



Prospects for Anaerobic Digestion in the U.S.

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Presented at the WTERT Bi-Annual Meeting
October 6, 2016




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GBB Quality – Value – Ethics – Results



- Established in 1980
- Solid Waste Management and Technology Consultants
- Helping Clients Turn Problems into Opportunities



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GBB's Waste Consulting Services

- Economic, technical and environmental reviews
- Procurements
- Due diligence third-party reviews
- Waste characterization and sourcing
- Process planning and conceptual designs
- Independent feasibility consultant



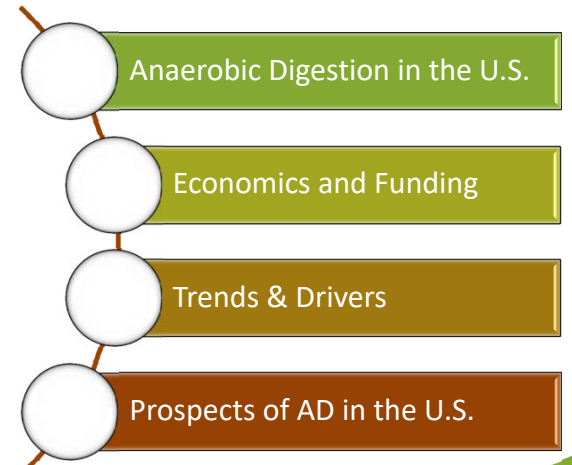
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Outline


- Anaerobic Digestion in the U.S.
- Economics and Funding
- Trends & Drivers
- Prospects of AD in the U.S.



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ANAEROBIC DIGESTION (AD) IN THE U.S.

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Operational Biogas Systems in the U.S. - Food Scrap Systems Only



Total number: 38
Stand Alone AD plants
processing food waste: 18

**American
biogas
Council**
americanbiogascouncil.org/biogas_maps.asp

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Facilities and Market Leaders

- Privately financed, owned and operated
- Commercial food waste
- Organics from MSW
- Mixed with yard waste




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- Established in 2006 in Cleveland, OH
- Initially European technology
- Integrated Anaerobic Digestion System (iADs)- patent pending technology developed at Ohio State University
- Over \$150M in Executed Projects
 - 14 Operational Digesters (OH, NY, MA, ME)
 - Capacity to annually manage 700,000 tons of organic waste
- Municipal, Industrial & Agricultural Ads
- Mature US Supply Chain



Cleveland, Ohio



Wooster, OH



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ZeroWaste™
ENERGY, LLC.
Recovery and Energy with Zero Waste



South San Francisco, CA

- US company based in Lafayette, CA
- Dry Anaerobic Digestion licensee for:
 - KompoFERM
 - SmartFERM
- Plants:
 - Monterey Regional Waste Management District, Marina, CA
 - Zero Waste Energy Development Co., San Jose, CA
 - Blue Line Transfer/SSF Scavengers, South San Francisco, CA
 - 3 plants under construction and development



San Jose, CA



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KOMPOGAS by Hitachi Zosen INOVA



Doha, Qatar

- One of the world leaders in AD
- Dry anaerobic digestion
- 75 plants around the world
- Plant under construction in San Luis Obispo County, CA
- 400 years of accumulated operating experience



Kompogas® Digester



Botarell, Spain



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Projects Under Development & Construction



Total: 26
Under Development: 16
Under Construction: 10

Yellow- Under development
Green- Under construction




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Prince William County, VA

- Through RFP procured a build, finance, own, operate contract with Freestate Farms
- 80,000 tpy of organics facility includes:
 - Wet Anaerobic digestion
 - Aerated composting of digestate and yard waste
 - On-site greenhouses for growing organic food
 - Sale of high grade compost
- Start construction fall 2016, operational 2018



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CR&R – Perris, CA



EISENMANN

- 500 tons per day of food and yard waste
- Expandable to 1,000 tpd
- Under construction, start up late 2016
- Methane to fuel waste collection trucks

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Food Waste Management Regulations and Legislations

- State Level
 - California
 - Connecticut:
 - Massachusetts
 - Minnesota
 - Rhode Island:
 - Vermont
- Local Level
 - Austin, Texas
 - New York City, New York
 - San Francisco, California
 - Seattle, Washington
 - Washington, DC

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ECONOMICS AND FUNDING




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System Economics

- Tipping fees at operating plants:
 - \$40-\$100/ton
 - Cleaner the feedstock lower the tipping fee
- Capital expenses
 - Different for different types of AD
 - \$300-\$500 per installed annual ton of capacity
- Operating Expenses
 - 2-3% of the Capital Expenses per ton processed



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Revenue Sources

- Electricity/ biogas sale
- Digestate/ fertilizer sale
- RINs
 - \$0.90-\$1.80/“gallon” (77,000 BTUs) for biogas>vehicle fuel
 - Types for biogas: D3 cellulosic advanced and D5 advanced
- Low Carbon Fuel Standard (LCFS), CA
 - Metric Tons of Carbon Dioxide equivalent (MTCO_{2e}) avoided
 - \$85-\$100 per credit
- RECs (eligibility depends of the state)
 - \$20/MWh – PJM value
- Production Tax Credit-
 - Section 45: Open/closed-loop Biomass (electricity)
 - 1.15 cents/kWh (x2 for closed loop)

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Capital Funding

- Investment Tax Credit-
 - Section 45: Open/closed-loop Biomass (electricity)
 - 30% of qualifying property (capital costs)
 - H.R.5489 — Agriculture Environmental Stewardship Act of 2016 (non-electricity)
 - 30% ITC
 - Loan Guaranteed
 - Private investment sources

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TRENDS & DRIVERS



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Trends

- Growing interest in managing organic waste separately
- Higher recycling and diversion goals
- From private initiatives only to the public sector
- More world leading technology developers/ vendors
- Legislative support
- Financial support
- Co-digestion at wastewater treatment plants



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AD Project Drivers

- Tipping Fees
- Landfill Capacity
- Waste Stream
 - Quality and Quantity
 - Collection Method
- Marketability of Commodities
 - Biogas Use
 - Compost market
 - Fuel replacement economics
- Regulations
- Community and Political Influences
- Competitive Landscape

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Circular Economy

Source: Ellen MacArthur Foundation

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PROSPECTS OF AD IN THE U.S.



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Significant Attention

- **Biogas Opportunities Roadmap**
 - By USDA, US-EPA, USDE- August 2014
 - Part of the White House Climate Action Plan- Strategy to Reduce Methane Emissions
- **U.S. EPA Sustainable Materials Management Program Strategic Plan (2017-2022)**
 - Develop infrastructure (composting and AD plants)
 - Promote opportunities across the entire food life cycle to reduce wasted food from landfills
 - Improve and standardize measurement of wasted food
- **ReFED- Rethink Food Waste**
 - A Roadmap to reduce U.S. food waste by 20%
 - Assessed Technical and Economic Impact of 27 Solutions



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Significant Funding Opportunities

amazon




Stern Brothers & Co.
INVESTMENT BANKING SINCE 1917


Google
green

 **Microsoft**

STIFEL

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Opinion of Future Trends

- Stand alone AD facilities
- AD facilities as part of Mechanical Biological Treatment Facilities or together with composting, MRF's or WTE facilities
- As projects like Prince William County become reality the public sector will feel more comfortable and willing to accept more risk
- More experienced AD project developers

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In Summary


- Bright future for the AD in the U.S:
 - AD technology is proven (moderate to low risk)
 - Vendors are known and experienced
 - Existing legislative support
 - Funding Sources available
- Business case is the key
- It is a game changer without significant system changes and fees increase

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FROM WASTE
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www.rewconference.com

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Questions and comments?

Thank you!

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