Intro to the Biogas Industry

Trends and Opportunities

Patrick Serfass, American Biogas Council
Sustainable Food & Beverage Packaging Value Chain Meeting
10 December 2014 | Washington, DC
American Biogas Council: The Voice of the US Biogas Industry

- The only U.S. organization representing the biogas and anaerobic digestion industry
- Over 220 Organizations from the U.S., Germany, Italy, Canada, Sweden, Belgium and the UK
- All Industry Sectors Represented:
  - project developers/owners
  - anaerobic digestion designers
  - equipment and supply chain companies
  - waste managers
  - waste water companies
  - farms
  - composters
  - utilities
  - consultants and EPCs
  - financial firms

ABC Membership

![Graph showing ABC Membership from 2010 to 2013](image-url)
Organic material is delivered to the digester system

This may include animal manure, food scraps, agricultural residues, or wastewater solids. Digested material may be returned for livestock, agricultural and gardening uses.

Organic material is broken down in a digester

The digester uses a natural biological process under controlled conditions to break down organic material into products for beneficial use or disposal.

Raw biogas is processed

Typically, water, carbon dioxide and other trace compounds are removed, depending on the end use, leaving mostly methane.

Processed biogas is distributed and used

The gas may be used to produce heat, electricity, vehicle fuel or injected into natural gas pipelines.

Digested material is processed and distributed

Solids and liquids from the digester may be used to produce marketable products, like fertilizer, compost, soil amendments or animal bedding.

What goes INTO a biogas system?
(organic materials)
Food Waste
Food Waste
Food Waste
Green Waste
Manure (animal/human)
What comes OUT of a biogas system?
(gas, solid and liquid products)
Electricity (gas)
Heat (gas)
Fuels (gas)
Soil Products (liquid/solids)
U.S. Biogas Market—Current and Potential

2,000+ Operational Biogas Systems Today

11,000+ Potential New Biogas Systems

<table>
<thead>
<tr>
<th></th>
<th>On Farm (Dairy and Swine)</th>
<th>Wastewater</th>
<th>At Landfills</th>
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<tbody>
<tr>
<td></td>
<td>239</td>
<td>1,241</td>
<td>636</td>
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<tr>
<td>Total</td>
<td>8,000</td>
<td>2,440</td>
<td>450</td>
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U.S. Biogas Market – Potential Impact

13,000+
Biogas Systems

Emission reductions equivalent to removing 1 - 11 million passenger vehicles from the road

Enough energy to power 3.5 million American homes
Trending:

**Adding Food Waste**

Making Vehicle Fuel

and

Making Products from Digestate
What wastes are BEST for making biogas?

- Fats & Greases: 35x manure
- Bakery Wastes: 25x manure
- Food Scraps: 10x manure
- Corn Silage: 3x manure
- Grass Silage: 2x manure
- Green Clippings: 1.5x manure
- Brewery Waste: 1x manure
- Chicken Manure: 0.5x manure
- Potato Waste: 0.25x manure
- Pig Manure: 0.1x manure
- Cow Manure: 0.05x manure

Cubic meters of biogas production per ton of substrate
A Focus on Commercial Organics

Sources: MIT and Tim Horton

- Restaurants (example), Grocery Stores, Convention Centers, Hotels
- Lots of organic waste generated
Mandates, Incentives — Food Waste Recycling

**Municipalities:** San Francisco, Seattle, Austin, Vancouver, New York City, most starting in 2009-10

**2011:** CT, Public Act 11-217 (updated in 2013)

**2012:** VT, Universal Recycling Law, Act 148—all organics, largest generators first, effective 7/1/2016

**2013**
- CT: Public Act 13-285 (update to 2011)—Commercial organics, **effective 1/1/14**
- NYC: Local Law 146-2013—Commercial organics, effective 7/1/2015

**2014**
- MA: 310 CMR 19.000 regulations—Commercial organics, effective 10/1/14
- **CA AB 1826: Mandatory Commercial Food Waste Recycling (awaiting Gov’s signature)**
- **MD: Composting and Anaerobic Digestion Facilities-Yard Waste and Food Residuals (pending)**
Central Connecticut Organics Recycling Facility
+ Near Hartford, CT
+ 75,000 tons/year of municipal and commercial organics (Food, yard and woody waste)
+ 16 municipalities contributing
+ 1.4 MW + CHP
+ Digested Material: high quality compost and engineered soil products
+ Construction: late 2014
+ Commissioning: late 2015
Food Waste + Biosolids (FL)

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
Manure Digester + Food Waste

70% of the electricity from food waste
Thank You!

• Learn More
  • Sign up for the **FREE Biogas News**

• Become a Member
  • Dues start @ $75-$1,250
  • Application online, or contact us

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Vehicles: Recent EPA changes to Renewable Fuels Standard (RFS2)

Before:
- Feedstocks: Biogas from manure, wastewater and landfills
- Uses: CNG vehicles
- RIN credit: D5 “advanced biofuel”

After:
- Feedstocks: Biogas from virtually ALL feedstocks (all the ones before + non-manure agricultural waste, food waste, yard waste, MSW, energy crops, crop residues)
- Uses: CNG vehicles + LNG, electric vehicles (battery and fuel cell), DME (renewable diesel)
- RIN credit: mostly D3 “advanced cellulosic biofuel” (more valuable) and some D5, depending on project.
Fuels
Zero Waste Energy
+San Jose, CA
+90,000 tons/year
+1.6 MW electricity + CHP
+Digested Material: high quality compost
+Phase 2 completed
+Phase 3: Turning residential food waste into biogas for vehicles
Sacramento, CA
+ Awarded International Bioenergy Project of the Year (2013)
+ 40,000 tons/year of food waste
+ 700,000/year diesel gallon equivalents of renewable CNG
+ fueling Atlas waste haulers and city vehicles
Himark BioGas/Western Plains Energy
+Biogas and ethanol (50M gal/yr) production

+Biogas Inputs: cattle feedlot manure, ethanol plant waste, slaughter-house waste and municipal organics, rich in sand, dirt, rocks, plastic, and cellulose.

+Biogas offsets fossil natural gas in ethanol plant (13MW equiv.)

+Digested materials fertilize largest plot of sweet sorghum in US
Products for sale made from digested materials

http://www.magic-dirt.com/


A Legislative and Regulatory Push

Federal Activities
- Farm Bill (elec.)
- Biogas ITC (gas)
- Tax Extenders (elec.)
- Renewable Fuel Standard (gas)
- Clean Energy Standard (elec.)
- USDA, EPA, DOE, DOD

State Activities
- Organic Waste Plans: Top 11 States
- CA, WA, OR, WI, MN, NY, MA, PA, NJ, MD, NC