PROGRESSIVE AGRICULTURE
Energy Options for Ohio Agriculture
• Renewable energy – natural gas, vehicle fuel (CNG/LNG), electricity & heating/cooling.

• Animal bedding, peat alternative and compost

• “equate” liquid plant food is a natural solution in lieu of chemical fertilizers.

• Reduced greenhouse gas emissions, cleaner air, soil and water
As a feedstock for anaerobic digestion, manure:
• is low in energy generating volatile solids,
• does not have a tipping fee,
• land application has nutrient values of approximately 0.8 – 0.4 – 0.11.

When co-digesting manure with other waste and biosolids:
• energy production increases,
• tipping fees are introduced into the project,
• and nutrient values increase to 10 – 6 – 12.

1. OSU Ohio Livestock Manure Management Guide
2. Based on representative sample from Central Ohio BioEnergy – nutrient values may vary based on inputs.
INPUTS

TYPES OF ORGANIC RESIDUALS:

- Food Processing Residuals
- Manure
- Energy Crops & Spent Grains
- Biobased Oils & Lubricants
- FOG (fats, oils & grease)
- Waste Water Treatment Sludge
- Ethanol and Biodiesel processing residuals
- Dissolved Air Flotation (DAF)
- Expired, damaged or off-spec consumer goods
- Packaged Organics (depackaging technology)
- Crop Residuals
- Glycerin & Stillage
- Whey
- Sugar Water
WHY ANAEROBIC DIGESTION?

- Manure Management
- EPA Compliance
- Control Energy Costs
  - Electricity for on farm use and sale to the grid.
  - Heat for farm operations.
  - CNG to run trucks.
- Other New Revenue Streams
  - Tip Fees from merchant material.
  - Fertilizer value of $250 per acre\(^1\).
- Reduce normal farm odors
- Reduce GHG Emissions

1. Based on 2013 oil prices
Our first project in Wooster, Ohio is located in the BioHio Research Park on The Ohio State University’s OARDC campus. The project produces enough electricity to offset one-third of the campus’ annual electric consumption.
OPERATING STATISTICS

• Tons of Material/Day
  - 80 tons

• Waste Streams Managed
  - dairy manure
  - FOG
  - Food Waste
  - Sewage Sludge

• Renewable Energy Generated
  - 650 kWh

• Gallons of Liquid Fertilizer (equate)
  - 7,000,000 gallons per year
In rural Haviland, Ohio (Paulding County) business leader Haviland Drainage Products wanted a sustainable solution for producing renewable electricity that could power part of its plastic recycling business. Anaerobic digestion was a logical choice — the project has been operating since 2011.
**OPERATING STATISTICS**

- **Tons of Material/Day**
  - 130 tons
- **Waste Streams Managed**
  - dairy manure
  - FOG
  - Food Waste
  - Sewage Sludge
- **Renewable Energy Generated**
  - 1000 kWh
- **Gallons of Liquid Fertilizer (equate)**
  - 11,000,000 gallons per year
For three generations the Ringler family has raised livestock with special emphasis on nutrient utilization, innovative transportation, and by-product management. The livestock division of the Ringler family raises quality pork throughout Pennsylvania, Ohio and Indiana.
THE RINGLER ANAEROBIC DIGESTION PROJECT

**Location:** Ashley, Ohio

**Project Completion:** April 2013

**Digester Capacity:** 980,000 gallons

**Generator:** 800 kW

**Animals:** 7,000

**Feedstocks:** Manure, Food-Waste, Biosolids, and FOG
OPERATING STATISTICS

- **Tons of Material/Day**
  - 144 tons

- **Waste Streams Managed**
  - 4 million gallons hog manure each year
  - FOG
  - Food Waste
  - Sewage Sludge

- **Renewable Energy Generated**
  - 650 kWh

- **Gallons of Liquid Fertilizer (equate)**
  - 11,000,000 gallons per year
GRAND OPENING: EXCITEMENT BUILDS AROUND ANAEROBIC DIGESTION

Event Speakers Included Leaders from the Following Organizations
Ringler’s second anaerobic digester with Quasar is under construction in Fairborn, Ohio and scheduled to be completed by the end of 2013.
CNG Fuel from BioGas: Ringler is already planning Phase II of their Ashley (OH) project which will include the installation of biogas upgrade equipment and a CNG fueling station. Most of the fuel will be used to power their fleet of 40 trucks that are used to transport within their operations. The fueling station will reduce their fuel costs by one-third to two-thirds depending on the market value of diesel fuel.
quasar is listed as an approved Renewable Fuel Producer under the EPA’s Renewable Fuels Standard 2 (RFS2) Program. quasar generates RINs from renewable fuel sold for transportation at the Columbus and Zanesville digesters. The fueling stations are open to the public Monday through Saturday.
Transit buses equipped with model year 2004 CNG engines compared to model year 2004 diesel engines:

- CNG buses produced 49% lower nitrogen oxides emissions
- CNG buses produced 84% lower particulate matter emissions

In a study of UPS delivery trucks running on CNG compared to diesel trucks of a similar age:

- CNG trucks produced 75% lower carbon monoxide emissions
- CNG Trucks produced 49% lower nitrogen oxides emissions
- CNG trucks produced 95% lower particulate matter emissions

REFERENCES:
1. U.S Department of Energy: [UPS CNG Truck Fleet: Final Results](#)
CONVERSIONS TO CNG VEHICLES

quasar Truck at Columbus Fueling Station

quasar Vehicles

quasar Conversion of OUL Vehicle
Understand the Inputs:
Digester inputs not only determine the amount of biogas the system generates, they also impact the nutrient value of the liquid fertilizer product.

Manure Only:
Manure only (swine grow-finish) has a nutrient value of 0.8 – 0.4 – 0.1\(^1\).

Manure and Food Waste:
A representative digester processing manure and food waste generates effluent with a 6 – 4 – 1\(^2\) value.

Biosolids:
Adding biosolids to the feedstock recipe increases the nutrient value to 10 – 6 – 1\(^3\).

1. OSU Ohio Livestock Manure Management Guide
2. quasar Buckeye Biogas Anaerobic Digester
3. Representative nutrient sample from COBE system
Effluent from anaerobic digesters is applied to farm fields for agronomic benefit.

- **ecofriendly alternative**: *equate* is an ecofriendly alternative to traditional fertilizer options such as land application of manure or chemical fertilizers.

- **high organic matter**: Adding organic matter to fields increases their ability to hold water in drought years and helps clay soils drain more effectively.

- **odor management**: odor causing solids are naturally reduced during anaerobic digestion by converting volatile solids into biogas – resulting in a product that is less odorous than manure.

*Typical Fertilizer Value*  
10-6-1

*average concentrations and values listed above are based on laboratory tests of representative samples. Nutrient values may vary slightly.
Progressive Agriculture: to stay competitive we need to constantly progress. Successful digester projects need to step up as examples to other farmers who could also benefit from energy generation, manure management, odor reduction and stronger relationships with residual sources. The technology is not new – and we are demonstrating that it works across Ohio.
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