The Wisconsin Biogas Survey

Moving Biogas Development *Forward* in Wisconsin

WISCONSIN SEO STATE ENERGY OFFICE

Clint Fandrich
BioEnergy Analyst

November 12, 2015 – 2015 Wisconsin Biogas Conference
Appleton, Wisconsin

Topic Outline

1. Why, What, Who, When, Where… How?
   A. Biogas Energy Overview
2. Major Findings of the Wisconsin Biogas Survey
   A. Setbacks and Challenges
      i. System Operational Challenges
      ii. Challenges to Biogas Industry Development
   B. Potential Solutions
      i. Components, Maintenance, and Training
      ii. Collaboration, Financing, and Research
3. Next Steps for Biogas Industry Development
   A. Biogas Industry Forums
   B. Education and Outreach
   C. Environmental and Economic Impact Analysis

Definitions:

CNG – Compressed Natural Gas, refers exclusively to transportation fuel

RNG – Renewable Natural Gas, refers to refined biogas that can be used interchangeably with conventional natural gas

Biogas – refers to the raw material produced by an anaerobic digester facility

Why did we do the Survey?

The survey was proposed in response to a request from a rural electric co-op in Wisconsin to investigate operational issues with on-farm digesters

How much biogas is being produced and how is it utilized?

SEO wanted to update anaerobic digester (AD) facility lists for all sectors

Also, SEO wanted to create a State-of-the-Industry evaluation for biogas in Wisconsin to assist:

- AD System Operators
- Local and State Policymakers

What format was the survey?

A 4-5-page questionnaire:

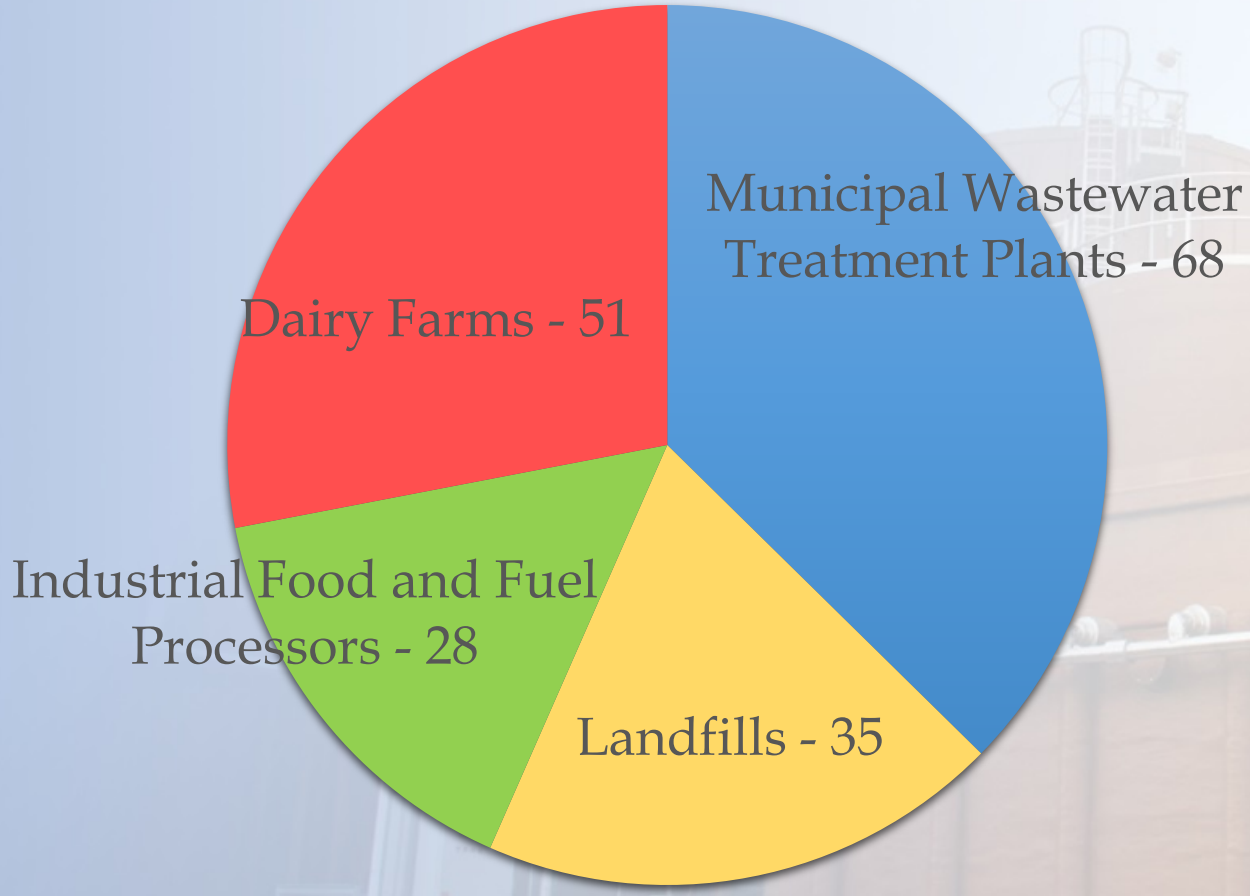
- How much biogas is produced, how is it utilized, what utility do you work with
- Questions about Maintenance and System Operations
- Feedstocks and Organic Waste Logistics and Management
- AD System Co-products
  - Concerns about animal bedding
- Biogas Policy

Answers to these questions were then inserted into a database by question to identify common responses or sector trends

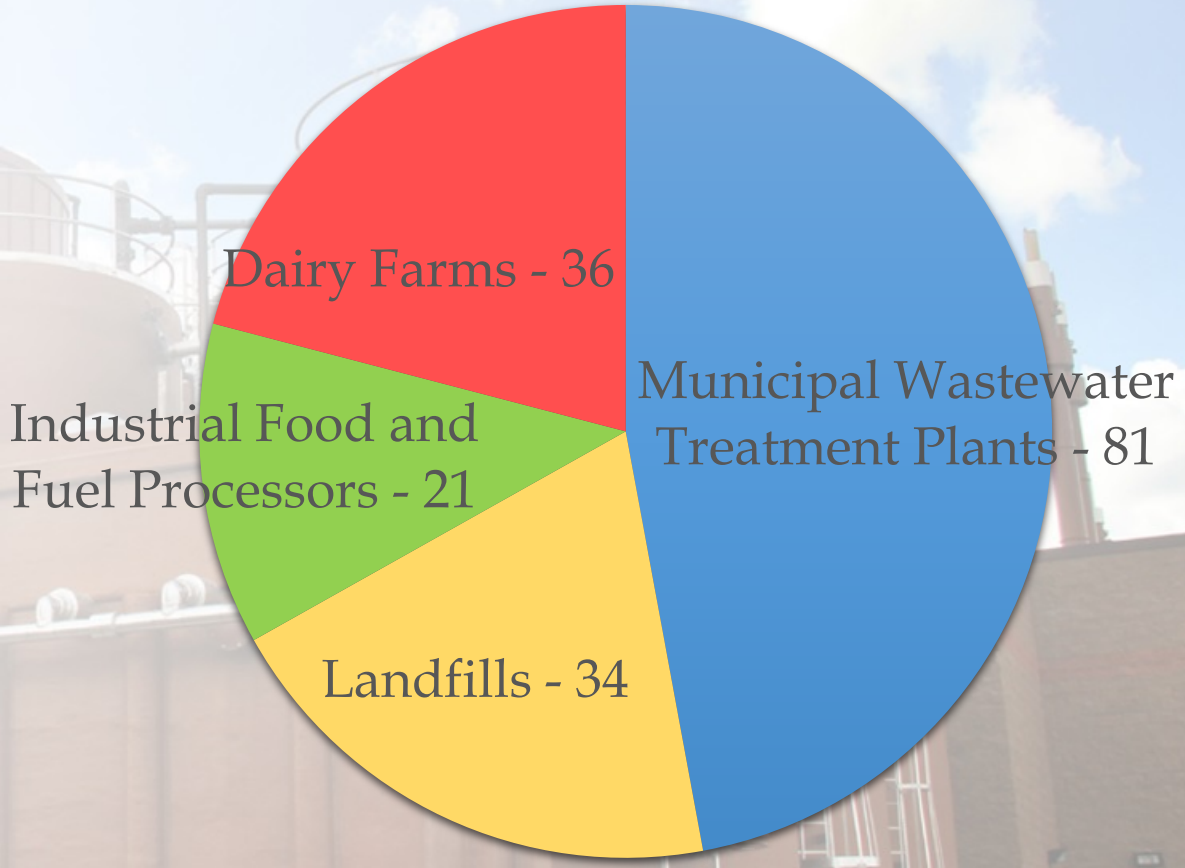
Most surveys were completed over the phone, but some were in-person or through email

Who did we survey?

Surveys Conducted



Biogas Facilities



When was the survey done?

Municipal Wastewater Treatment Plants
- September 19, 2014 – November 26, 2014

Landfill Biogas Facilities
- October 14, 2014 – December 2, 2014

Industrial Food and Fuel Producers
- December 8, 2014 – March 23, 2015

Dairy Farms
- December 10, 2014 – March 19, 2015

Follow-up analysis and reporting are ongoing, there is so much to 'digest'!

How was the survey done?

Sector	Phone Survey	In-Person Survey	Electronic Survey	Partial or Informal responses
Municipal Wastewater Treatment Plants	45	18	0	20
Landfills	17	1	0	24
Industries	16	6	0	9
Agriculture	35	7	1	21
Totals	113	32	1	74
	Total Complete Surveys: 146			

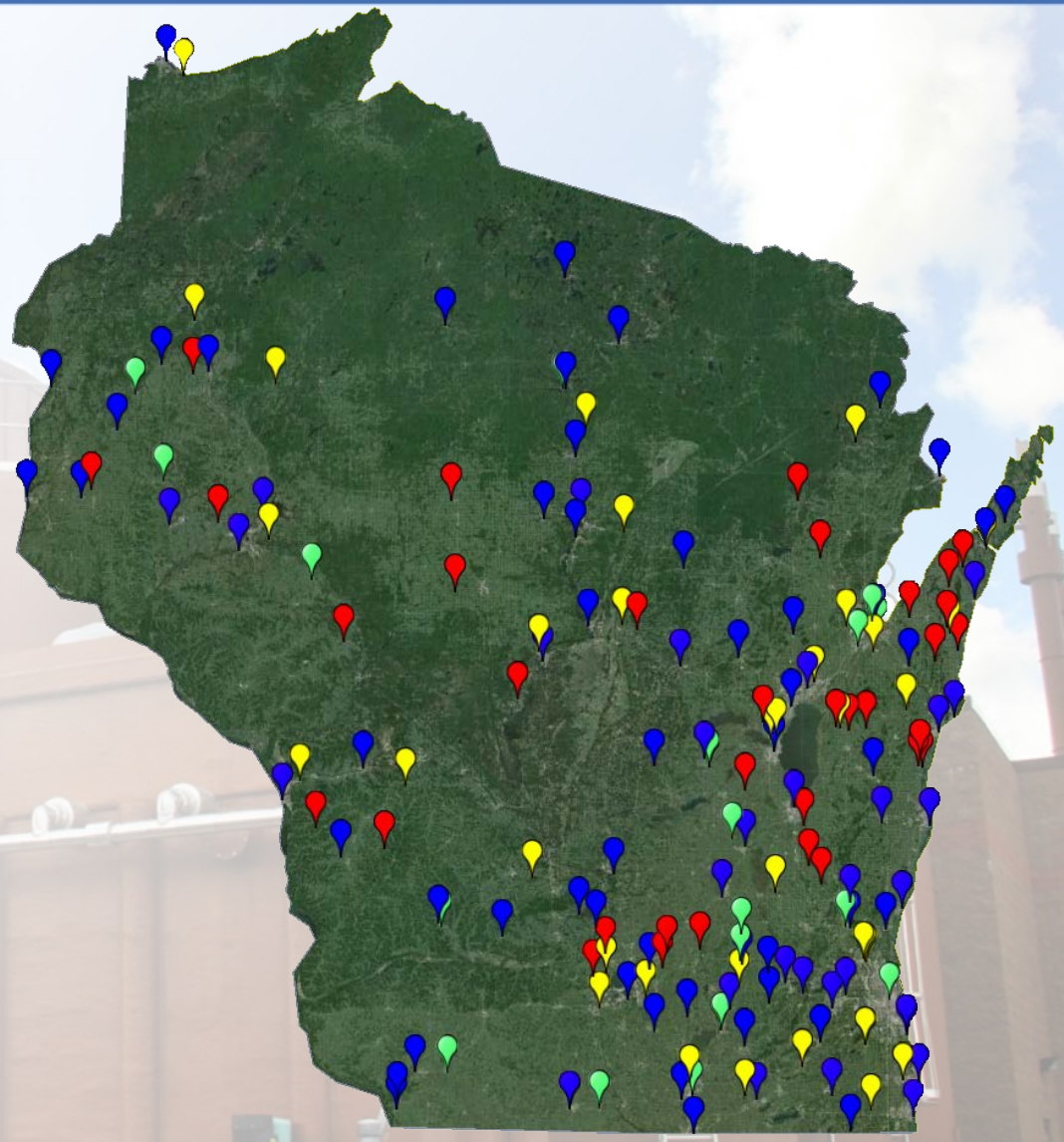
Most surveys were conducted over the phone, but many respondents offered or were open to on-site visits

Where are the facilities in WI?

Most biogas facilities are located in or near urban centers of the state, around Milwaukee, Madison, and Green Bay

This is particularly true of Wastewater and Industrial plants

Dairy farm systems are spread over a central band across Wisconsin, but in higher densities near Lake Michigan

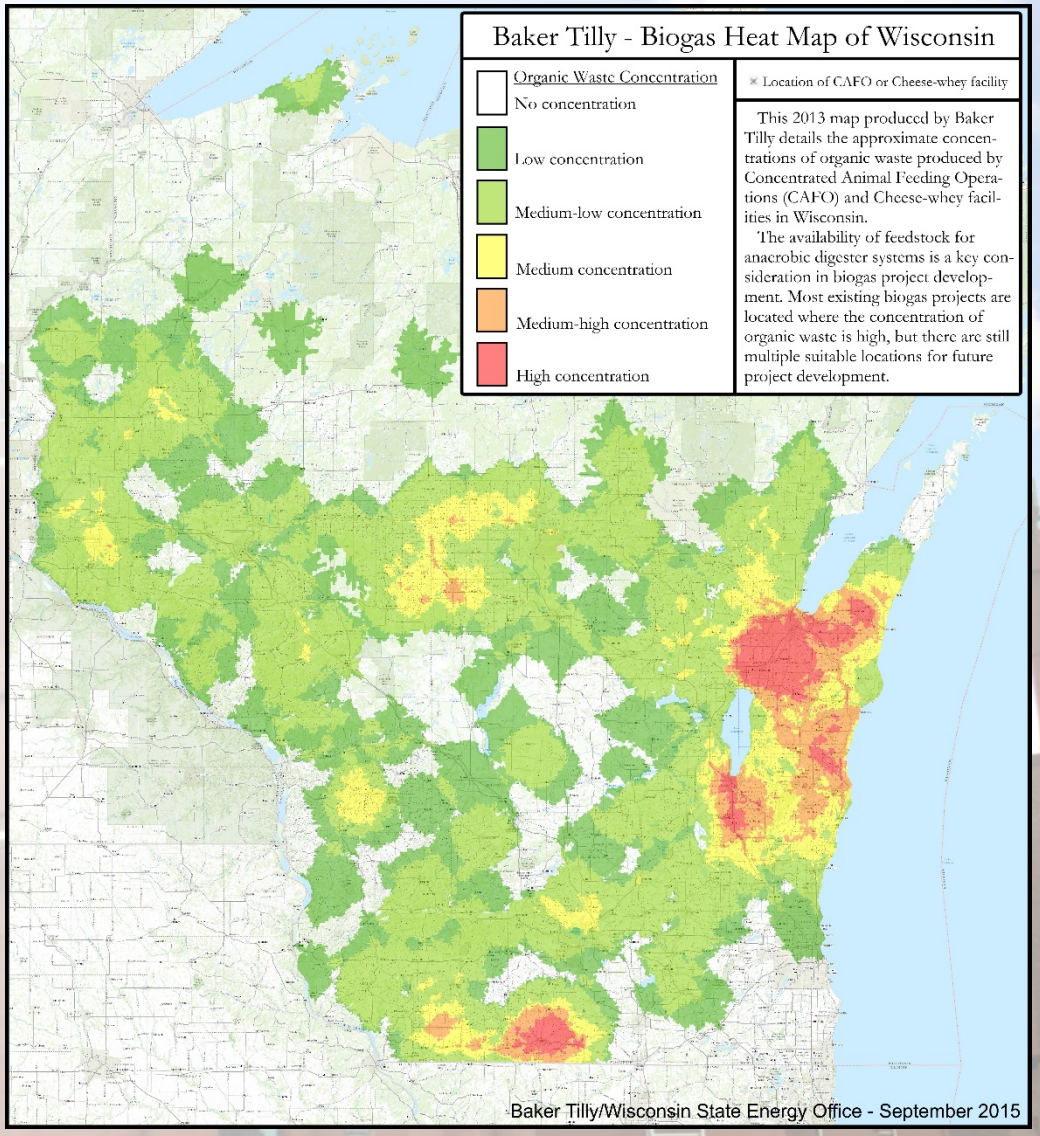


Where is the feedstock?

Map of dairy industry and large farm (CAFO) organic waste provided through a 2013 study by Baker Tilly

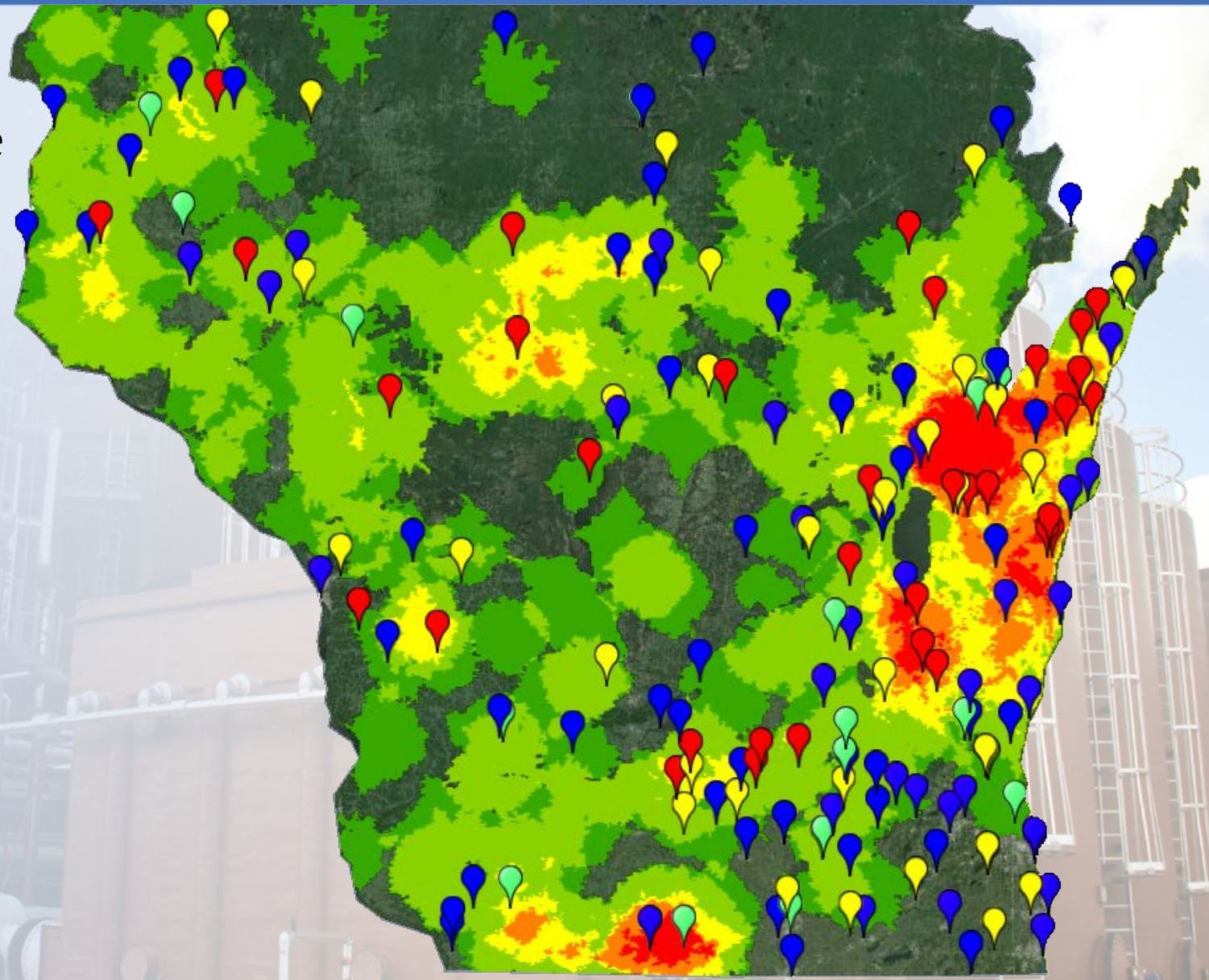
Again, these resources are concentrated around urban centers in eastern Wisconsin, with the notable exceptions of Monroe and Marshfield

But when you combine the data…



AD Facilities and Feedstock

An overlay of the two maps shows that while many AD facilities in the state are well-positioned geographically, there are still some gaps available for future development



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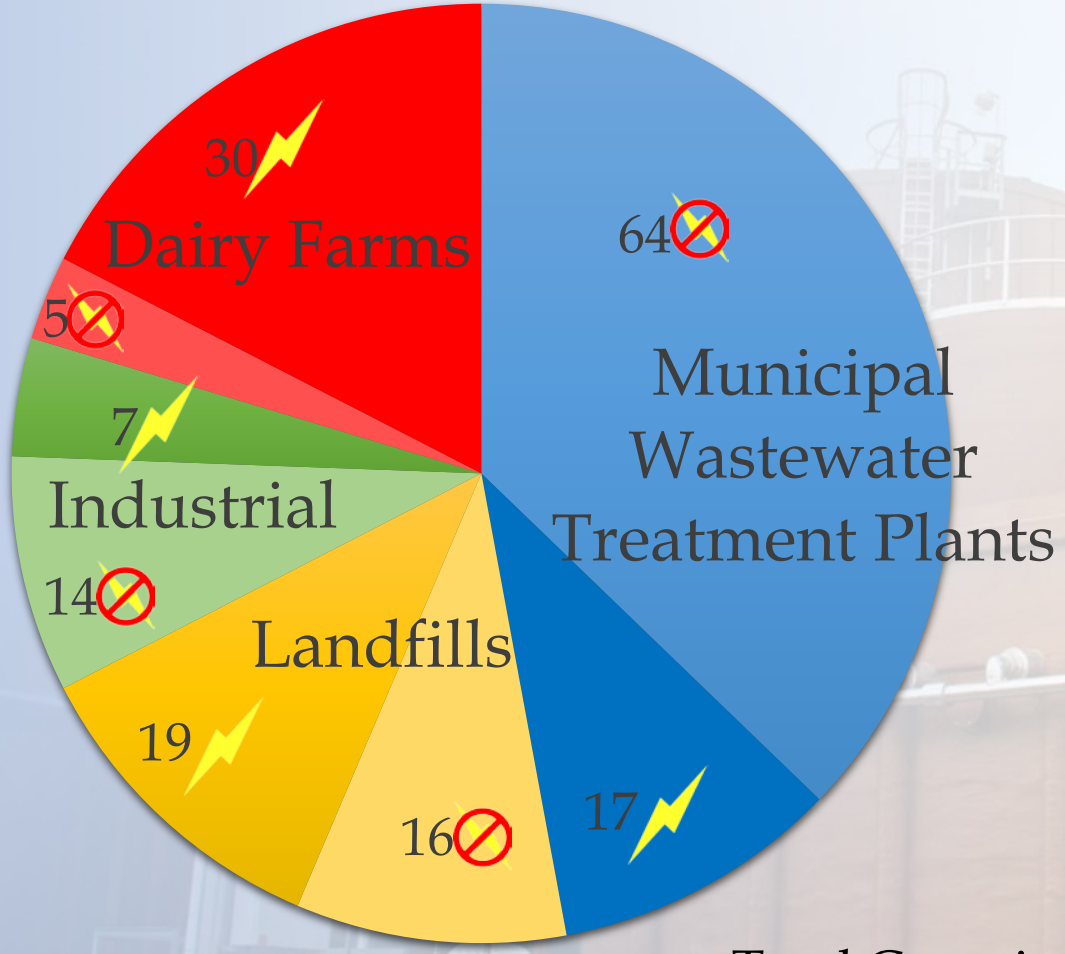
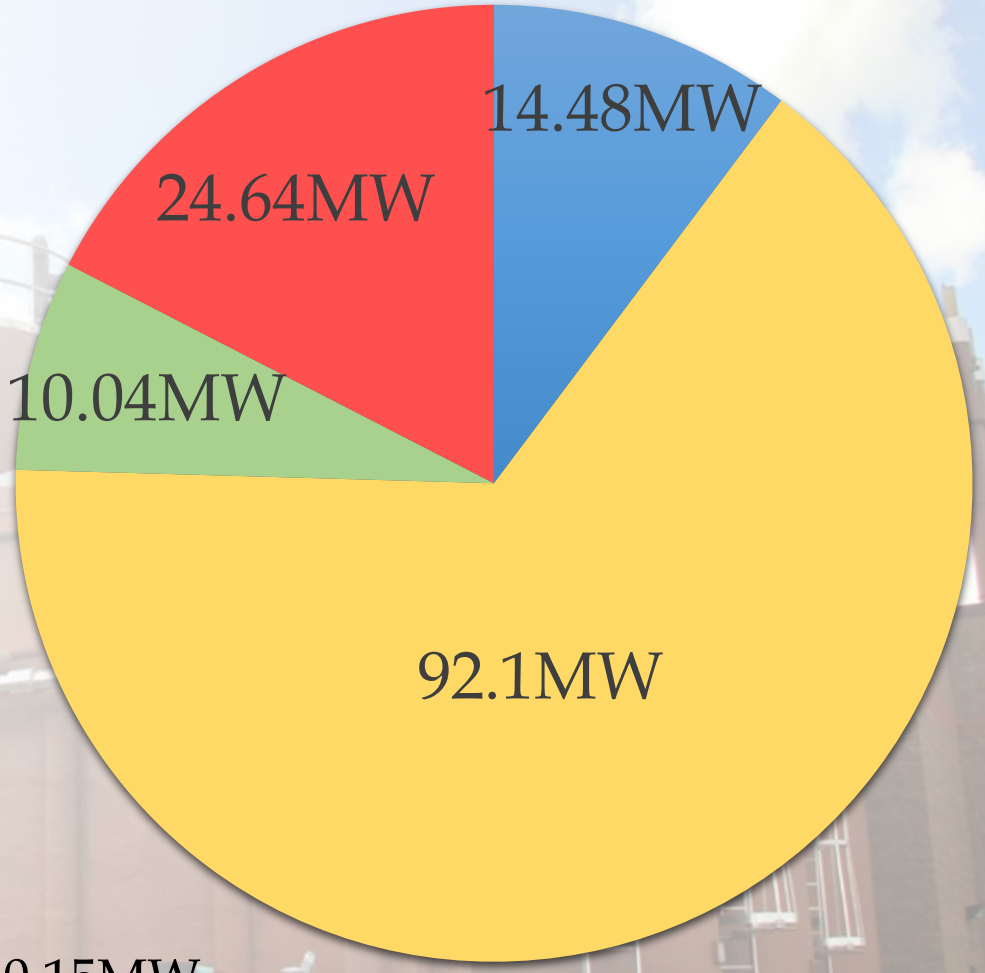
Wisconsin Biogas Energy

Electricity Production by facility:



Electricity Capacity by sector:



Total Capacity: 140.15MW

Wisconsin Biogas Energy

Compressed Natural Gas Production:

COUNTY of DANE WISCONSIN 1839

CITY OF JANESVILLE

Wisconsin Biogas Energy

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Compressed Natural Gas Production:

Sector	CNG for Municipal/Internal Fleet	Interest in CNG Development
Municipal Wastewater Treatment Plants	1	5
Landfills	1	6
Industry	0	4
Agriculture	0	7

Wisconsin Biogas Energy

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Heat Production and Combined Heat and Power (CHP):

Sector	Heat produced with electricity (CHP)	Heat Only	Heat produced with NG backup
Municipal Wastewater Treatment Plants	8	43	32
Landfills	8	0	N/A
Industry	4	7	0
Agriculture	26	3	1

Wisconsin Biogas Energy

Renewable Natural Gas (RNG) Production:

- Production of pipeline quality RNG by AD systems in Wisconsin is primarily restricted by the low market price of natural gas.

- Some facilities have engaged in pipeline RNG production in recent years, but no facility is currently engaged in this activity.

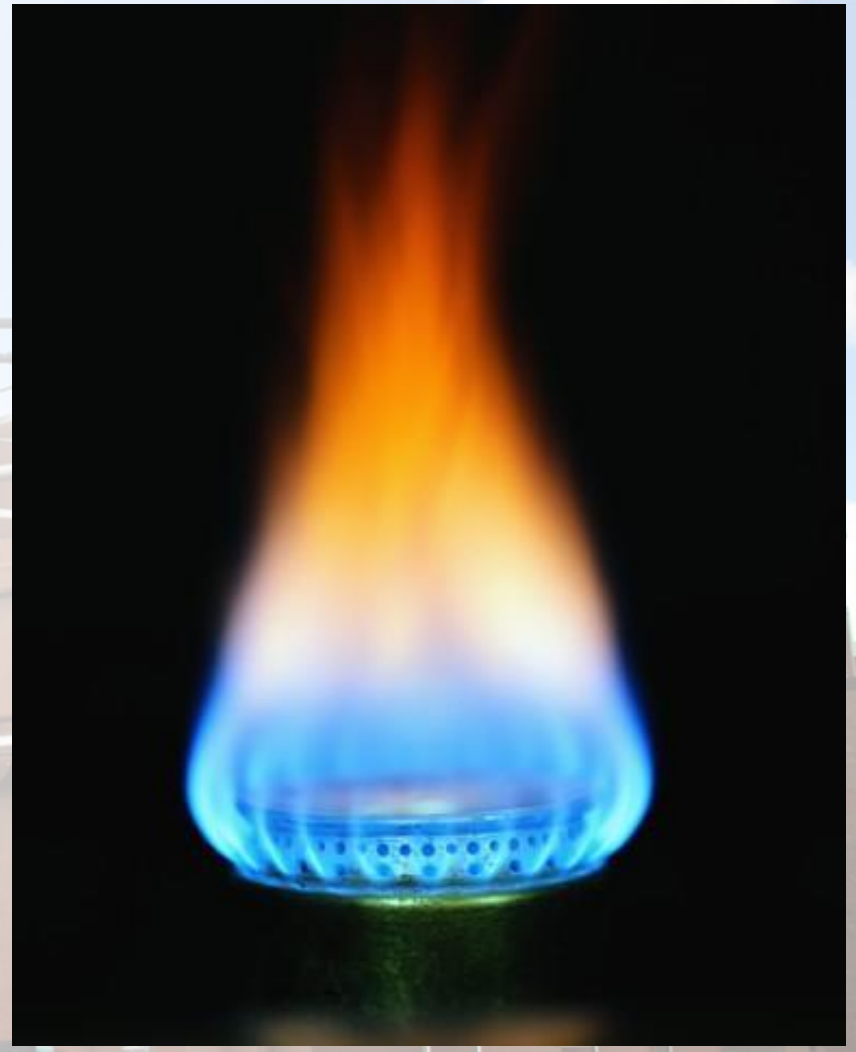

Photo Credit: Public Service Commission of Wisconsin

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Major Findings of the Survey

Setbacks and Challenges:

- Managing Foaming and Complex Digestate Chemistry
- Electricity Generation Equipment Endurance
- Project and Operational Financing
- PPAs and Interconnection
- Other Non-Financial Barriers

Potential Solutions:

- Pre-Mixing and Feedstock Storage Tanks
- Biogas Scrubbing and Improved Contaminant Removal
- Advanced Training
- Diversification of Ownership Models
- Information Sharing and Annual Conference
- Excite Biogas Research and Development

Setbacks and Challenges

System Operational Challenges:

Managing Foaming and Complex Digestate Chemistry

- Many operators spoke about **extended acclamation periods** to learn how a system was going to react to certain feedstock inputs. This is time and resource consuming!
- There are still some unknowns about **co-digesting certain feedstocks**. This is important as 49 AD facilities are processing two or more waste stream types.
- Foaming occurrences span the biogas industry, but certain sectors were more prone to challenges because of:
  - Inconsistent feeding
  - Lacking pre-testing of influent
  - Insufficient digester mixing

Photo Credit: Wisconsin State Energy Office

Setbacks and Challenges

System Operational Challenges:
Electricity Generation Equipment Endurance

- A key motivator of the survey
- Many projects were developed to streamline costs, often **excluding biogas scrubbing components or under sizing the equipment**
- Lacking **choices for genset sales and service**
  - Long wait times for service = long downtime and lost revenue!
- **Insufficient resources, time, and/or expertise** allocated to generator equipment maintenance and upkeep

Setbacks and Challenges

Challenges to Biogas Industry Development:
Project and Operational Financing

- Many banks are unwilling to provide favorable **loans for new projects**
- Recent funding programs for AD systems have been limited by overall **program caps or problematic eligibility requirements**
- No significant effort- from local, state, or federal governments- in **infrastructure spending for municipal facilities** had been undertaken since the 1970s with the Clean Water Act

Setbacks and Challenges

Challenges to Biogas Industry Development:
Power Purchase Agreements (PPA) and Utility Interconnection

- Having satisfied Wisconsin's **Renewable Portfolio Standard** (RPS) for 2015, power companies are no longer offering suitable PPAs for new projects or for expiring agreements at existing facilities
- **Interconnection requirements** established by different power companies can vary dramatically leading to difficulties with biogas project development in certain utility service territories
  - Lacking flexibility when choosing interconnection technology
    - (Radio Transmitters vs Fiber- optics)

Photo Credit: Wisconsin State Energy Office

Setbacks and Challenges

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Challenges to Biogas Industry Development:
Other Non-Financial Barriers

- **Unevenly applied regulations** controlling phosphorus, formaldehyde, and other air and water emissions are hampering biogas system development
- **Lacking collaboration and information sharing** in the biogas industry about tipping fees, operational best practices, strategic maintenance, shared costs, etc.
- **Unclear energy policy in Wisconsin and the United States** concerning biogas and renewable energy in general
- **Inadequate local and state government engagement** with the biogas industry
  - What about **education and outreach** to local communities?!
- **Aggressive, unfavorable press** exposing the challenges and not the successes

Potential Solutions

Pre-Mixing and Feedstock Storage Tanks:

Pre-mixing tanks allow operators to **precisely formulate a digestate recipe** for anaerobic bacteria

- Provides an opportunity for **pre-testing the influent** to avoid introducing harmful materials that can damage digester biology

Feedstock storage allows operators to **store substrates to be used during times when they may not be available**; holidays, weekends, unexpected shutdowns, etc.

- Allows operators to **feed a digester more consistently and avoid upsets**

Photo Credit: Wisconsin State Energy Office

Potential Solutions

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Biogas Scrubbing and Improved Contaminant Removal:

Proper capacity and contaminant targeting for biogas scrubbing components

- Not all biogas is created equal – Siloxanes, moisture, H_2S, etc.
- A common response from the survey: **"equal expense for electricity generators and biogas scrubbing systems"**
- More than one system may be necessary to polish the gas to protect equipment

Improving generator performance includes implementing a **more robust maintenance schedule**

- Streamlining and developing biogas engine sales and service in Wisconsin
- Allocating and managing expertise…

Potential Solutions

Advanced Training:

Photo Credit: Wisconsin State Energy Office

Some biogas industry sectors emphasize **standardized training and experience fewer technical challenges**

- Covers operational setbacks from digestate chemistry to equipment repair
- **Current standards for AD operations may need an update!**

New research and training to **address unknowns about co-digestion**

- 49 facilities in Wisconsin co-digest multiple feedstock types
- Other respondents were interested in co-digestion or adamantly avoid it

Shared training resources and expertise…

Potential Solutions

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Diversification of Ownership Models:

Community Digesters and Regional Resource Recovery Centers

- To reach shared organic waste management goals (input management)
- Better utilize biogas resources (output management)
- Share costs of operation, maintenance, and training
- Achieve economies of scale for project development

Utility Ownership of Power Generation

Third-Party Operators

- Free up farm/factory staff
- Highly trained operators dedicated to the AD system

Potential Solutions

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Information Sharing and Annual Conference:

Greater transparency between biogas industry sectors could be useful to:

- Assist project developers to choose **components for similar AD applications**
- Present opportunities for **cross-training**
- More **efficiently utilize available feedstocks and substrates**

Greater collaboration could allow the biogas industry to:

- **Organize outreach and lobbying efforts** on behalf of the industry in Wisconsin
- **Share costs** of project development and operation

Forums for the Wisconsin Biogas Industry

- The State Energy Office, WWOA, UW-Oshkosh and Marquette, etc.

Potential Solutions

Excite Biogas Research and Development:

Potential for improved interaction with universities

- UW-Oshkosh has made significant progress with AD research and operation
- UW-Madison is looking at small-scale AD applications in US and abroad
- Marquette and Dr. Zitomer hold regular trainings and process improvement seminars

Development of new technologies

- Feedstock refining, such as cell licing
- Phosphorus management systems
- Rapid digestate testing equipment and techniques
- Effluent co-products for revenue generation

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Next Steps

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Biogas Industry Forums:

INTERNATIONAL BIOMASS CONFERENCE & EXPO
a BBI International event
April 11-14, 2016
Charlotte Convention Center
Charlotte, North Carolina

Tuesday, October 6th - Friday, October 9th, 2015
Kalahari Resort - Wisconsin Dells, WI

WWOA
WISCONSIN WASTEWATER OPERATORS' ASSOCIATION

American biogas Council

BIOCYCLE 15TH ANNUAL CONFERENCE
REFOR15
RENEWABLE ENERGY FROM ORGANICS RECYCLING

Next Steps

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Education and Outreach:

There is an enormous opportunity to involve communities around Wisconsin in the development of the biogas industry

- Biogas projects in the state have stalled due to lacking information about biogas
- Many faces light up when presented with a way to produce energy from waste

For future development, key policymakers at all levels of government should be well-informed about the role and potential of biogas in Wisconsin

- This can be achieved through biogas industry coordination through associations and through 1-on-1 exchanges with local leaders
- Biogas presents opportunities to create jobs and foster economic activity
- Specific policy prescriptions – RPS, financial assistance, to act as a conduit between biogas owners and electric/natural gas utilities, etc.

Next Steps

Environmental and Economic Impact Analysis:

What are the actual benefits of biogas systems in Wisconsin?

- Air and water quality
- Jobs and economic activity
- Reduced waste disposal costs for local governments and businesses

What other sectors of Wisconsin's economy are affected by the biogas industry?

- Tourism
- Electric/Natural Gas Utilities
- Municipal Governments
- Transportation
- ?????

Photo Credit: Clint Fandrich

Thank you!

Clint Fandrich

Clinton.Fandrich@Wisconsin.gov

(608) 267-7854

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