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Where excellence and opportunity meet.™

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Waste To Energy Using Anaerobic Digestion

Earth & Science Climate Change
3rd International Conference
July 28-30, 2014

Thomas Sonnleitner
Vice Chancellor for Administrative Services
University of Wisconsin Oshkosh

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"The trouble with our time is that the future is not what it used to be."

Paul Valerey (1871 – 1945)

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UNIVERSITY & COLLEGES



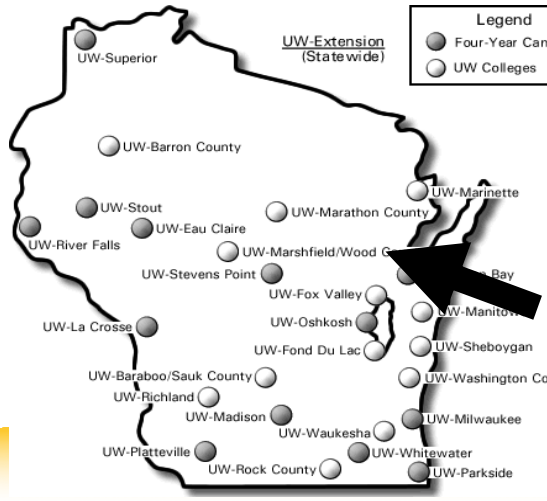
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Representing Sustainability on Higher Education Campuses

- Universities and colleges are, and must continue to be, national leaders in the sustainability and renewable energy movements.
- Waste-to-energy technology offers two sustainability solutions to campuses: organic waste diversion and renewable energy.

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University of Wisconsin–Oshkosh



University goal:

Increase the use of energy from renewable sources.

University of Wisconsin–Oshkosh Background

- 3rd largest UW school
- Founded in 1871
- 14,000 Students
- 74 associate, baccalaureate, master's and doctoral degree programs
- In October 2012, UW Oshkosh has hosted for the 11th consecutive year one of the world's largest Earth Charter Community Summits
- 1st Fair Trade University in United States
- Charter Member of Higher Education ACORE Committee

University of Wisconsin–Oshkosh Sustainability History

- President's Climate Commitment
- Carbon footprint inventories
- Sustainability councils/directors
- Student advocacy groups and research
- Environmental studies curriculum
- Wind purchases
- Performance contracts around energy efficiency
- Statewide lighting retrofits

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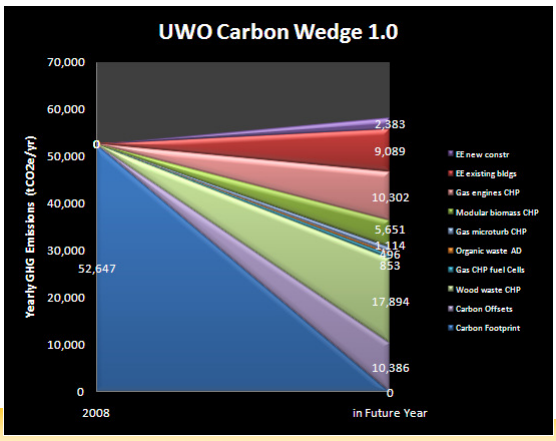
University of Wisconsin–Oshkosh Sustainability Initiatives

- 1st university in WI to sign the President's Climate Commitment and pledge to attain carbon neutrality
- Taken and continues to take great steps towards this goal:
  - Carbon Footprint Inventory
  - Study and implementation of several renewable energy projects (solar, geothermal, biogas) to reduce campus dependence on coal-fueled power

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University of Wisconsin–Oshkosh Developing a Plan

Develop a Structure | Crate a Baseline | **Develop a Plan** | Progress Reports



- Emissions today & forecast into future
- Inventory management plan & tools update, track and audit
- Strategies for dealing with supply side & demand side for energy

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University of Wisconsin–Oshkosh Case Study: Biodigester 1



Oshkosh Northwestern

Tuesday, March 2, 2010 www.thenorthwestern.com 50¢

TODAY
>Nation & World

Chile troops battle looters

DEBATES
FREE & OPEN TO THE PUBLIC
Oshkosh Seniors Center, 200 N. Campbell Road, south building

ELECTION 2010

UWO plant 1st in nation

Biodigester will turn food waste to energy

BY JEFF BOLLIER

The University of Wisconsin-Oshkosh plans to turn grass clippings and food scraps into heat and electricity in a new plant they say will be the first of its kind in the United States.

The dry fermentation anaerobic biodigester will be built this spring on Dempsey Trail, behind the university's Campus Service Center. It will be able to convert 8,000 tons of yard and food waste per year to 495 kilowatts of energy — enough to cover 5 percent of the campus' electricity and heating needs.

"This will be a chance for UWO to establish a living, learning laboratory for students, faculty, staff, the community and others," UWO Vice Chancellor Tom Stanley Litzer told the Oshkosh Plan Commission last month. The Oshkosh Common Council approved a conditional use permit to operate the plant last week.

The biodigester uses dry materials instead of smelly manure or sewage to generate gas that can be captured and burned to provide heat or converted into electricity to power university buildings. The food scraps will likely come from UWO operations while grass clippings and yard waste will be transported from the city's drop-off site near the central garage off Witzel Avenue.

The material will be placed in the building and deprived of oxygen. Microorganisms will then break down the material through a series of processes that produce

BIODIGESTER, Page A7

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University of Wisconsin–Oshkosh Case Study: Biodigester 1

- Dry Digester
  - 1st commercial scale dry fermenter in nation
  - Processes 8,000 tons of food waste and yard waste annually from UWO and the community
  - Produces 370 kW of continuous electrical power OR 495 kW of continuous thermal energy
  - Private/public collaboration between the UWO Foundation, BIOFerm™ Energy Systems, City of Oshkosh and WPS



University of Wisconsin–Oshkosh Case Study: Rosendale

- Wet digester
  - Largest dairy farm in WI
    - 9,600 cows
  - Helps solve environmental issues
  - Construction began June 3rd, 2013
  - Partnership with Milk Source Dairy
  - Partnership with Infinity Lawn and Garden
  - Partnership with Alliant Energy

University of Wisconsin–Oshkosh Case Study: Allen Farms

- Small scale, plug-and-play digester
  - 1st small scale digester installation
  - Designed for limited waste steam
  - Processes up to 2,000 tons of cattle manure and bedding from 135 cows
  - Produces 64 kW continuous electrical power OR 101 kW of continuous thermal energy



University of Wisconsin–Oshkosh Digesters and Campus Sustainability

- Reduces organic waste input to landfills
- Produces renewable energy
- Creates residual processing economies
- Increases focus on sustainability education/curriculum
- First commercial scale dry fermentation system in the nation!
- Creates unique private/public partnership

University of Wisconsin–Oshkosh Funding the Project

- Write a business plan based on real data
  - Business partner
  - Financing institution
  - A blueprint for operations
- Find a business partner to provide financing and will in turn benefit from the project
  - UW Oshkosh Foundation

University of Wisconsin–Oshkosh
The Business Plan

- Writing was a journey of discovery
  - Resources, consultations, creating a model
- The plan
  - Resources, consultations
  - Marketing
  - Operations
  - Financials/Cash Flow Projection
  - Concluding Statement

University of Wisconsin–Oshkosh
Identifying a Project for Your Campus

Every campus is different:

1. Understand sustainability efforts/benefits
2. Explore the viable options
3. Identify best options
4. Build support
5. Find partners
6. Write the business plan
7. Secure funding
8. Build it!



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"The pessimist complains about the wind. The optimist expects it to change. And the realist adjusts the sails."

William Arthur Ward (1921 - 1994)

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Reasons to Consider Food Waste Diversion?

An estimated 25% of fresh water usage in U.S. is used on food that is never eaten.
– Food Waste Reduction Alliance



"Americans throw away enough food every day to feed 200 million adults" – *Mongabay.com*

Our country wastes enough food to fill the 90,000 seat Rose Bowl every day. – *Alternet.org*

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Turning Food Waste from a Burden to a Benefit

Renewable Energy at UW Oshkosh

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UW Oshkosh Commitments

- Earth Charter (signed in 2002)
  - Principles
    - Primary: *Respect and Care for the Community of Life*
  - Supporting
    - (Safeguard) *Ecological Integrity*
    - (Promote) *Social and Economic Justice*
    - (Advance) *Democracy, Nonviolence and Peace*

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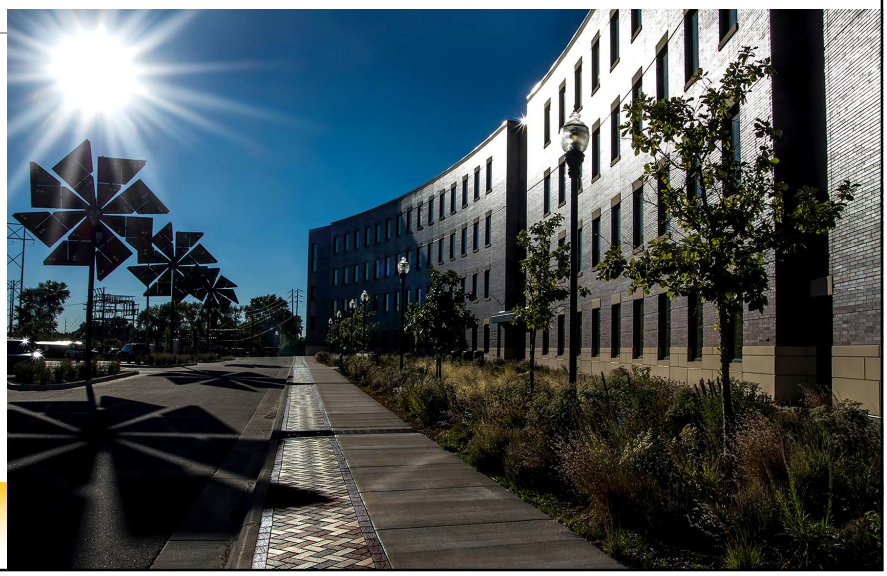
UW Oshkosh Leading by Example:

- American College & University Presidents Climate Commitment
  - Attain climate neutrality by mid-century or sooner
  - Steps to climate neutrality involve:
    - Use reductions through:
      - Efficiency (performance contracts, green building)
      - Behavior change
    - Renewable energy credits (~20%)
    - Onsite renewable energy (solar = 3% electric)
    - Carbon offsets

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Leadership in Energy & Environmental Design (LEED)

(At UWO: 3 certified, 1 in review, several in planning)



UW Oshkosh Biogas Systems

City – Dry Fermentation



Small Farm – Plug Flow



Large Farm – Complete Mix



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BD1: The First Commercial Scale Dry Fermentation System in the Nation!



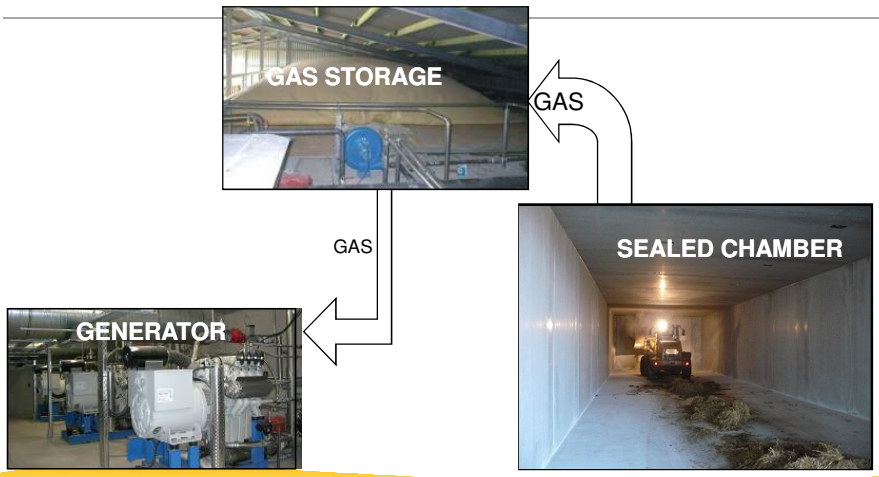
University of Wisconsin–Oshkosh Case Study: Biodigester 1

Dry Digester

- Processes 10,000 tons of food waste and yard waste from the community
- Produces 370 kW of continuous electrical power
- Waste water treatment plant collaboration
- Private/public collaboration

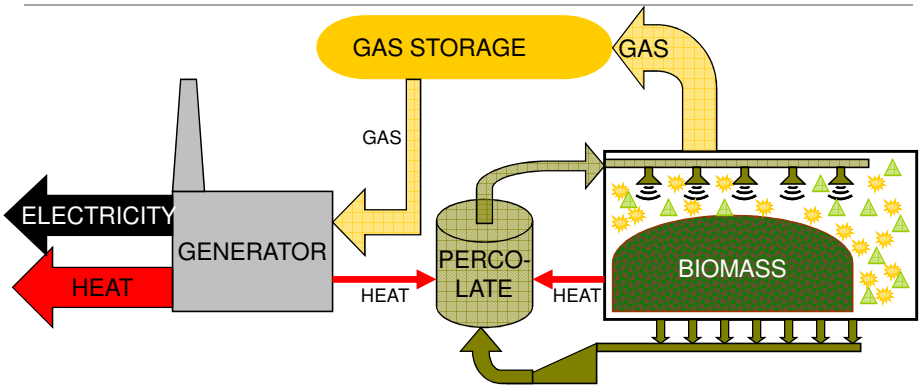


Dry System: 3 Basic Components



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Electricity and Heat are generated…



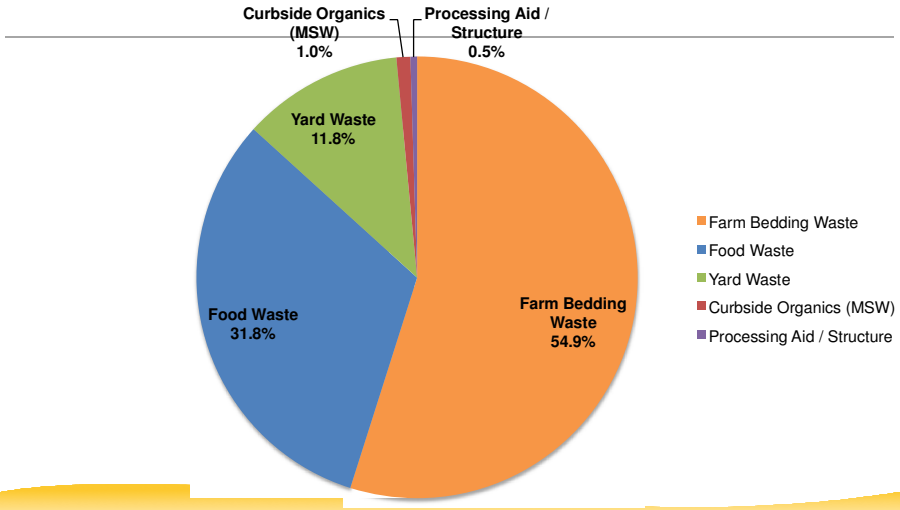
Solid "digestate" → aerobic composter site
(can be custom batched – e.g. organic)



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BD1 – Average Feedstock Totals



Annual Organic Material Processed = 10,000 tons per year

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Why Reduce Waste?

Paying to send food waste to the landfill is…… a waste!



- Environmentally sound practice
  - Methane is 75-100x more potent as a GHG than CO_2 over 20 years
- Cost
  - Potentially cost neutral
- Resource Opportunity
  - Use in generating renewable energy and heat
  - Creates education and PR opportunities
  - Extends landfill life-cycle

FOOD WASTE: WHAT IS USEABLE FOR FOOD STOCK

MAY CONTAIN:

- ✓ Leftover food, coffee grounds & tea bags
- ✓ Lightweight paper products (paper napkins, paper straw wrappers, etc.)
- ✓ Pizza boxes & other corrugated cardboard
- ✓ Limited Plastic must be BPI certified to be compostable





MAY NOT CONTAIN:

- **X – Excessive grease or bone waste**
- **X – Uncooked meat**
- **X – Paper with wax coating**
- **X – Plastic not BPI certified to be compostable**

WHAT MAKES SUCCESSFUL FOOD DIVERSION PROJECTS?

Successful projects have:

- ✓ Leadership & team buy-in
- ✓ Site specific plan
- ✓ Site champion(s)





- ✓ Training & follow-up review of site collections
- ✓ Simple & consistent collection system to minimize contamination

Organic Containers







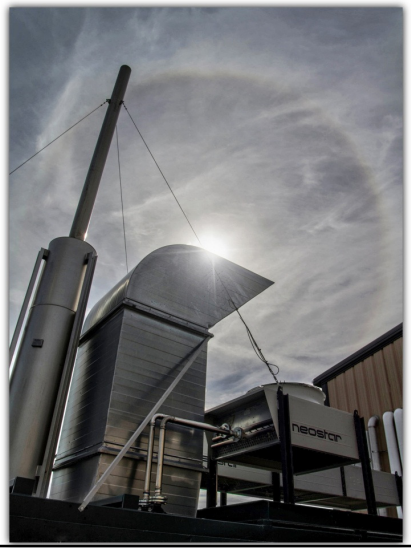
Sanimax
Reclaim·Renew·Return

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Fossil Fuels or Renewable Energy?

Be part of the transition!





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Next Steps

- Accurate Site Assessment
  - Tonnage
  - Current Infrastructure
  - Current hauling costs/contracts
- Cost Benefit Analysis
  - Financial

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Area Participants

- UW Oshkosh
- Walmart
- Rocky knoll-Plymouth Nursing home
- Piggly Wiggly-Lomira
- St Agnes Hospital-Fondulac
- Ripon Medical Center
- Waupan Memorial Hospital
- Xavier High School-Appleton
- Secura Insurance Company-Appleton
- Humana Insurance Company-Depere
- Festival Foods-Neenah
- Festival Foods-Oshkosh
- Wisconsin Resource Center-Winnebago
- UWGB
- Schreiber Cheese-Green Bay
- Bellin Memorial Hospital
- Piggly Wiggly – Beaver Dam
- Etc..

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Oshkosh Area School District Opportunities

- Proximity to BD1 & UW Oshkosh
- Pre-Consumer – two kitchens
- Post-Consumer – similar meal waste for H.S.
- OASD by the #s

	# days	# meals	# meals/yr	
5500 meals -district wide	180	5500	990,000	
1430 meals - at high schools	180	1430	257,400	
32lbs/student, 1200 h.s.students-38,400 lbs waste/year				19.2 Tons/yr
32lbs/student, 4300 district students-137,600 lbs waste/year				68.8 Tons/yr

UW Oshkosh Biogas Systems

City – Dry Fermentation



Small Farm – Plug Flow



Large Farm – Complete Mix



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Facility Type

	BD1	BD2	BD3
Location	City of Oshkosh	Rosendale Dairy	Allen Farm
Size/animal type	NA	9000 Cattle Dairy Farm	130 Cattle Dairy Farm
Feedstock	Manure – 45% Food Waste - 39% Yard Waste – 15% Curbside MSW – 1%	Manure	Solid Manure – 56% Wash Water – 24% Bedding – 13% Co-Substrates – 7%
Pre treatment	Mixing via Front-End Loader	Sand Separation	Mixing via Front-End Loader

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Digester System

	BD1	BD2	BD3
Technology	BioFerm - Dry	Schmack - COCCUS	Schmack - EUCOlino
System Type	Dry	Complete Mix	Plug Flow
Target Temp	Mesophilic	Mesophilic	Mesophilic
Target Internal Solids Content	25 – 35%	8 – 12%	10 – 15%
Target HRT	28 days	28 days	21 - 28 days
Tons per Year	10,000	110,000	4,000

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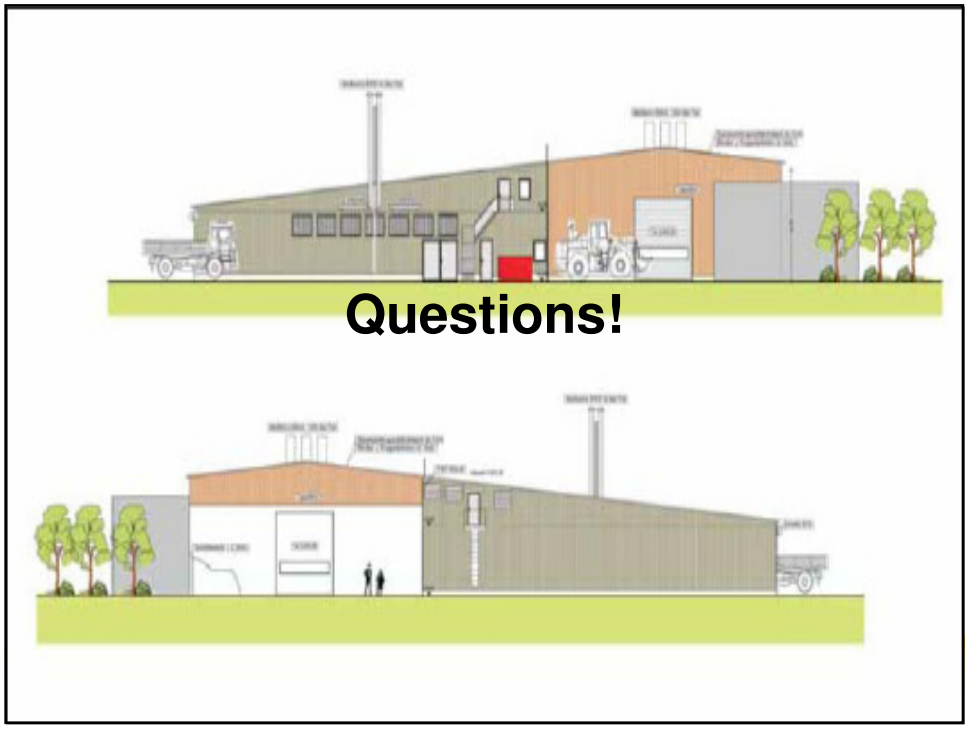
Biogas Use / Digestate Management

	BD1	BD2	BD3
CHP Size	370 kW	1426 kW	64 kW
Electric Use	Export – PPA (WPS)	Export – PPA (Alliant)	Export – PPA (WPS)
Revenue Blended Rate ($/kWh)	$0.08	$0.09	$0.08
Digestate End Use	Composted	Current – Separated Fiber Future – Further processing	Sent to Manure Pit
Digestate Value	Top Soil	Current – Farm Use Future – Bagged Fertilizer	Fertilizer – Farm Use

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Why AD for UW-Oshkosh?

- Sustainability Goals
- Education
- Research
- Revenue
- Scholarships
- Organic Diversion
- Partnerships


Questions!