High Solids Anaerobic Digestion: An Overview of Installed Facilities

2011 Biosolids Specialty Workshop
December 8, 2011

Ohio Water Environment Association
Preserving & Enhancing Ohio's Water Environment

quasar energy group

ABOUT quasar energy group

quasar is an Ohio-based renewable energy company.

- Aggregation of the best anaerobic digestion technology available
- Provide complete full service, turn-key anaerobic digestion solutions for our customers
- Produce energy for use as electricity & fuel from organic sources
- Operate laboratory & engineering facilities on OSU-OARDC campus
- Dedicated to building systems based on US components and US suppliers
- More than 40 projects in our current business pipeline
- Four facilities operating in Ohio and one in Massachusetts

quasar's **Mission … "To produce affordable renewable energy from commercial, municipal and agricultural biomass, while improving the environment."**

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PROJECTS: Completed or in Progress

quasar has four facilities operating.

Operational facilities are:

Columbus, Ohio – 1 MW

Rutland, Massachusetts – 300 kW

Wooster, Ohio /OSU-OARDC – 600 kW

Zanesville, Ohio – 1MW

Facilities under construction are:

Cleveland, Ohio – 1 MW

Haviland, Ohio – 1 MW

North Ridgeville, Ohio – 1 MW

Zanesville, Ohio *i***AD***s* - expansion

quasar's operating facilities are exceeding design capacity by approximately 30% . . .

ANAEROBIC Digestion

Anaerobic digestion is a natural process where microorganisms break down organic biomass in the absence of oxygen.

INPUTS

- Agricultural Biomass (manure, crop residuals, energy crops)
- Food Processing Residuals & FOG (fats, oils and grease)
- Municipal Wastewater (biosolids)
- Ethanol residuals
- Expired, damaged or depackaged organics

PRODUCTS

- Renewable Energy – Natural Gas, Electricity, Motor Vehicle Fuel (CNG/LNG)
- Animal Bedding, Peat Alternative, & Compost
- Concentrated fertilizer (P) separation
- Reduced Greenhouse Gas Emissions, Cleaner Water, Soil & Cleaner Air

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CLEVELAND, OH

Under Construction:
Annual Tons: 42,600 wet tons
Generator: 1 MW

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COLUMBUS, OH

Placed in Service: 2010
Annual Tons: 50,000 wet tons
Generator: 1 MW

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HAVILAND, OH

Under Construction
Annual Tons: 43,000 wet tons
Generator: 1 MW

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RUTLAND, MA:

Placed in Service: 2011
Annual Tons: 15,000 wet tons
Generator: 300 kW

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WOOSTER, OH

Placed in Service: 2010
Annual Tons: 20,000 wet tons
Generator: 600 kW

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ZANESVILLE, OH

Placed in Service: 2010
Annual Tons: 30,000 wet tons
Generator: 1 MW

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ANAEROBIC DIGESTERS Planned in Ohio

Operational Facilities:
Akron, OH
Columbus, OH
Wooster, OH
Zanesville, OH
Rutland, MA

Coming in 2011:
Celina, OH
Cincinnati, OH
Cleveland, OH
Columbus, OH
Dayton, OH
Haviland, OH
North Ridgeville, OH
Norton, OH
St. Clairsville, OH
Wooster, OH
Zanesville *i*AD*s*, OH

Offices:
Headquarters
Cleveland, OH
Engineering
Wooster, OH
Laboratory
Wooster, OH

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COLLABORATING with The Ohio State University

Engineering Offices:

Laboratory:

Laboratory:

THE OHIO STATE UNIVERSITY OARDC

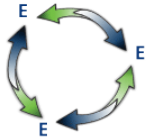
BioHio Digester:

OHIO'S POTENTIAL | Renewable Energy from Biomass

Anaerobic digestion can generate energy that will offset fossil fuel use.

- [1]Ohio can support thousands of anaerobic digestion renewable energy facilities that can produce: **Natural Gas** - $1.76 Billion *or*
  Electricity - $1.44 Billion *or*
  CNG - $3.33 Billion

- These facilities represent $18.2 Billion in investment that will:



***E**nergy:* Promote Energy Independence
***E**conomy:* Create Green Jobs
***E**nvironment:* Reduce Greenhouse Gas Emissions

- By training the next generation of technicians now, we can be prepared to answer the growth of this industry with a ready and able workforce

- This isn't about building biogas plants it's about building a new energy economy for Ohio and improving our environment.

Imagine 17% of Ohio's fuel being supplied from organic sources in Ohio!

1. Based on a study supported by The Ohio State University

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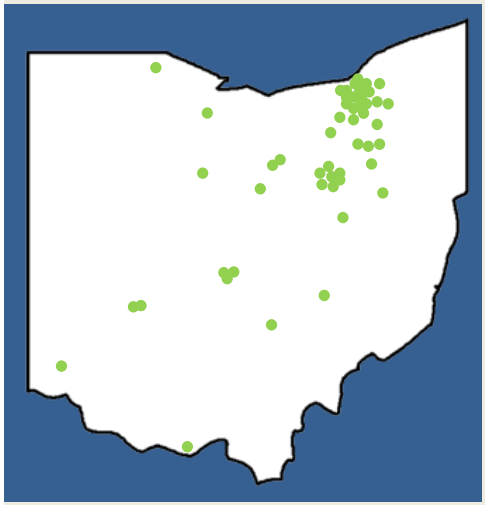
BUILDING An Industry



quasar is working with more than 60 Ohio contractors, suppliers, manufacturers and fabricators to source components and labor for our facilities.

- Prior to 2007, components for AD systems were primarily sourced in Europe.
- Over the past 5 years, quasar has worked with U.S. and specifically Ohio vendors to source major components .
- ***NOW***, more than 98% of our components are sourced in the U.S. and **more than 76% of those are from Ohio based companies!**

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COMPONENTS

Designed by quasar

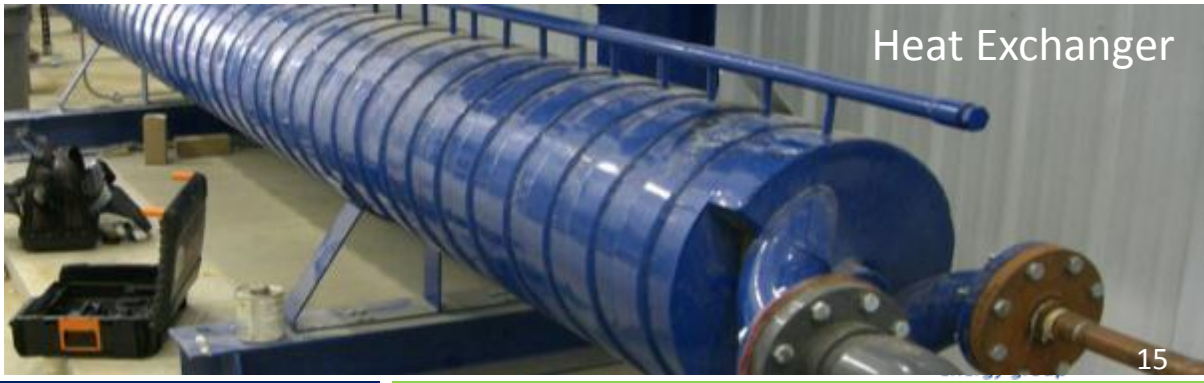
Flare

Membrane

Live Bottom Hopper

Mixers & Stands

Heat Exchanger



EDUCATING For Careers of the Future

OSU – ATI Train for Jobs

Growing a bioenergy industry means growing the demand for educated, experienced technicians.

Direct Jobs:
Civil Engineering
Mechanical Engineering
Electrical Engineering
Construction Management
Plant Operators
Biological Analysis
Regulatory Compliance
Agronomy
Wastewater Specialists
Accounting
Project Finance
Biogas Specialists

Indirect Jobs:
Agriculture
Engineering
Soil Analysis
Environmental Analysis
Biomass Transportation
Component Design
Component Fabrication
Component Supply
System Construction
Legal – Advanced Energy
Waste Management
Manufacture of CNG Vehicles
Design and construction of CNG/ LNG fueling systems

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THE FUTURE is Renewable Fuel

quasar is integrating **CNG** fueling stations into our anaerobic digestion facilities to service public and private fleets, and small vehicles.

- CNG **costs less** than gasoline or diesel.
- **Ohio** can lead the way in U.S. conversion of vehicles to CNG fuel. The time is NOW.

qng STATION

At the Columbus Digester

energy economy environment

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