Bio-digester Case Study and Organics Reuse

Louisville Reuse Summit
June 3, 2016

Presented by:
Steve Simmons
Gershman, Brickner & Bratton, Inc.

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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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Today's Presenter

Steve Simmons, GBB Vice President

Over 35 years of renewable energy from waste and sustainable materials management experience:

- Bachelor of Mechanical Engineering degree from University of Missouri-Rolla
- Professional Certificate in Energy and Sustainability from University of Denver

Currently assisting 3 counties in implementing digester and zero waste-to-landfill projects

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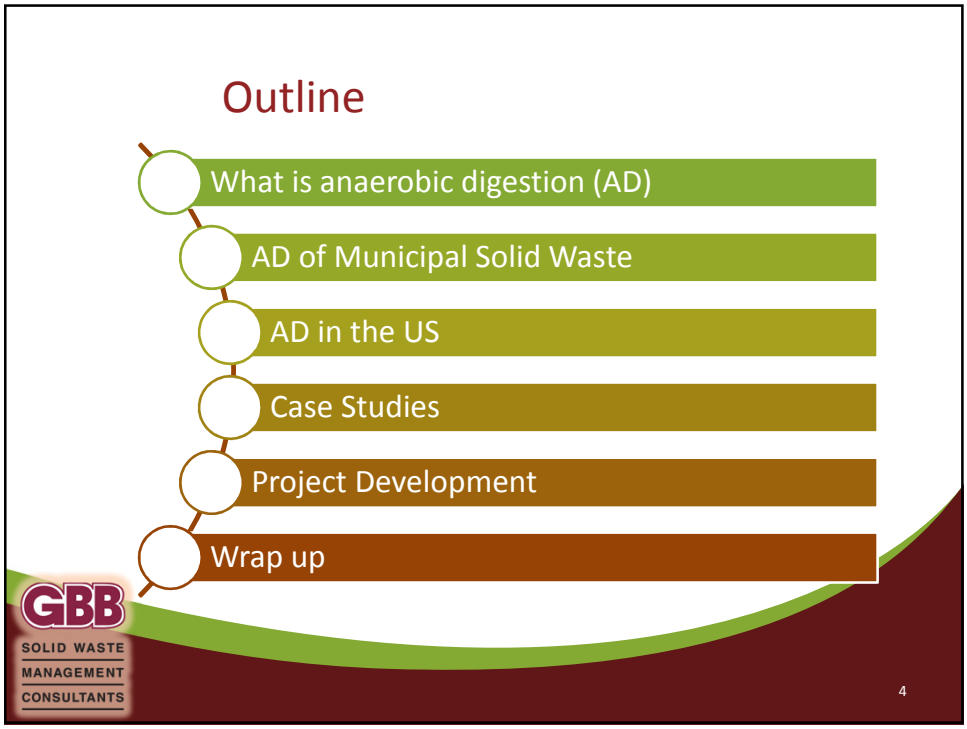
Outline
What is anaerobic digestion (AD)
AD of Municipal Solid Waste
AD in the US
Case Studies
Project Development
Wrap up
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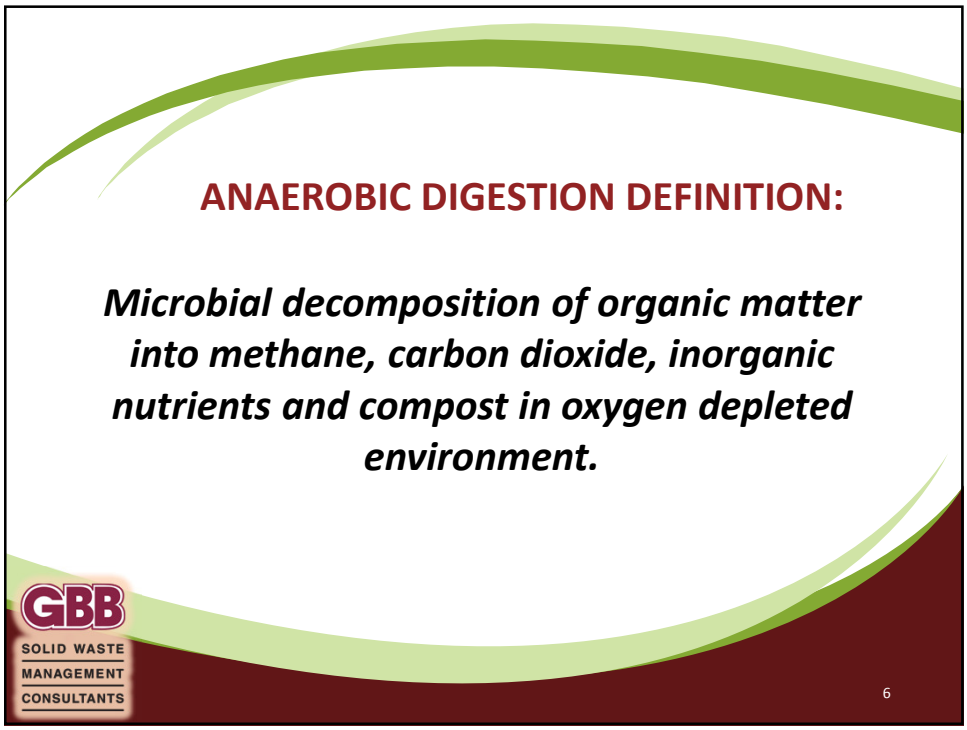
ANAEROBIC DIGESTION DEFINITION:
Microbial decomposition of organic matter into methane, carbon dioxide, inorganic nutrients and compost in oxygen depleted environment.
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Anaerobic Digestion in Nature

Wetlands

Rice Fields

Animal intestines, manure

- Responsible for the carbon cycle in the ecosystem
- Natural Vs. Man-made sources of methane 30%:70%

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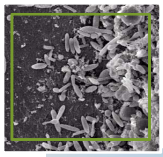
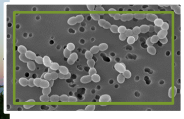
Microbiology of AD Reactions

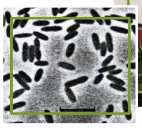


Hydrolytic Bacteria

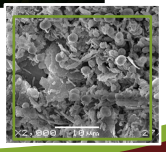
Microorganisms live together for the common good (in syntrophy)



Fermenting Bacteria



Acetogenic Bacteria



Methanogenic *Archaea*

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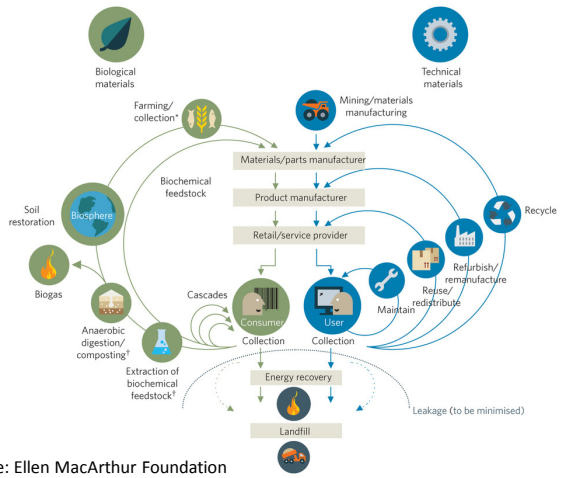
Circular Economy



Source: Ellen MacArthur Foundation

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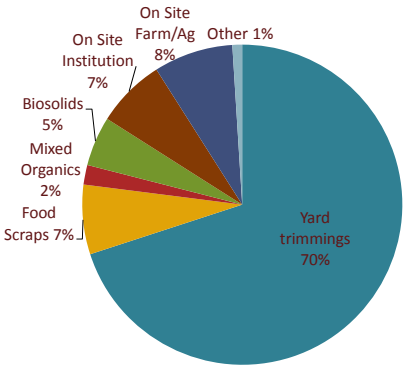
Composting in the United States



Composting Facilities by Type

- Aerobic decomposition of biodegradable waste
- 4,914 composting operations in 43 states
- 19.4 million tons of organics diverted for composting (reported by 33 states)
- Average amount of organics processed at a composting plant: 5,155 TPY
- >20 states have yard waste bans from landfills

Source: Institute for Local Self-Reliance & BioCycle, July 2014

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ANAEROBIC DIGESTION OF MUNICIPAL SOLID WASTE

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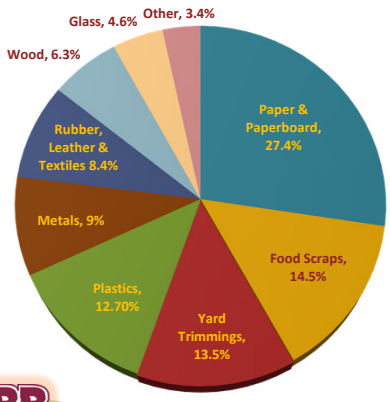
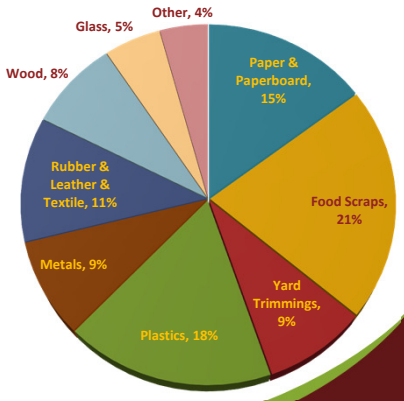
Municipal Solid Waste Composition

MSW Before Recycling



MSW After Recycling



Source: US EPA, 2014

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Digester Feedstock Sources

Grocers | Restaurants and Cafeterias | Urban Farms | Food Processing Industries | Curbside Collections

Source: Getty Images

Source: Seattle Public Utilities

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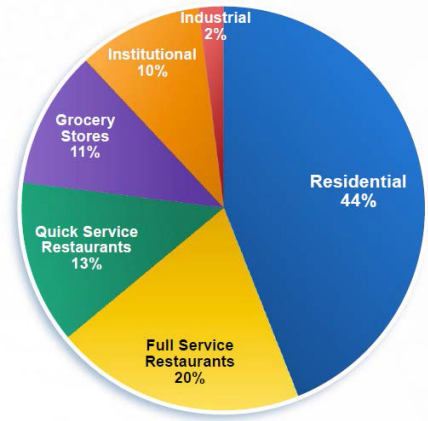
Food Waste Sources



Source: Food Waste Reduction Alliance, 2013

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Organics from Mixed Municipal Solid Waste

- Can be collected curbside via green bin
- Can be recovered from a Mixed Waste Processing Facility that can also recovers recyclables
  - Not as clean for re-use as source separated organics

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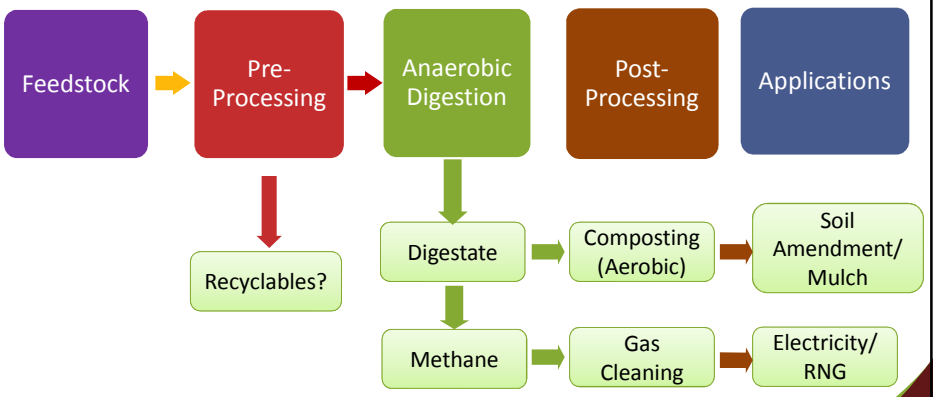

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Pre-Processing Organics for AD

- Pre-Processing for Wet Digestion
  - More Intensive to break down organic material, remove residue, and achieve the correct solids content (Processor Dependent)
- Pre-Processing for Dry Digestion
  - Source Separated may need yard waste mulch added to achieve stackability
  - MSW needs equipment to separate from other materials but can then be processed directly

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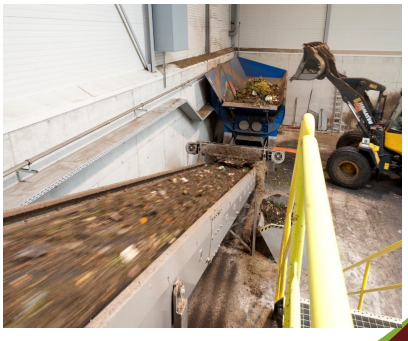
Pre-Processing of Feedstocks

Source Separated (Dry AD)

Source: GBB Visit to Zero Waste – Monterey, CA

Source Separated (Wet AD)



Source: Kompogas

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AD Process – Gas Production

Source: GBB Visit to ZeroWaste Monterey, CA

Source: GBB Visit to Quasar – Wooster, Ohio

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Applications – Methane Gas

IC Engine/Electricity and Heat

Source: GBB Visit to Zero Waste – Monterey, CA

Renewable Natural Gas (RNG)

Source: CleanEnergy

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AD Process –Digestate

Dry AD

Source: GBB Visit to Zero Waste – Monterey, CA

Wet AD

Source: Kompogas

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Post-Processing of Digestate

- Wet Digestate
  - Requires dewatering and may need additional drying
- Dry Digestate
  - Screening (Separation by Size)
  - Air Classification (Separation by Weight)
  - Optical Units (NIR, X-Ray)

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Applications - Compost

Source Separated Organics

Maturing Windrows

Screened Final Compost

Source: GBB Visit to Zero Waste – Monterey, CA

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Applications – Soil Amendment

MSW Sourced Organics

Maturing Windrows

Screened Final Product

Source: GBB Visit to Zero Waste – San Jose, CA

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ANAEROBIC DIGESTION IN THE US

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Facilities and Market Leaders

- ~ 20 facilities operating in the U.S.
- Privately financed, owned and operated
- Commercial food waste
- Organics from MSW
- Mixed with yard waste

quasar energy group

Anaergia

ZeroWaste ENERGY, LLC. Recovery and Energy with Zero Waste

KOMPOGAS

OWS Organic Waste Systems

HARVEST Power of We

EISENMANN

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Municipal AD Projects Under Development

City of Portland, OR
- Columbia Biogas

County of Santa Barbara, CA – Mustang Renewable

City of Perris, CA – CR&R

Town of Brunswick, ME

Johnson, Rhode Island- Blue Sphere

Prince Georges County, MD – TBD

Prince William County, VA – Freestate Farm

City of Charlotte, NC - Blue Sphere

City of Columbia, SC - W2E

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AD Development Drivers

- High recycling and diversion goals (up to 80%)
- Zero waste goals
- Food waste disposal bans/mandates-VT, CT, CA, MA and RI
- Recognition of the food waste as a feedstock for AD plants and biogas production
  - Biogas as a fuel from organic waste included in the RFS2 under advanced fuel qualifying for the D3/D5 RINs
- Financial support for infrastructure development

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CASE STUDIES

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Harvest Power- Orlando Energy Garden, FL

- Wet AD
- 120,000 tons/yr commercial food waste and biosolids
- Energy Output:7 MW (CHP: 3.2 MW electrical, 3.8 MW thermal)
- Product Output: 5,000 MT/yr granular fertilizer

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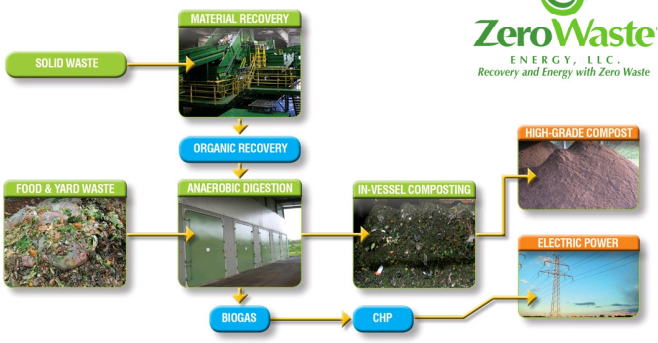
ZERO WASTE ENERGY
GREENWASTE/ZANKER PROJECT- San Jose, CA



ZeroWaste ENERGY, LLC. Recovery and Energy with Zero Waste

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GREENWASTE/ZANKER PROJECT- San Jose, CA

- State-of-Art dry AD facility
- 16 SMARTFERM AD digesters
- Four In-Vessel composting Units
- Capacity of 90,000 TPY of commercial organic waste- biggest in the world
- 1.6 MW power output

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CR&R – Perris California

- 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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Case Study: Prince William County, VA

- County DPW operates the waste management system
- Through RFP procured a build, finance, own, operate contract with Freestate Farms.
- New 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 late summer 2016, operational 2018.

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PROJECT DEVELOPMENT

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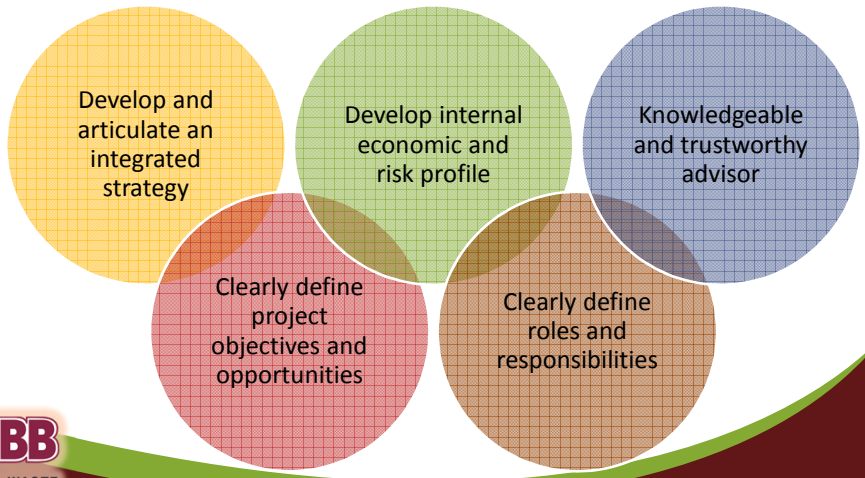
Developing Digestion Projects in the US



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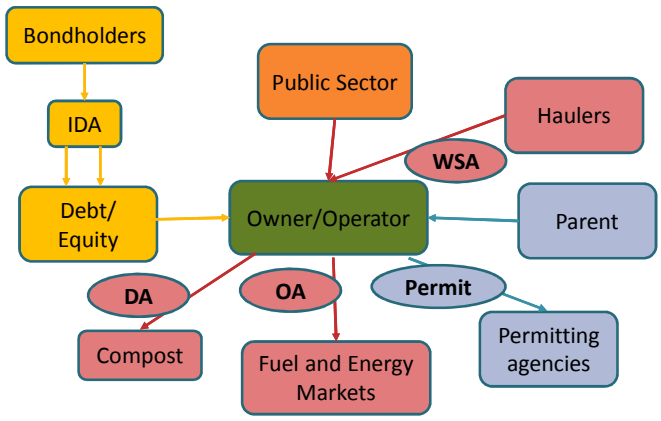
Public / Private Project Building Blocks



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Wrap up

- Growing interest in managing organic waste separately from the municipal waste stream.
- California and Northeast states are leading the way in the US.
- Anaerobic Digesters provide a pathway to recover energy and nutrients from organic waste.
- Feedstock quality is key.

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Questions and comments?
Thank you!
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