

# MDEQ Observations on Sustainability

## Municipal Wastewater Recycling in Michigan – How can we measure?

Presented by

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**MWEA Sustainable Energy Seminar**

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# Michigan Recycling Program



[http://www.michigan.gov/deq/0,4561,7-135-70153\\_69695-313206--,00.html](http://www.michigan.gov/deq/0,4561,7-135-70153_69695-313206--,00.html)

# THERE ARE SIMILARITIES AND SYNERGIES BETWEEN LANDFILLS AND WASTEWATER TREATMENT PLANTS

## Solid Waste

- Build it / Use it / Close it
- Relies on haulers bringing waste to the landfill
- Generates biogas
- Recycling used to extend life



Bing Maps [www.bing.com](http://www.bing.com)

## Wastewater Treatment

- Build it / Use it / Renovate
- Steady & predictable source of waste
- Potential to generate biogas
- Recycling beneficially uses nutrients, organics, and moisture



Bing Maps [www.bing.com](http://www.bing.com)

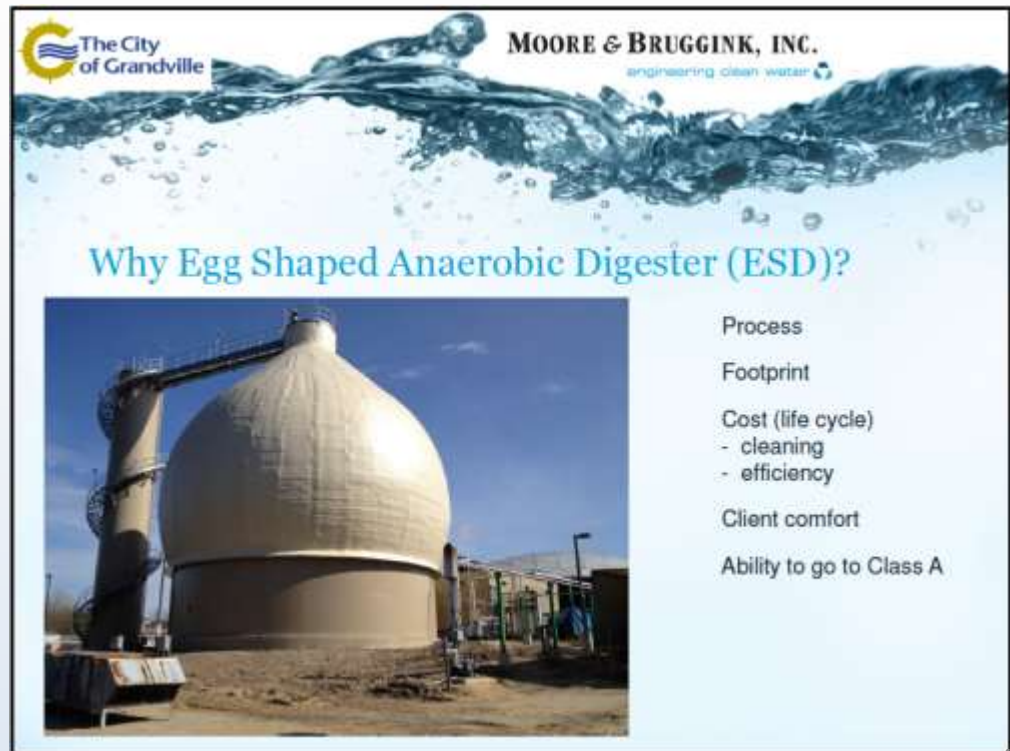
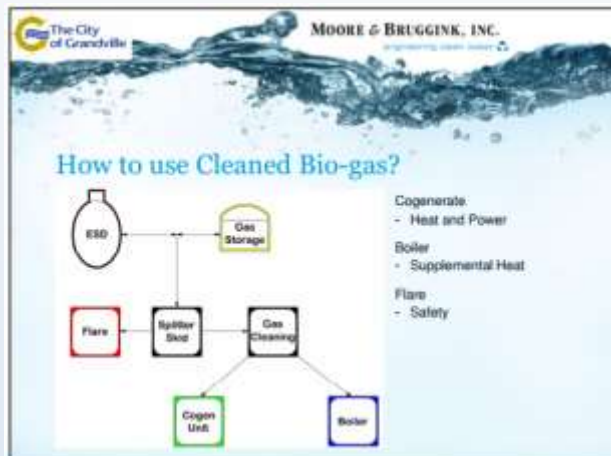
# Recycling in Michigan ....



[http://www.michigan.gov/images/DVD\\_cover\\_w\\_motto\\_127834\\_7.GIF](http://www.michigan.gov/images/DVD_cover_w_motto_127834_7.GIF)



[http://www.gvrba.org/sites/default/files/Logo1\\_1.png](http://www.gvrba.org/sites/default/files/Logo1_1.png)

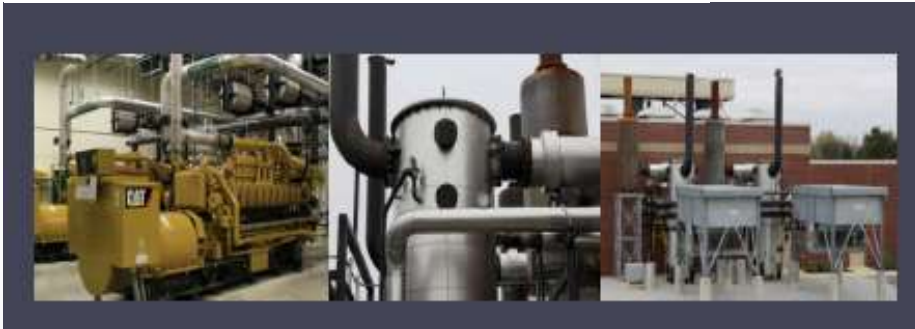


<http://www.mi-wea.org/docs/Hannon%20-%20Grandville%20Digester.pdf>

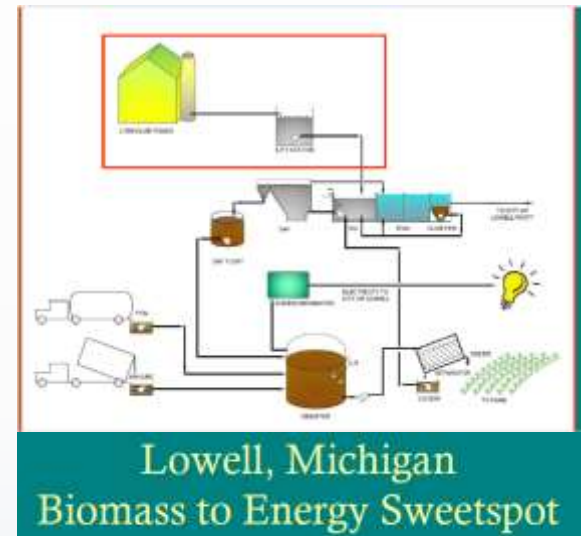


# Recycling in Michigan ....

## City of Midland, Michigan Combined Gas to Energy Facility



[http://www3.epa.gov/lmop/documents/pdfs/conf/15th/06Tholo\\_Final.pdf](http://www3.epa.gov/lmop/documents/pdfs/conf/15th/06Tholo_Final.pdf)



[http://www.mi-wea.org/docs/Williams-Lowell\\_Biomass\\_to\\_Energy.pdf](http://www.mi-wea.org/docs/Williams-Lowell_Biomass_to_Energy.pdf)

## *Green heat recovery system cuts heating bills at MI wastewater treatment plant*

COMMERCE TOWNSHIP, MI, Sept. 3, 2014 – A new green heat recovery system recently installed at the wastewater treatment plant (WWTP) in

[www.waterworld.com/articles/2014/09/new-green-heat-recovery-system-eliminates-heating-bills-at-commerce-township-wastewater-treatment-plant.html](http://www.waterworld.com/articles/2014/09/new-green-heat-recovery-system-eliminates-heating-bills-at-commerce-township-wastewater-treatment-plant.html)

# How can we measure?

August 2015 – MDEQ / MWEA quarterly meeting

Bill Creal discussed Governor's goals for recycling

That the same could be applied to WWTPs

List of metrics offered to MWEA for review

# Please Note ....

- The numbers presented today are order of magnitude estimates
- Need some idea as to where we are to know where to go
- The values will change as information is collected and methods of analysis are refined
- Assumptions used to generate the initial estimates are listed and are important to note



# Solids

- Consolidate statewide biosolids annual report form information
- Annual report includes accounting of biosolids generated, land applied, and disposed of by other means
- Determine what % of total biosolids generated were land applied or processed for other reuse applications (e.g. Detroit BDF project, compost, etc.)



<http://www.wilx.com/home/headlines/Authority-Honored-for-Cleaning-Up-Michigan-Landfills-204018441.html>

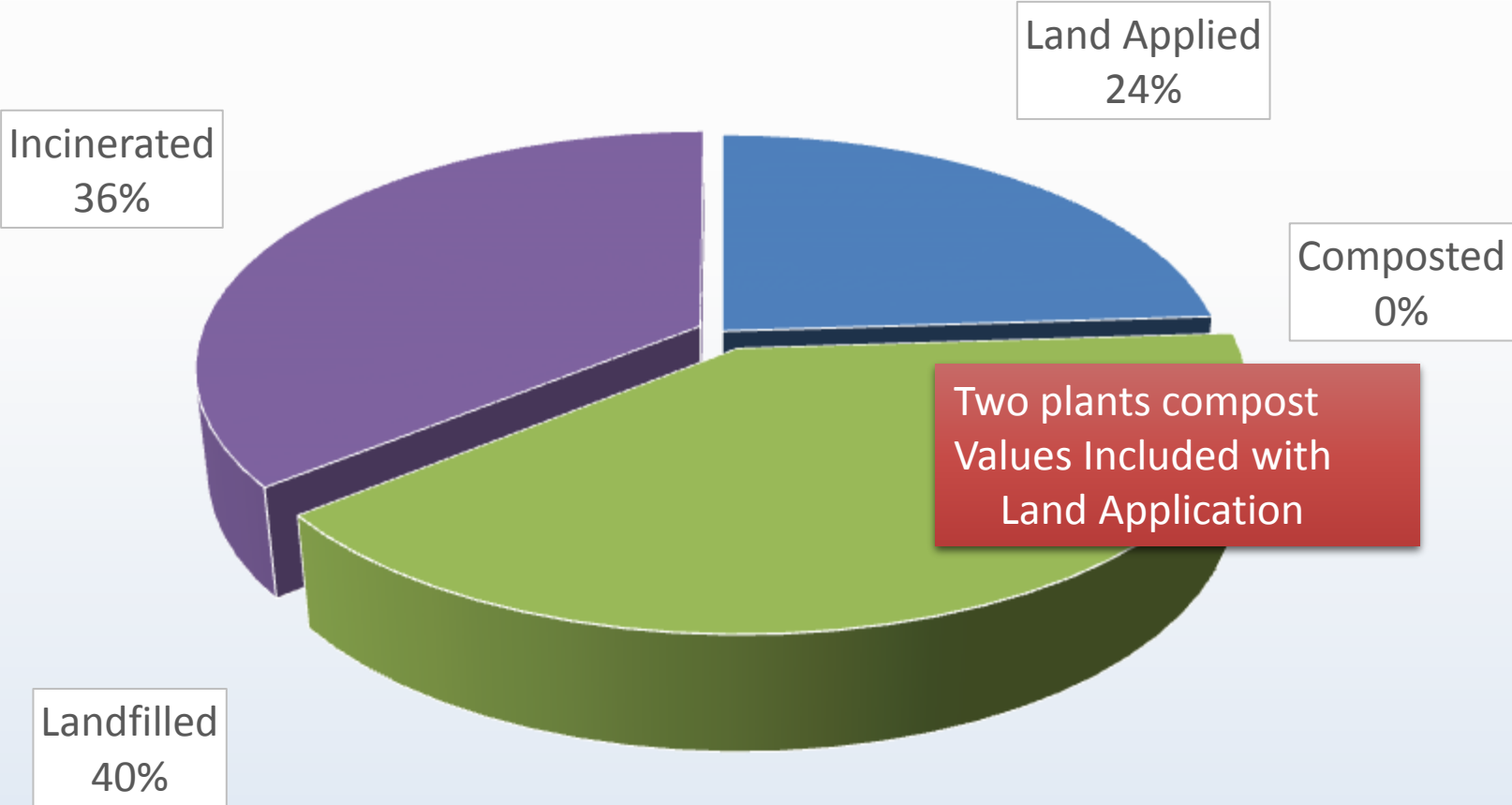


<http://tecalive.mtu.edu/meec/module21/Cost-WW.htm>





# Wastewater Solids Handling Techniques



# WW Recycling Estimates – Solids

## 2014 Est. of Biosolids Recycling

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### Given:

Total Biosolids Land Applied =	80,897 dry tons/year
Total Biosolids Composted =	- dry tons/year
Total Solids Landfilled =	135,622 dry tons/year
Total Solids Incinerated =	<u>120,995 dry tons/year</u>
Total Solids Disposed =	337,514 dry tons/year

### Assumptions:

Percent of solids generated via treatment process = 90%

### First Estimate (Order of Magnitude):

Total Biosolids Recycled =	80,897 dry tons/year
2014 Est. % Biosolids Recycled =	22%

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# Phosphorus, Nitrogen

- Determine nutrient load to municipal WWTPs
  - ✓ DMR (actual)
  - ✓ Basis of design (estimated)
- Determine nutrient load to receiving water
  - ✓ DMR (actual)
  - ✓ Permit limit (estimated)
- Determine the % of nutrients captured in solids
  - ✓ Estimate % of nutrients land applied or processed for other reuse applications (e.g. Detroit BDF project, compost, etc.)

# WW Recycling Estimates – Nutrients

Est. of Municipal WWTP Surface Water Discharges and  
Nutrient Loadings

## Given:

DWSD discharge	600 MGD
DWSD as a % of municipal surface water discharge in the state	approx. 50%

## Assumptions:

Influent TKN (est.)	25 mg/L
Influent P (est.)	5 mg/L

## First Estimate (Order of Magnitude):

Est. Annual Muni WWTP Surface Water Discharge =	438,000 MGY
Est. Annual Muni WWTP Nitrogen loading =	91,323,000 lbs/yr
Est. Annual Muni WWTP Phosphorus loading =	18,264,600 lbs/yr

# WW Recycling Estimates – Nutrients

## Nutrient Recycling Rate Estimates – 2014 / 2016

<u>Given:</u>			
2014 Biosolids data:	dt/yr	80,897	Statewide Land App
DWSD BDF average capacity of	dt/day	315	Sept. 2015
From 2014 Data (statewide averages):			
Nitrogen (N, % of TS)		3.8%	
Phosphorus (TP, % of TS)		1.9%	
<u>Assumptions:</u>			
Percent removal of solids via treatment process =		90%	



# WW Recycling Estimates – Nutrients

## Nutrient Recycling Rate Estimates – 2014 / 2016

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<u>First Estimate (Order of Magnitude):</u>		<u>Current</u>	
		2014	
Annual Biosolids Land Applied (2014) =	dt/yr	80897	
Est. Annual Nitrogen Land Applied =	dt/yr	3074	
Est. Annual Phosphorus Land Applied =	dt/yr	1537	
Est. Annual Nitrogen Recycled =		6%	
Est. Annual Phosphorus Recycled =		15%	

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# WW Recycling Estimates – Nutrients

## Nutrient Recycling Rate Estimates – 2014 / 2016

<u>First Estimate (Order of Magnitude):</u>		<u>Current</u>	<u>w/DWSD BDF</u>
		2014	2016
Annual Biosolids Land Applied (2014) =	dt/yr	80897	195872
Est. Annual Nitrogen Land Applied =	dt/yr	3074	7443
Est. Annual Phosphorus Land Applied =	dt/yr	1537	3722
Est. Annual Nitrogen Recycled =		6%	15%
Est. Annual Phosphorus Recycled =		15%	37%

# Energy

- Identify facilities that currently recover digester gas for energy
  - Determine what % of energy used for unit process is recovered (e.g. natural gas consumption versus recovered digester gas used)
- Determine if other energy reuse activities exist in Michigan
  - Heat exchangers?
  - Wastewater source heat pumps?
- Potential Sources of Information
  - NPDES compliance staff poll municipal WWTPs
  - MWEA poll of members

# Michigan WWTPs with Anaerobic Digesters

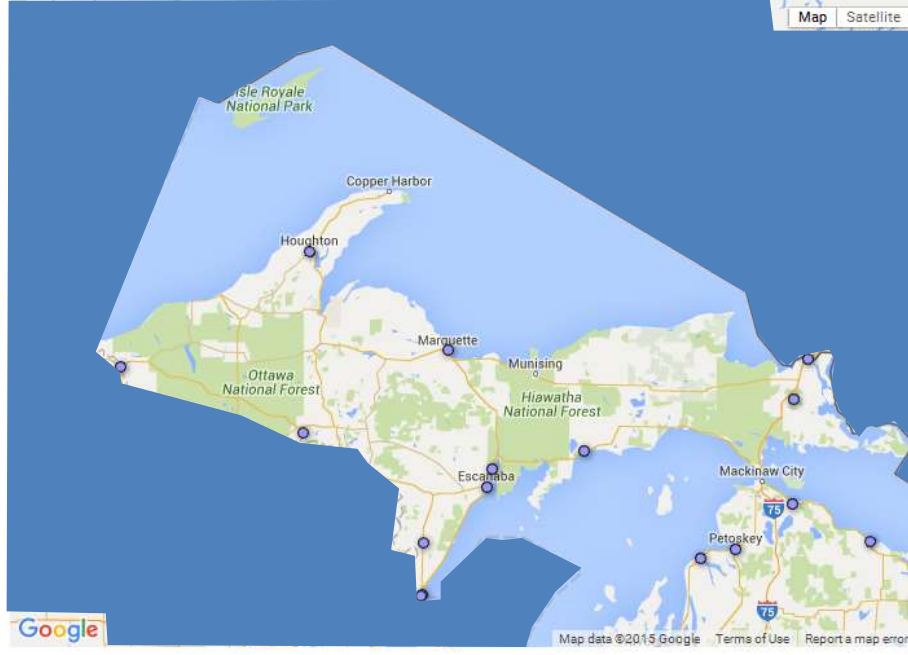
## Operational Biogas Systems in the U.S.

### Display/Hide Feedstock Maps

TIP: Select a *single* feedstock for detailed information on each site.

Agriculture  Landfill  Wastewater

Wastewater [\[view full screen\]](#)



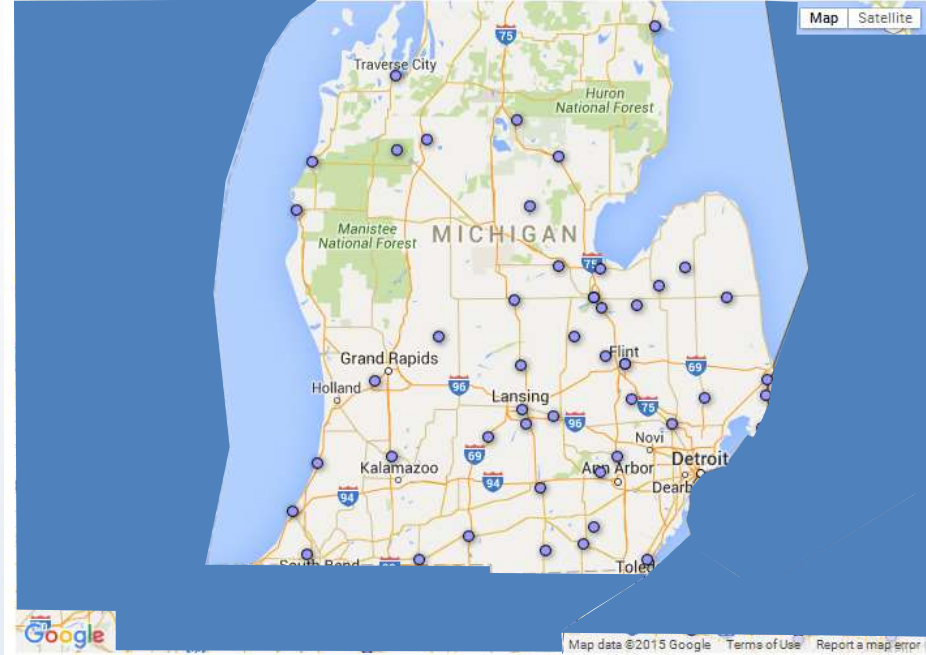
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Wastewater [\[view full screen\]](#)



[http://www.americanbiogascouncil.org/biogas\\_maps.asp](http://www.americanbiogascouncil.org/biogas_maps.asp)

# Biogas Utilization

## Biogas Partnership



## Database of WWTPs with Anaerobic Digesters

[http://www.americanbiogascouncil.org/biogas\\_maps.asp](http://www.americanbiogascouncil.org/biogas_maps.asp)

- 65 WWTPs in Michigan have anaerobic digestion
- 40 plants report using the biogas
- 12 plants report using digester gas to produce power
- Represents about 150 MGD of wastewater treatment



# WW Recycling Estimates – Energy

## 2014 Est. of Energy Consumption

<u>Assumptions:</u>		Unit	Note
Average Energy Intensity of Michigan WWTPs	2,300	kWh/MG	(1)
<u>Given:</u>			
No. of permitted municipal MI WWTPs	380		(2)
Average Daily flow of all municipal WWTPs	1,200	MGD	(3)
<u>First Estimate (Order of Magnitude):</u>			
Order of Magnitude Estimated	1,007,400,000	kWh/year	
	\$70,500,000	per year	(4)
<u>Reduction:</u>			
To be determined			

Notes: (1) Estimated average; (2) EPA ECHO database; (3) See nutrients calcs; (4) \$0.07 per kWh blended

# Current status

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- MWEA Members provided feedback on the metrics
  - Solids, energy, and nutrients are can do / go do items
  - A number of other metrics were offered, but require further development
    - ✓ Food Waste
    - ✓ Water
    - ✓ Carbon

# Next Steps

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- Small Group of MDEQ and MWEA members to meet to discuss next steps
  - Where to obtain information
  - Refinement of calculations
  - Additional information that is needed

# Other potential topics

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- Launching of the effort
  - ✓ Seminars
  - ✓ Guidance documents
- Phosphorus, Nitrogen
  - ✓ Investigate other means for reuse of nutrients in wastewater effluent
  - ✓ [WaterWorld article](#) - “New separation technologies are capable of extracting phosphates from the waste stream, which can be sold to manufacturers.”
  - ✓ Reuse for agriculture, commercial irrigation, etc. (see [EPA webpage](#))
- Food waste synergy with WWT
- MWEA Sustainable Energy Committee Survey

# MWEA Sustainable Energy Committee Survey

## Goals

- To baseline energy use at Michigan WWTPs
- To identify projects that have been implemented
- To identify barriers that are being encountered
- To provide the information needed to spur growth and development that will allow the states WWTPs to become Water Resource Recovery Facilities (WRRFs)

## Approach – a number of options are available

- Energy Star Portfolio Manager
- Self reporting of energy consumption
- Other



# Thank you

Questions?

Comments?

Suggestions?



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