mixed with animal wastes and sent to the digesters. Of the rest of the distillers grain, some will be sold and the rest will be mixed into feed for the finishing barns.

Water treatment system

The Symbiosys concept includes a two-stage water treatment process designed to take the liquid coming out of the digester and turn it into potable water. The first stage uses the solids separator component to separate out any remaining solids. The solids are fed to the combustion component while the liquid goes on to second-stage treatment in the water filtration component that removes impurities such as ammonia.

While the final filtration will produce potable water, current plans are to use this water as part of the closed-loop, continuous-flow process for cleaning the barns, as well as process water elsewhere in the Belmont campus.

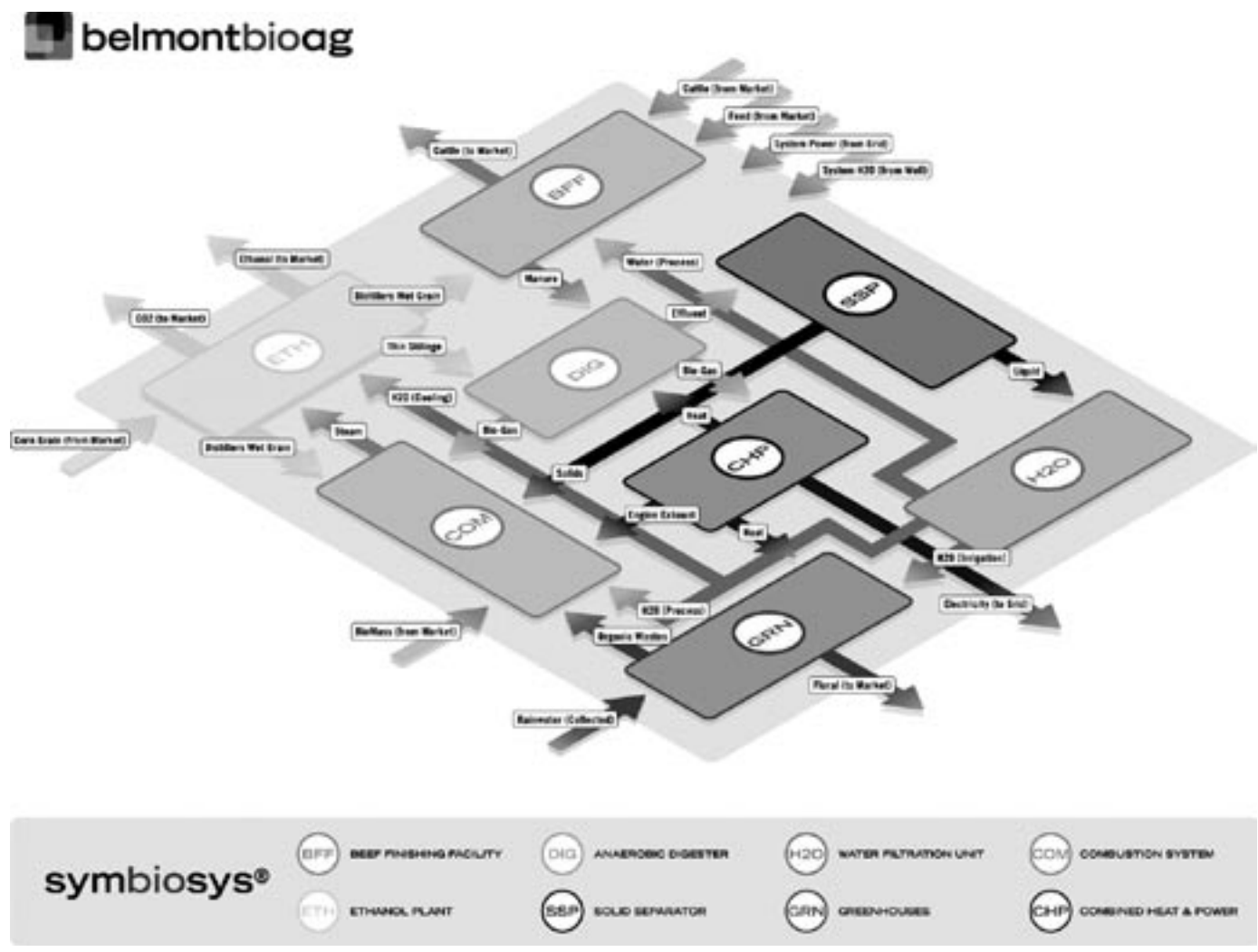
Greenhouse

There will be one 11.2-acre greenhouse in Belmont BioAg, including production, shipping, storage, and receiving areas. Varieties of annual bedding, plants, and flowers will be started from seed and cuttings brought in, transplanted, and grown in the facility. The greenhouse plays an integral role in turning what would otherwise be waste heat into value-added products – bedding plants to be sold to a wholesaler and destined for large retailers in Wisconsin.

In summary, the state-of-the-art Symbiosys design takes feed, corn, biomass from animals, 700-lb cattle, seeds, enzymes, bacteria, natural gas, sand, and water and turns them into finished cattle, bedding plants, ethanol, distillers grain, food-grade carbon dioxide, electricity, ammonia products, fertilizer from ash by-product, and mineralized nitrogen (N), phosphorus (P), and potassium (K).

The only products expected to be leaving the facility as wastes are some flue gases from the high-temperature combustion system, clean-in-place chemicals from the water treatment process, minimal dust and odor from the cattle feedlot, and, possibly, minor air emissions from the ethanol plant.

To find out more, Belmont BioAg president Bob Brodbeck and Lafayette BioAg CEO Tim Baye will provide an overview of the Belmont BioAg process at an informational meeting next Tuesday. The meeting is scheduled for Dec. 6 at the Belmont High School gymnasium, taking place from 7:30 to 9:30 p.m. The public is invited.



A diagram showing all of the properties that will be involved with the Belmont BioAg site.