US Biogas Industry Development

Indications for Biomethane
American Biogas Council:

- The **only** U.S. organization representing the biogas and anaerobic digestion industry.
- **143 Organizations** from the U.S., Germany, Italy, Canada, Sweden, Belgium and the UK
- **All** Industry Sectors Represented:
  - Landowners
  - Fuel refiners
  - Manufacturers
  - Project developers
  - Biogas users
  - Plant owners
  - Financiers
  - EPC firms
  - Wastewater
  - Utilities

www.americanbiogascouncil.org
Promoting the Advancement of Anaerobic Digestion Technologies

Dedicated to maximizing the production and use of biogas from organic waste

Some of our members:

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2012 Goals

- Maximize amount of biogas produced from organic, non-woody waste
- Promote biogas markets, technologies and infrastructure
- Promote the beneficial use of the organic outputs from anaerobic digestion (AD)
- Achieve policy parity with other renewables
- Promote anaerobic digestion as a best practice for environmental stewardship and greenhouse gas reduction
Changing the Biogas Industry

- Legislative and Regulatory Affairs
  - **Federal:** Biogas Tax Credit; Clean Energy Standard; Natural Gas Act; Farm Bill
  - **State:** California, Iowa, Massachusetts, Indiana, more...

- Sharing Expertise
  - **8 Specialized Working Groups:** Biofuels, Digestate, Biogas to Electricity, Biomethane to Grid, Feedstocks, Agriculture, Municipalities, GHG Credit Market.

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Biogas is on the radar of multiple federal agencies

- Agriculture (USDA), Rural Development and Conservation
- Defense (DOD)
- Environmental Protection EPA:
  - AgStar:
  - Landfill Methane Outreach Program:
- Energy Efficiency and Renewable Energy (DOE)
- Federal Energy Regulatory Commission (DOE)

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Education and Outreach

- Popular Science puts ABC in the public view (July 2011)
- 6 articles written, quoting the ABC
- “100 Companies Now Growing the U.S. Biogas Industry” press release on thousands of websites (June 2011)
- Advertising now for sale on website and newsletter
- ABC’s Biogas News published 2x/mo. in 2 editions: members only, public
- ABC represented at virtually every major biogas conference—usually through members
- 16,000 video views on ABC’s YouTube channel: youtube.com/gobiogas

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Many feedstocks, multiple revenue streams

Choice of process dictated by feedstocks
Both processes require carbon:nitrogen balancing
Either process could be local or central

Biogas production is determined by feedstocks and process
Quantity and composition of effluents depends on inputs and process

Value of energy depends on market conditions and type of energy produced

AGRICULTURAL
- MANURE
- STOVER
- STUBBLE
- SPOILAGE
- COMPOSTED MORTALITY
- ENERGY CROP

AG PROCESSING BYPRODUCTS
- GLYCERIN
- SYRUP STILLAGE
- BLEACHING CLAY
- COBS AND HUSKLAGE
- SPOILAGE

FOOD PROCESSING RESIDUALS
- BAKERY
- FATS, OILS AND GREASES
- VEGETABLES
- WHEY
- OTHER DAIRY WASTE
- RUMEN CONTENTS
- ANIMAL RENDERING FATS

PAPER WASTE
- SHREDDED OFFICE PAPER
- SHREDDED CARDBOARD

COMMUNITY
- LEAVES
- GRASS CLIPPINGS
- RESTAURANT WASTE
- CAFETERIA WASTE

Need to know what is available
where and at what cost

WET DIGESTION
5-13% TOTAL SOLIDS
1-10 SCF/GALLON BIOGAS
Minimum Economical Size:
25 million gpy

BIOGAS ~600 btu/scf

DRY DIGESTION
20-45% TOTAL SOLIDS
40-100 SCF/GALLON BIOGAS
Minimum Economical Size:
50,000 ton/yr

LIQUID NUTRIENTS
Composition depends on inputs
Quantity depends on process

SEPARATED SOLIDS
Composition depends on inputs
Quantity depends on process

MEDIUM BTU GAS SOLD TO LARGE USER
HIGH BTU GAS SOLD TO LARGE USER OR UTILITY
ELECTRICITY SOLD TO LARGE USER OR UTILITY
USE AS VEHICLE FUEL REPLACEMENT

DIRECT LAND APPLICATION
CONCENTRATION AND BULK SALES
ALGAE CULTIVATION
GREENHOUSE AQUACULTURE

CELLULOSIC ETHANOL PRODUCTION

Use of effluents depends on local market conditions
Opportunities for new business development
US BIOGAS = JOBS

Choice of process dictated by feedstocks
Biogas production is determined by feedstocks and process
2,200+ biogas-producing sites Currently Operational

- 171 Digesters on Farms (100 MW)
- 1,500 Digesters at Wastewater Treatment Plants (only 250 use the biogas they produce)
- 563 landfill-based energy projects (26 pipeline, 537 electricity/boiler)

11,000+ sites Available for Development

- Farms: 8,200 (only counting dairy and swine)—1700 MW
- Wastewater Treatment Plants (WWTPs): 3,250—750 MW
  - 2,000 WWTPs > 1 MGD don’t have a digester
  - 1,250 WWTPs producing, but not using biogas
- Landfills/MSW?

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TIME OUT - Negative Economic Impacts to the Biogas Industry with 2011 expiration of Sec. 1603 Cash Grants

- Total Projects: 324*
- Total Power Capacity: 649 MW*
- Total Industry Investment: $3.5 billion
- Average: $5.74 million/MW
- Average: $12.6 million/project

* As reported by individual companies to the American Biogas Council, Fall 2011
Dynamics Impacting On-Farm and Agricultural-Based Biogas Projects

MOSTLY NEGATIVE IMPACT
- Budget Deficits
- Campaigns and Elections
- Low Natural Gas Prices
- Low Feed-in-Tariffs and High Interconnection costs
- Limited Carbon Market and GHG skepticism
- Little/No Regulation or Incentive for Manure Treatment

MOSTLY POSITIVE IMPACT
- High Oil/Gasoline/Diesel/Propane/Fuel Oil Prices
- High On-farm Purchased Electricity Costs
- Cash-Flow Trending Better due to Improved Commodity Margins
- More Options for Feedstocks and Energy Revenue

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WHAT VALUE CAN YOU GET FOR THE ENERGY?

NYMEX Natural Gas Futures
Close (Front Month)

Residential Heating Oil

Residential Propane

Regular Gasoline Prices

On-Highway Diesel Fuel Price

Source: Energy Information Administration
BIOMETHANE VS. NATURAL GAS

PREVIOUSLY -

- Natural Gas Pricing floated somewhat with oil pricing, even though competitive focus was electricity

- Natural Gas distribution limited in many rural communities,
  - Forcing use of costlier propane, diesel or fuel oil
  - Increasing interconnection costs

- Carbon offset value low compared to offsetting coal – roughly 5%

- CNG vehicle conversions and refueling infrastructure limited and costly

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BIOMETHANE VS. NATURAL GAS

FUTURE TRENDS –

⊙ Pricing disconnected from oil market, competitive focus shifting to vehicle fuel
⊙ New transmission and distribution lines being installed
⊙ Shale Gas extraction emissions far closer to coal, oil
⊙ Biogas to Biomethane equipment highly competitive with electrical production and viable on farms – proven
⊙ CNG vehicle conversions and refueling infrastructure rapidly expanding, getting cheaper
THE BIOGAS UPGRADING PROCESS

Initial steps are similar to those needed when using the biogas for other purposes.
BIOGAS UPGRADING REQUIRES SEPARATION OF METHANE FROM OTHER GASES

CARBON DIOXIDE REMOVAL
- Water wash
- Amine scrubber

membrane
- or
- cyrogenic
- or
- PSA

High BTU biomethane/renewable natural gas 100 to 500 psig, to meet pipeline specifications

Compression

USE
- Tube trailers 4000 psig
- Gas grid injection 50 - 1000 psig
- Vehicles 3500 psig
- On-site generation or direct use

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PROVEN TECHNOLOGY, NOT R&D
QUESTIONS?

THANK YOU!