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WISCONSIN



**OSHKOSH**



Where excellence and opportunity meet.™

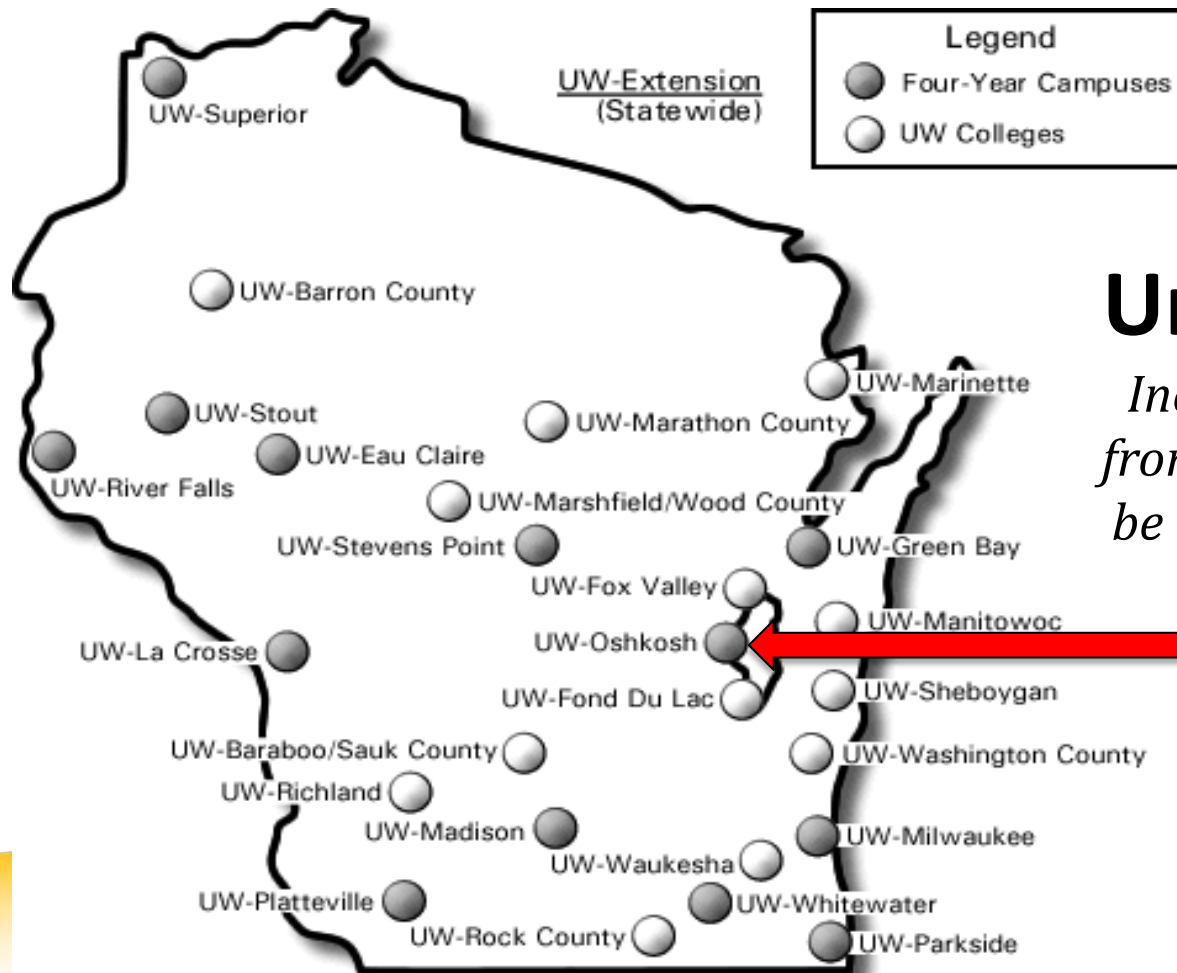
# **Wisconsin Distributed Resources Collaboration**

**July 15<sup>th</sup>, 2016**

**Brian M Langolf – Director of Biogas Systems**



# University of Wisconsin–Oshkosh



## University goal:

*Increase the use of energy from renewable sources and be leaders in sustainability.*

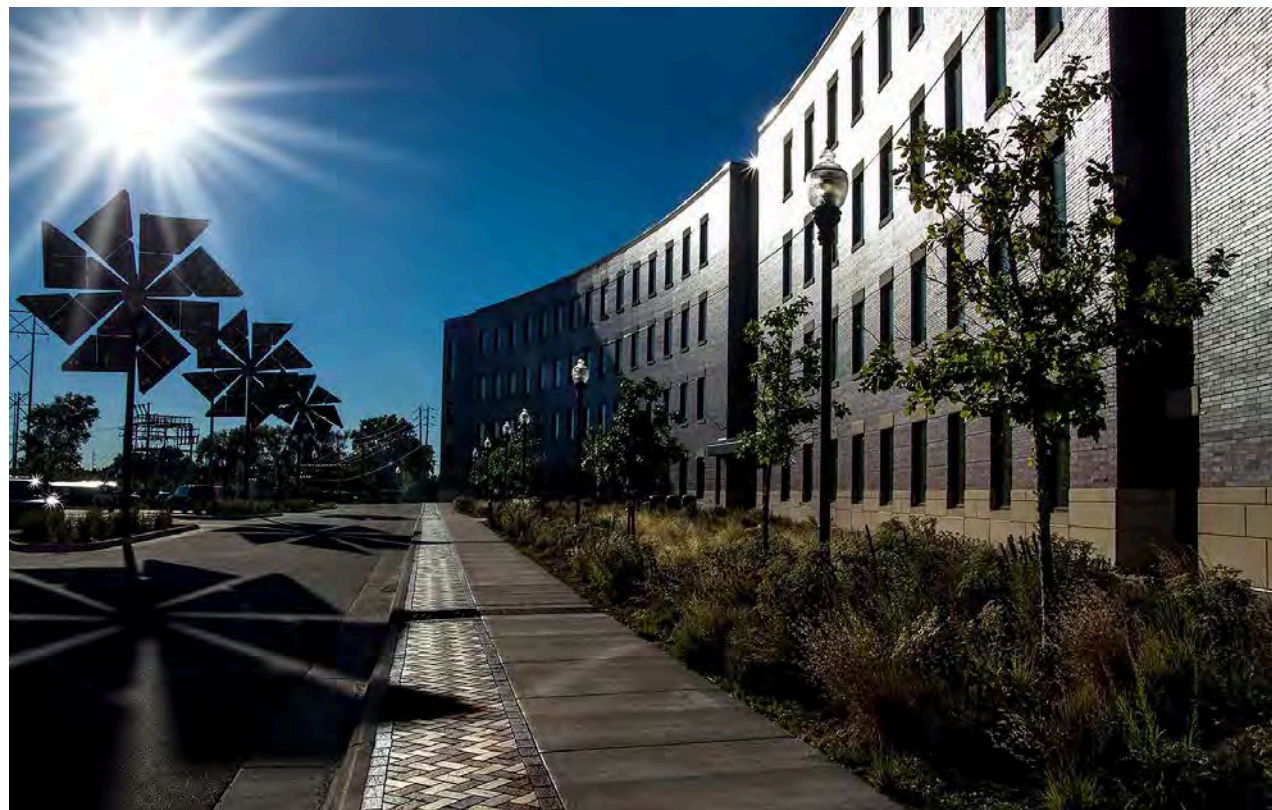
# University of Wisconsin–Oshkosh Background

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- 3<sup>rd</sup> largest UW school
- Founded in 1871
- 14,000 Students
- 74 associate, baccalaureate, master's and doctoral degree programs
- Recently named Sierra Club's 3<sup>rd</sup> Greenest Campus
- In October 2014, UW Oshkosh hosted one of the world's largest Earth Charter Community Summits for the 13th consecutive year.
- 1<sup>st</sup> Fair Trade University in United States
- Charter Member of Higher Education ACORE Committee

# UW Oshkosh — No. 3 Greenest School in the U.S.

—Sierra Club Magazine 2015



## University of Wisconsin–Oshkosh Sustainability History

- 
- UW Oshkosh was ranked #3 in Sierra Magazine’s “Cool Schools” rating.
  - BestColleges.com ranked UW Oshkosh # 5 in the nation in its green school rating system.
  - In 2013, UW Oshkosh was one of only 21 schools listed in Princeton Review’s “Green Honor Roll” and also earned Gold in the AASHE STARS program
  - In 2011, the University installed a dry fermentation anaerobic biodigester, the first of its kind in the country, and earned the 2011 Silver Waste-to-Energy Excellence Award from the Solid Waste Association of North America.
  - UWO’s three biodigesters are rated to generate nearly half of the university’s electricity needs

# University of Wisconsin–Oshkosh Sustainability History

- 
- UWO purchases 16% of its electricity from green energy through renewable energy credits
  - As the first designated Fair Trade Campus in the country, UWO offers an increasing variety of socially and environmentally responsible products including coffee, tea, chocolate, clothing, and household and decorative items
  - UW Oshkosh has been designated a “Tree Campus USA” school every year since 2011, by the National Arbor Day Foundation for its tree canopy, diversity, and educational programming
  - In 2015, campus was designated a Monarch Butterfly Waystation for its monarch-friendly landscaping

# UW Oshkosh Biogas Systems

City – Dry Fermentation



Small Farm – Plug Flow

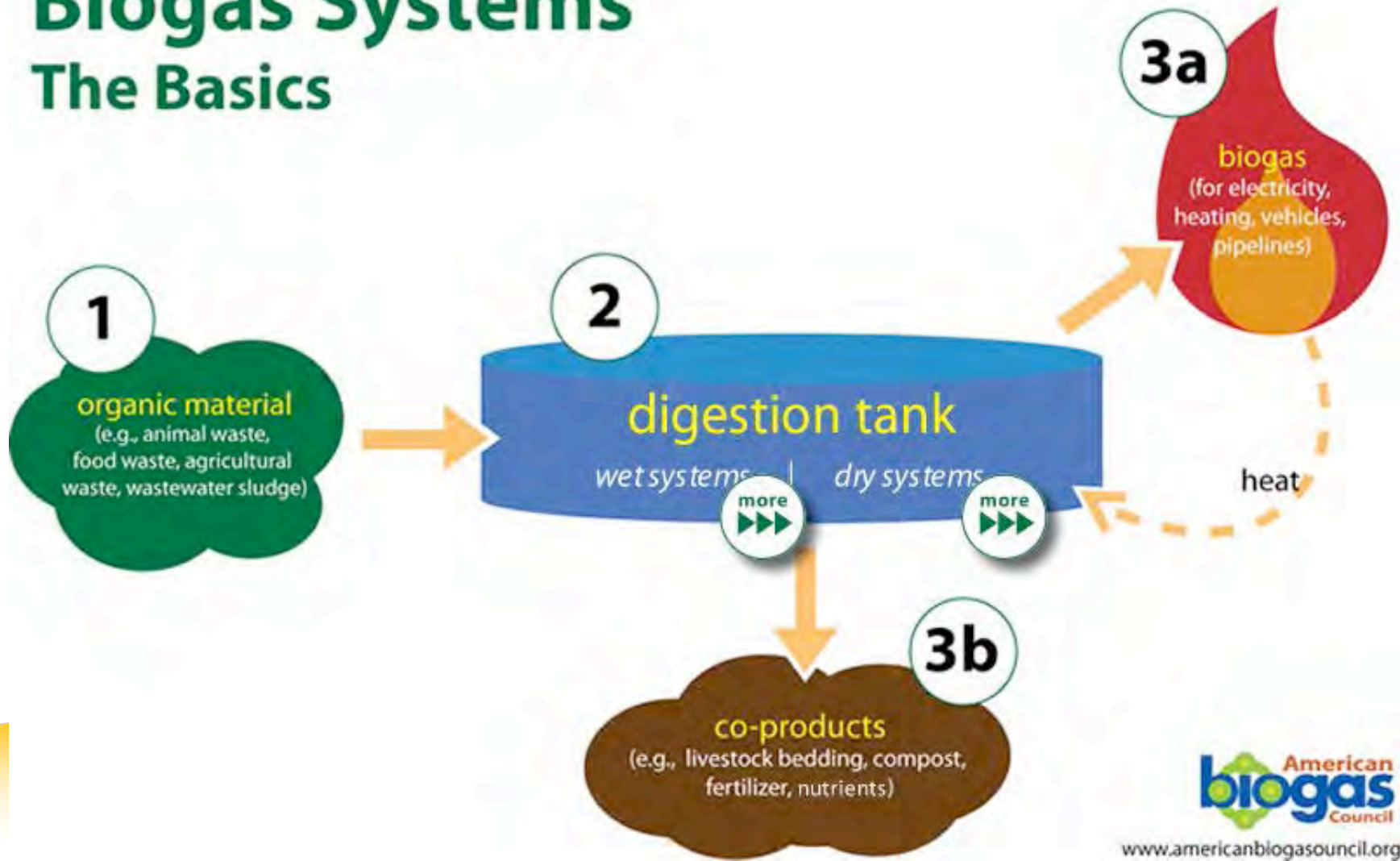


Large Farm – Complete Mix





# Biogas Systems The Basics



# Dry Anaerobic Digestion Facility at UW-Oshkosh



# University of Wisconsin–Oshkosh Case Study: Biodigester 1

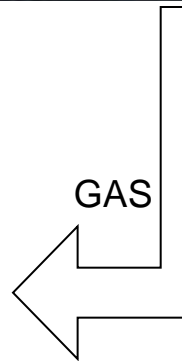
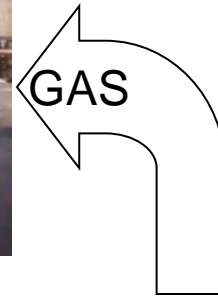
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## Dry Digester

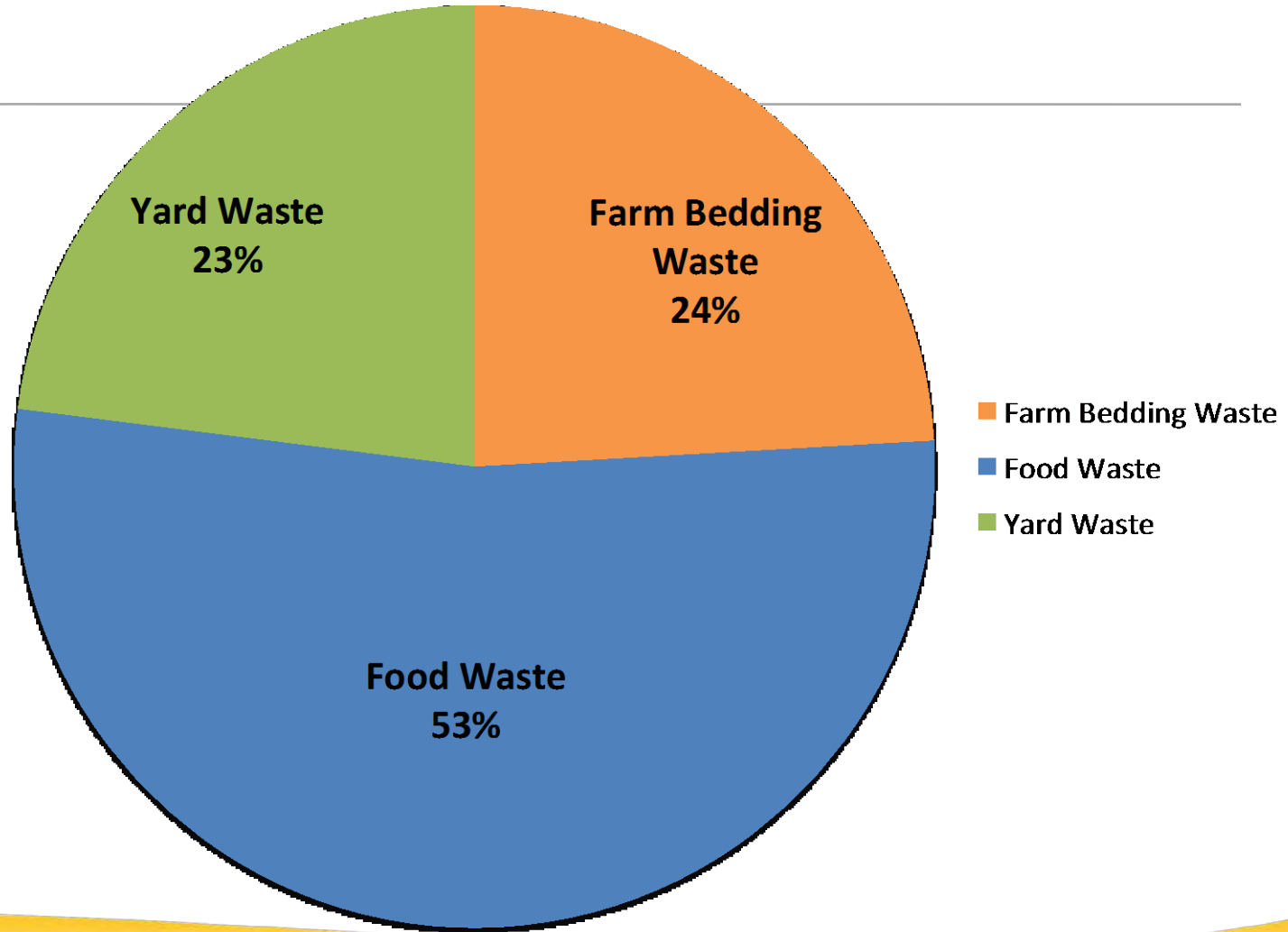
- Processes 10,000 tons of organic waste
- Produces 370 kW of continuous electrical power
- Waste water treatment plant collaboration
- Private/public collaboration



# Dry System: 3 Basic Components



# BD1 – Average Feedstock Totals



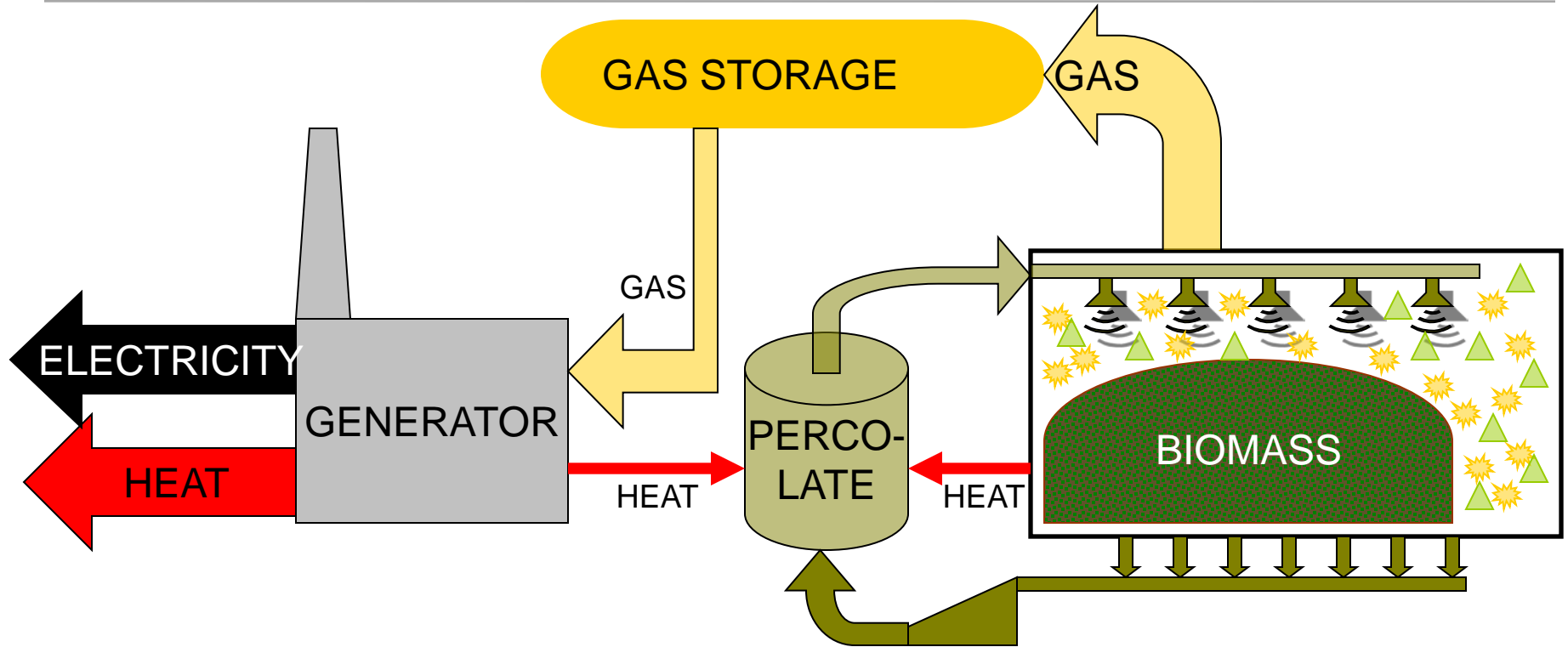
**Annual Organic Material Processed = 10,000 tons per year**



# Organic Containers



# Electricity and Heat are generated...



Solid “digestate” → aerobic composter site





# University of Wisconsin Oshkosh - Rosendale Digester Project

- Wet digester – Complete Mix
  - Largest dairy farm in WI
  - Provides manure management
  - Construction began June 3<sup>rd</sup>, 2013
  - 110,000 tons annually
  - 1426 kWh electrical and 1533 kWh thermal



# OSHKOSH Aerial Overview

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\* Photo taken and supplied courtesy of Milksource

















# Electrical Generation – 1426 kW









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# Solids Separation

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# Innovative Manure Management





# University of Wisconsin - Oshkosh Allen Farm Digester (BD3)

- Small scale prototype, plug flow digester
  - Education and research focus
  - Small farm installation
  - Designed for solid and liquid waste streams
  - Processes up to 6,000 tons of organic waste from on the farm
  - Produces 64 kW continuous electrical power and 101 kW of continuous thermal energy





## System Overview

Technology	Schmack / BioFerm - EUCOIno
System Type	Mixed Plug Flow
Target Temp	Mesophilic
Target Internal Solids Content	8 – 15%
Target HRT	21 days
Tons per Year	4,000 – 6,000
Animal Units	120 Dairy Cattle
Feedstock	Manure Scrape – 82% Bedpack / Manure – 12% Co-Substrates – 6%
CHP Size	64 kW
Electric Sales (\$/kWh)	\$0.08 (Export via PPA with WPS)
Digestate End Use	Lagoon Storage, No Separation Today
Digestate Value	Fertilizer – Farm Use

# Overview of the Farm Incorporation of Technology



# OSHKOSH Digester Components



OSHKOSH Various Site Views



# OSHKOSH Various Site Views



# OSHKOSH Various Site Views

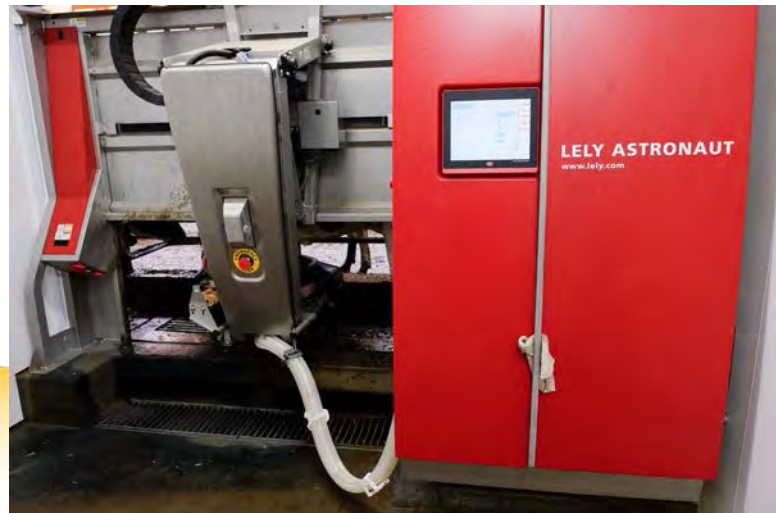




# OSHKOSH Free Stall Barn & Robotic Milking



# OSHKOSH Free Stall Barn & Robotic Milking



# Manure Collection and Transfer to the Digester



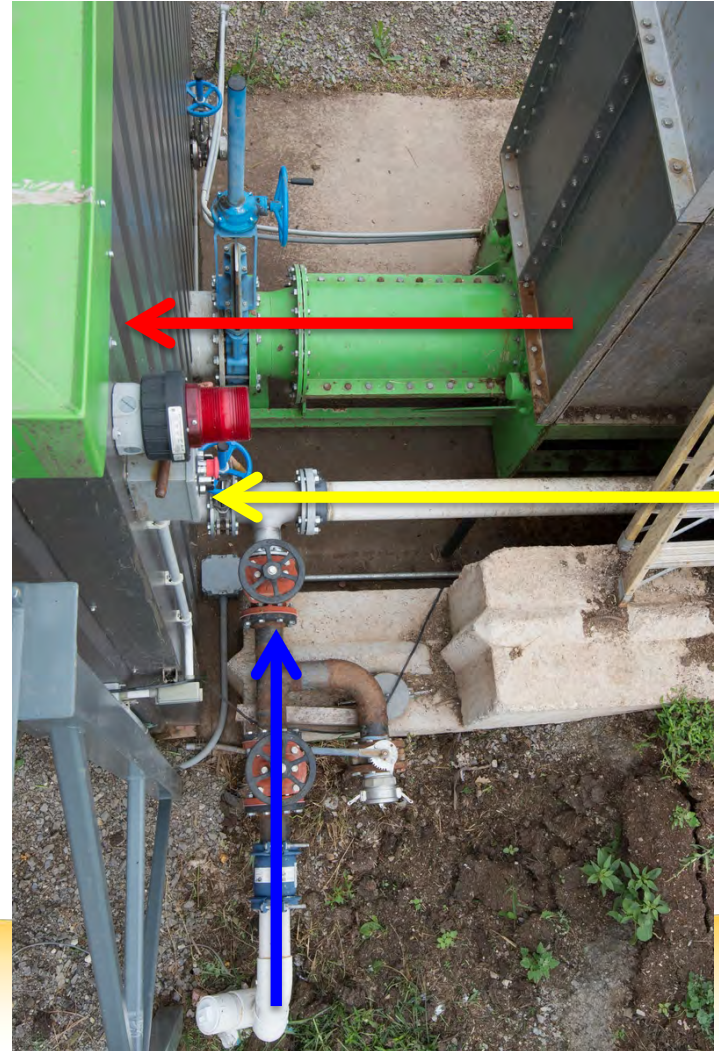
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## Solid Bedpack Collection



# OSHKOSH Solid and Liquid Feeding Options







## Mixing inside the fermenter tanks

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# Biogas Storage & Analysis



# OSHKOSH Pump Room



# OSHKOSH Biogas Conditioning





# Control Cabinet & Heat Transfer







# Final Storage Lagoon

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# Land Application

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## Challenges to AD

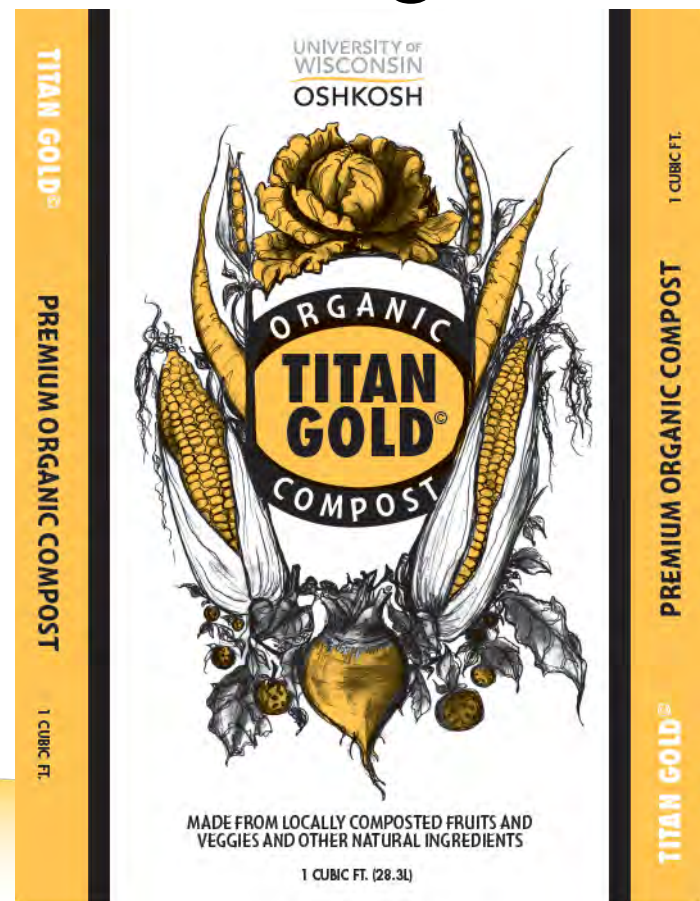
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- Electricity (natural gas) prices
- PPAs
- Need for multiple revenue streams for each facility
- Feedstock stability
- Seasonality of some feedstock
- Transportation costs
- Climate
- Technology development and transfer

## AD Benefits Beyond Electricity

- 
- Thermal value for local usage
  - Nutrient management
  - Pathogen destruction
  - Water control and reuse
  - Pollution control
  - Odor reduction
  - **Value-added products from solids**
    - Compost
    - Soil amendment
    - Workforce development –
      - Engineering Technology
      - Environmental Health

# How UW Oshkosh is solving the AD challenge!



TITAN GOLD®

PREMIUM ORGANIC COMPOST

1 CUBIC FT.

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MADE FROM LOCALLY COMPOSTED FRUITS AND  
VEGGIES AND OTHER NATURAL INGREDIENTS

1 CUBIC FT. (28.3L)

TITAN GOLD®

PREMIUM ORGANIC COMPOST

1 CUBIC FT.

# MAKING COMPOST

the Titan Gold™ way

## step 1: collect local organics



food, farm and yard waste  
from local public and private sources  
are diverted to our digester

## step 2: use as renewable resource

energy, heat and compost are created  
generating up to 10% of campus energy  
needs while creating organic compost



## step 3: bring compost to community



Titan Gold is tested, bagged and sold  
by UW Oshkosh using STA standards  
to ensure the safest and highest quality  
compost for our community



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Produced and sold by: UW Oshkosh Foundation-Witzel LLC  
Distributed by: UW Oshkosh Environmental Research and  
Innovation Center, 783 Pearl Ave., Oshkosh, WI 54901

Learn more  
(920) 424-0657  
titangold@uwosh.edu  
uwosh.edu/eric/titangold



**From Food**

**To Compost**

# OSHKOSH How it Began – Local Composter



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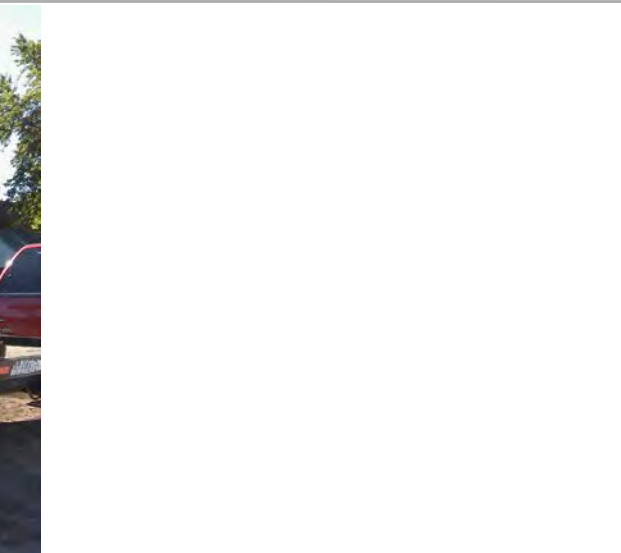
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# OSHKOSH Final Destination



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Environmental  
Research  
**Innovation** Center



**US Composting  
Council**  
*Seal of Testing  
Assurance*



# Environmental Research and Innovation Center (ERIC)

- USEPA, WIDNR, US Composting Council certified facility.
- Contract R&D for clients from the Canadian Yukon to Central America that provide real-world answers and solutions to their companies questions.
- Provides state-of-the-art lab facilities for research and consulting for those interested in biogas applications.
- Transfer of experience, technology, and expertise from public sector to add value to industry partners and their products and services.
- Facilities and expertise not available anywhere in WI or the nation.
- Unique third party that possess the operational and research expertise to bring projects from cradle to grave.



# Questions?

