Biogas Advances and Preview of WEFTEC’s Biogas Program

Patrick Serfass - American Biogas Council

WEFTEC | Chicago, IL
2 October 2017
American Biogas Council: The Voice of the US Biogas Industry

- The only U.S. organization representing the biogas and anaerobic digestion industry
- Over 200+ Organizations from the U.S., Germany, Italy, Canada, Sweden, Belgium and the UK
- All Industry Sectors Represented:
  - project developers/owners
  - anaerobic digestion designers
  - equipment dealers
  - waste managers
  - waste water companies
  - farms
  - utilities
  - consultants and EPCs
  - financiers, accountants, lawyers and engineers
  - Non-profits, universities and government agencies

Today

- Briefly: Overall US Biogas Market
- New National Data on WRRFs
- New WRRF data for Regions 7&8
- Briefly: RNG, RINs, the RFS and food waste
- New Digestate Standard
- The Biogas Sessions at WEFTEC
U.S. Biogas Market – Current and Potential

247
on Farm
(dairy, swine only)

1,269
Water
(860 using their biogas)

39
Food Scrap

645
at Landfills

2,200+
Operational
Biogas Systems

13,500+
Potential
New Biogas Systems

8,241
on Farm
(dairy, swine only)

3,888
Water
(incl. 380 not using their biogas)

931
Food Scrap

440
at Landfills

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americanbiogascouncil.org
New!
National WRRF Data
Market Opportunity & Digester Types

WRRFS ≥ 1MGD WITH BIOGAS SYSTEMS AND TYPES - NATIONAL

- NO Biogas System: 75%
- Biogas-Mesophilic: 25%
- Biogas-Thermophilic: 1%
- Biogas-Both: 18%
- Biogas-Unknown Type: 5%
Biogas System Penetration

Biogas System Development Potential by Size of WRRF

- <1 MGD: 11917 WRRFs With AD, 100 WRRFs Without AD
- 1-10 MGD: 1078 WRRFs With AD, 711 WRRFs Without AD
- 10-100 MGD: 283 WRRFs With AD, 283 WRRFs Without AD
- > 100 MGD: 21 WRRFs With AD, 30 WRRFs Without AD
- UNKNOWN: 145 WRRFs With AD, 2725 WRRFs Without AD

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Biogas Utilization at WRRFs with Anaerobic Digesters

- Pipeline Injection: 39
- Driving Machinery: 152
- Electricity Generation: 415
- HVAC: 465
- Digester Heating: 849
- Flare Some Gas: 906
- Flare All Gas: 139
- Total Biogas Systems: 1269
WRRFS THAT ACCEPT ADDITIONAL ORGANIC MATERIAL

- Additional Organics Added: 7%
- No Organics Added: 79%
- Unknown: 14%

Additional Substrates?
Biosolids/Digestate Use

BENEFICIAL USE OF BIOSOLIDS
- NATIONAL

- Biosolids Not Beneficially Reused: 41%
- Distributed to Consumers: 59%
- Sold to Consumers: 2%
- Unknown Use: 22%
New!

WRRF Data in Regions 7&8

Region 7: NE, KS, IA, MO
Region 8: UT, CO, WY, MT, ND, SD
2013 - roughly half the facilities we know about have digesters, but 2/3 of all facilities are unknown.

2017 – Twice as many facilities do not have digesters compared to those that do. Some facilities contacted had shut down their anaerobic digesters in favor of aerobic digestion but not enough to be considered statistically significant or to indicate a trend.
BioGas System Type Comparison: National vs. Regions 7&8

Regions 7&8 have a slightly higher proportion of digesters at large facilities compared to the national average.
Most of the facilities surveyed are located in small towns and do not track their gas production. Two-thirds of biogas systems flare at least some of their gas regularly. For non WRRF biogas systems, pipeline injection is a growing trend, but one we do not yet see at WRRFs.
Trends in 2017 are the same as in 2013. Due to the low response rate in 2013, this data cannot be interpreted as indicative of an increase in number of systems.
In Regions 7 and 8, the largest facilities, >100MGD, that we were able to contact all have biogas systems. Only facilities that verified the presence or lack of biogas systems were included in this chart.
The vast majority of biosolids are beneficially used. Perhaps this is expected however, since most of the facilities are located in rural areas; land application is very accessible.
Region 7 and 8's reported known beneficial use of biosolids is up 95% from 2013.
RNG and Food Waste

• Large cities are already adding food waste:
  – LA, NYC, Boston, San Francisco, etc.
• More cities are exploring adding food waste:
  – Washington, DC, Philadelphia, Chicago, etc.
• Major benefits: more revenue, more recycling
  – more biogas
  – RIN credits (if upgraded to RNG for vehicles)
  – tipping fees
RNG Production: US

RNG Vehicle Fuel Production (millions of D3 EGEs)

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Renewable Fuel Standard-RINs

- For upgraded biogas/RNG as vehicle fuel
- Fossil NG = $3.00/MMBTU +
  - D3 RIN @ $3.03 = $40.00/MMBTU
  OR
  - D5 RIN @ $1.12 = $14.50/MMBTU

**Electricity:**
1MMBTU will run a 1MW engine for ~ 6 mins ($5/MMBTU @ $.05/kWh) + 1/10 of a REC

- Biosolids, LFG
- Manure, MSW
- Food waste
• Use ALL of the biogas
  – 70% flare some biogas
• Add food waste
  – Add 10% food waste, get 2-5x more biogas
• Upgrade biogas to RNG
  – RNG = $3/MMBTU; RIN credits = $40/MMBTU
• Sell the digestate
  – Certify it at www.Digestate.org
New US Digestate Standard

www.Digestate.org
Too often, digestate is a cost, even when given away for free

What if it could generate just a little bit of revenue/ton?

Reference projects:

- College campus food and yard waste = 10,000 tpy
- 1,000 cows = 50,000 tpy | 15,000 cows = 800,000 tpy
How do we get digestate customers to pay?

Convince them the product is safe to use, comes from a good course (a digester), and has the nutrients the producers says it does.
## Table 1: Required testing for Digestate End Use Classifications

These tests provide the minimum information required to determine appropriate use. Digestate users may require additional testing parameters prior to acceptance.

<table>
<thead>
<tr>
<th>Possible Digestate End Use</th>
<th>Generally Unrestricted Bulk Sales or Land Application</th>
<th>Restricted Land Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal Coliform or Salmonella</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Total N, P, K</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Organic Ammonia and Nitrate Forms</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Secondary and Micro-Nutrient Assay</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Total Solids and Moisture Content</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Volatile Solids</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Metals</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Physical contamination</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Soluble Salts</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Stability (VFA or CO$_2$ Respiration)</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*Levels similar to or more stringent than EPA Part 503*
Main Benefits

• For Digestate Producers:
  – Increased revenue
  – Increased marketability
  – Address biosolids stigma

• For Digestate Buyers:
  – Third party testing assures product meets health and safety requirements
  – Can trust nutrient label and claims
WRRFs: Sign up today!
www.Digestate.org
Digestate Products

![Environmental Moss](image1)

**Super For Natural Beauty in Your Garden!**

**Digestate Products**

**Peat Moss**

**Magic Dirt**

**Potting Mix**

**EnerGro**

**Better Plants. Greener Planet.**

**Organic Premium Potting Soil**

**Superior Performance**

**All Organic Plant Food**

**Bio-Enhancement for Better Root Growth, Less Rooting**

**100%**

**Low-volume ingredients, balanced nutrients, safe and beneficial energy.**

**Bio-Enhancement for Better Root Growth, Less Rooting.**

**American Biogas Council**

[americanbiogascouncil.org](http://americanbiogascouncil.org)
Thank You!

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  • www.AmericanBiogasCouncil.org

• Become a Member
  • Application online, or contact us

Patrick Serfass, Executive Director
American Biogas Council
1211 Connecticut Ave NW #650
Washington, DC 20036
202.640.6595
pserfass@ttcorp.com
info@americanbiogascouncil.org
## Biogas Related Sessions at WEFTEC 2017

### Monday October 2, 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>1:30 pm - 5:00 pm</td>
<td>Session 208 Fundamentals of Anaerobic Digestion I</td>
</tr>
<tr>
<td>1:30 pm - 5:00 pm</td>
<td>Session 209 Odors and Air Emissions at Water Resource Recovery Facilities</td>
</tr>
<tr>
<td>1:30 pm - 5:00 pm</td>
<td>Session 210 Biogas Cleaning, Treatment, and Use for Economic Gain</td>
</tr>
<tr>
<td>1:30 pm - 3:00 pm</td>
<td>Session 211 Residuals Management</td>
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### Tuesday October 3, 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:30 am – 12:00 pm</td>
<td>Session 302: Late Breaking Research II: From Biogas to Endocrine Disruption – Advances in Advanced Monitoring and Treatment Processes</td>
</tr>
<tr>
<td>8:30 am – 12:00 pm</td>
<td>Session 310 Co-Digestion of High-Strength Wastes</td>
</tr>
<tr>
<td>9:00 am – 10:30 am</td>
<td>Session 327: Mobile Session – Anaerobic Digestion Fundamentals</td>
</tr>
<tr>
<td>1:30 pm – 3:00 pm</td>
<td>Session 402: Anaerobic Treatment for Brewery Wastewater</td>
</tr>
<tr>
<td>1:30 pm - 3:00 pm</td>
<td>Session 410 Improving Anaerobic Digestion Through Pre-Treatment</td>
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### Wednesday October 4, 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</thead>
<tbody>
<tr>
<td>1:30 pm – 4:30 pm</td>
<td>Session 601: Application of Advanced Biological Treatment Processes to Challenging Industrial Wastewaters</td>
</tr>
<tr>
<td>1:30 pm – 5:00 pm</td>
<td>Session 609 Anaerobic Digestion</td>
</tr>
</tbody>
</table>
Additional Slides
East Bay MUD
+ 2011: 40 tons/day of post consumer food waste, 240,000 gal/day of food processing waste
+ generates 90% of 5MW needed
+ ramping up to 120 tons/day of post-consumer food
DC Water

+largest advanced wastewater facility in world
+370 MGD wastewater
+$400 million project,
Operational since June 2015
+13 MW generated, uses 26 MW
+saves $10M/year in electricity costs + $15M/year in other costs (30 fewer truck trips/day)
+provides all emergency power if major failure
+Hired firm to explore how to add food waste
Harvest Energy Garden
+130,000 tons per year of biosolids, fats, oils, grease, and food waste—mostly from Walt Disney Resorts and hotels
+3.2 MW of installed power generation
+2.2 MW of recoverable heat
+Digested material: class AA granular fertilizer and phosphorous-rich Struvite sold as a fertilizer additive
LA County, NYC, Boston

LA County Sanitation +
+PPP between LA County Sanitation District and Waste Management
+CORe System turns 85 TPD of food waste into a slurry at transfer station
+Delivered to WRRF
+Running in LA since Feb 2014
+Interim results reported at WEFTEC 2015
+Used also in NYC, Boston and other cities who don’t want to accept food waste directly
Village of Ridgewood, NJ
+5 MGD
+240 kW, 1.5 MMBTU/hr thermal + Solar
+Accepts FOG
+Net energy positive (due to co-digestion)
+Private developer upgraded existing digesters to take substrates and increase capacity
+20-year agreement reduces OpEx, increases revenue (tip fees), predictable energy price