



SMART
RECYCLING U.S. LLC

Advances in Anaerobic Digestion

A positive pathway towards **ZERO** Waste



Presentation Overview

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 - ❖ EPA Food Recovery goal, 50% diversion by 2030
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- ❖ Questions?



Introduction

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- ✧ CRA, VRA, GRC, RFT, SERDC
- ✧ Editorial Advisory Board (multiple)
- ✧ Conference Presenter
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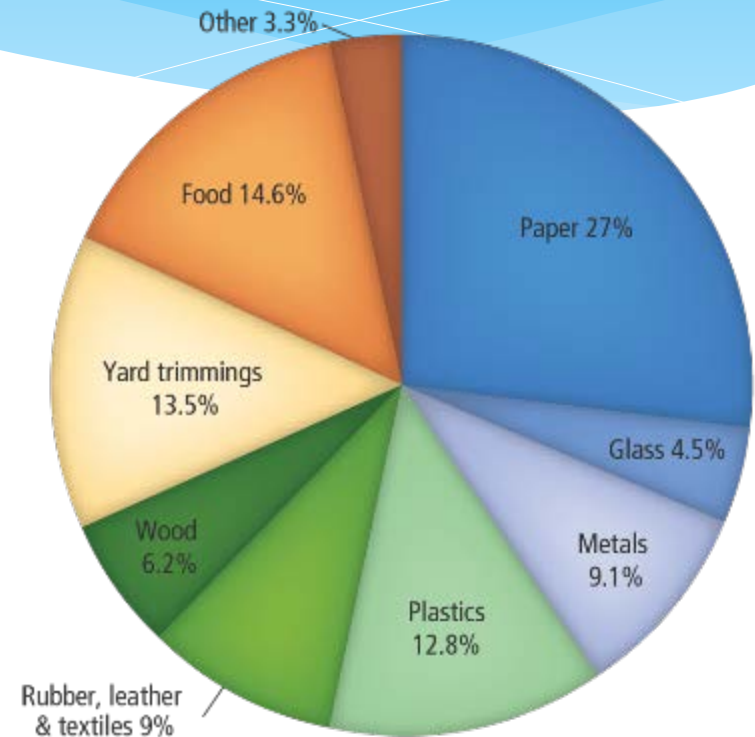
Landfills becoming LandFULLS

- ❖ There are currently 1,931 active MSW landfills and over 12,000 old municipal landfills in the United States
- ❖ The cost to build new landfill can be greater than \$500,000,000 and can take more than ten years to build
- ❖ Landfill tipping fees are increasing dramatically due to increased value of landfill airspace
- ❖ Organics and missed recyclable materials must be diverted, and could help extend the life of landfills from 15% - 150%



Necessity of Organics Diversion

- ❖ Organic materials are the largest component of MSW, accounting for as much as **50%** of the waste stream
- ❖ Due to high levels of organic material decomposing anaerobically, landfills are the **third largest source of methane emissions** in the United States
- ❖ Methane is a potent green house gas with **21x** the warming potential of carbon dioxide



Total MSW Generation 2013
254 million tons (before recycling)

Source, US EPA

Barriers to Traditional Recycling

Consumer Confusion

- ✧ Acceptable items vary greatly from place to place
- ✧ Unidentified plastics, mixed materials, often end up in trash or clogging up machinery

Organic Contamination

- ✧ Wet waste contaminates recyclables and requires costly cleaning procedures

On average
\$11.4 billion worth
of recyclable
materials end up
in US landfills
every year

Source: LA Times

Source Separation Advantages

Clean MRF

- ✧ Material entering a clean MRF typically weighs 50 to 100 pounds per cubic yard
- ✧ More than 90% of the material entering a clean MRF is processed and made ready for sale

Dirty MRF

- ✧ Material entering a dirty MRF weighs about 350 pounds per cubic yard
- ✧ A dirty MRF recovers between 5% and 45% of the incoming material as recyclables, then the remainder is landfilled

A New Two Bin System

Separate “wet waste” from “dry waste” for easier processing

Clearer identifying principals

Great opportunity to pull recyclables from the waste stream

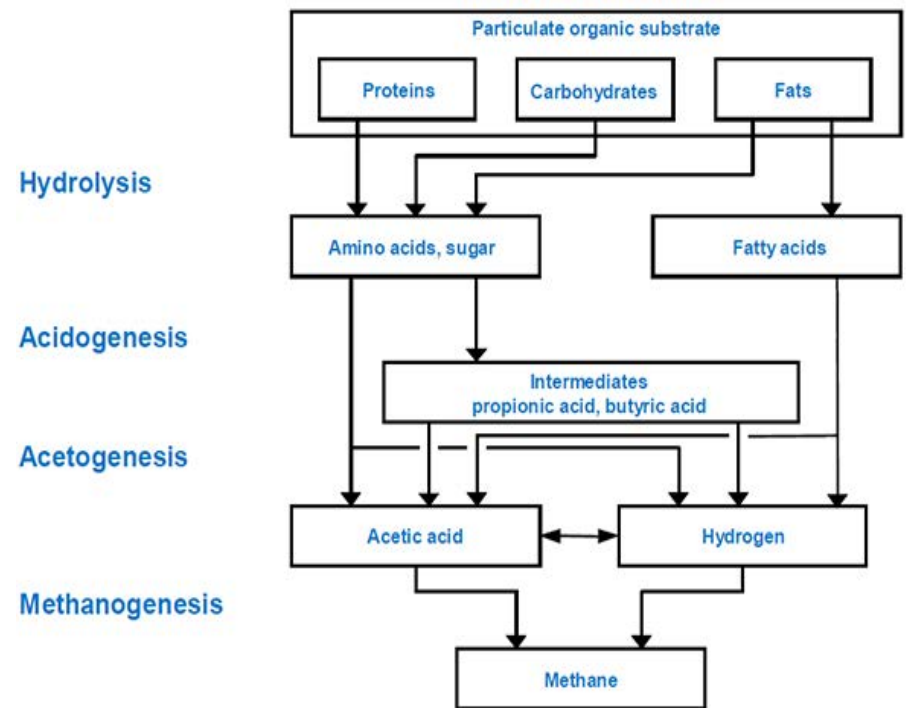
Eliminates need for dirty MRFs and increases total return on items collected

What is Anaerobic Digestion?

Anaerobic digestion is a process where bacteria break down organic matter in a controlled environment (vessel, tank, concrete structure) in the absence of oxygen.

The decomposition of biodegradable waste occurs in four stages:

- 1) Hydrolysis
- 2) Acidogenesis
- 3) Acetogenesis
- 4) Methanogenesis



Co-digestion and Feedstock Materials

In agriculture, co-digestion is often used to increase methane production from the anaerobic digestion of manure. There are multiple choices for co-digestion feedstocks, including:

- Food Waste
- Brewery waste
- Restaurant or cafeteria food wastes
- Food processing wastes or byproducts
- Fats, oil and grease (FOG) from restaurant grease traps
- Energy crops

Some consideration must be given to mixing of the feedstocks to create a homogenous feed to the digester

Things to consider when choosing co-digestion feedstocks:

- Local availability and cost
- Moisture and total solids
- Mixing and particle size
- Gases that suppress bacteria
- Nutrient balance (C:N ratio) ideal carbon to nitrogen ratio 20:1 to 30:1
- Digester capacity
- Permitting
- Biodegradability
- pH

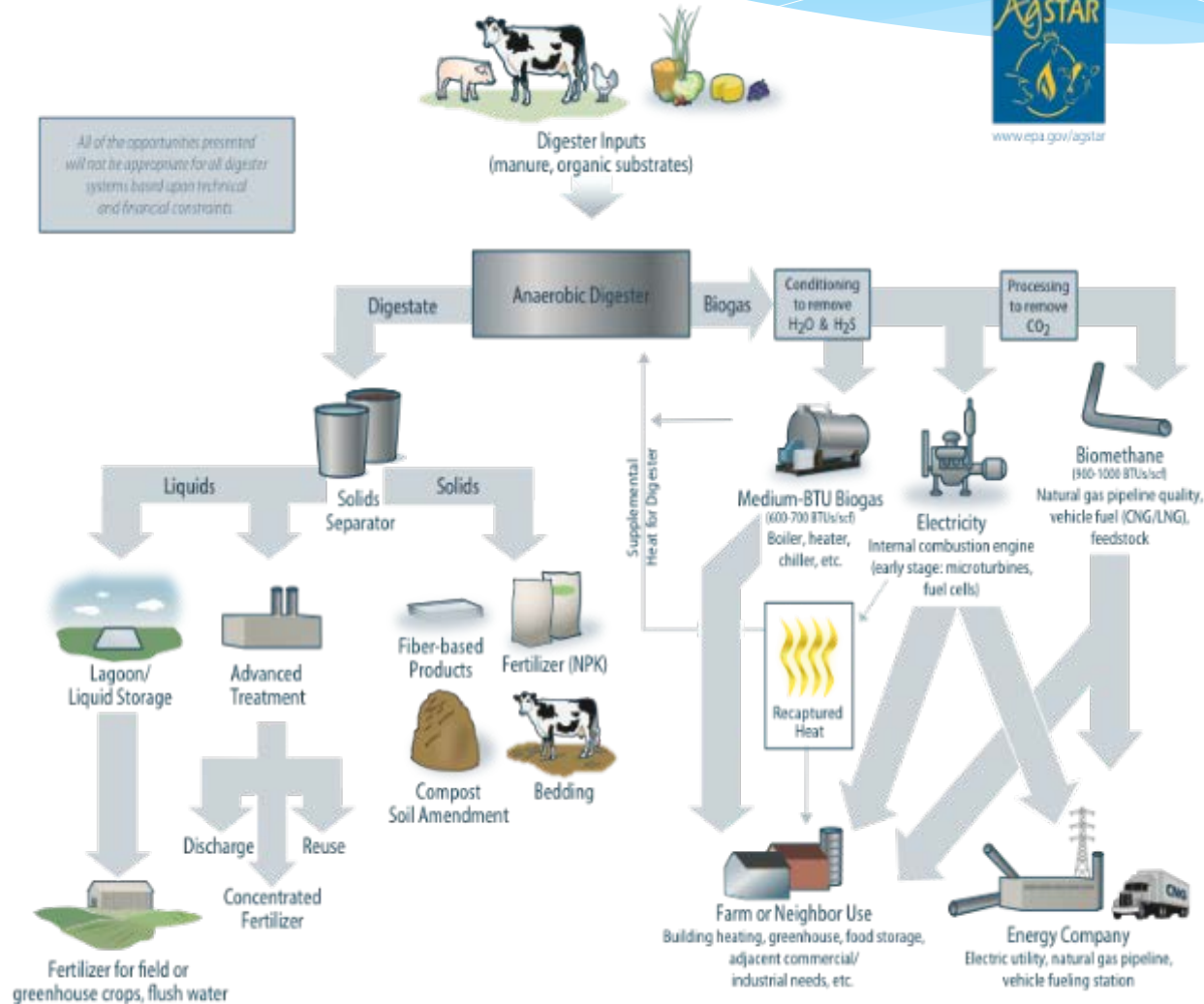
Anaerobic Digestion Flow Process

Basic Anaerobic Digester System Flow Diagram



www.epa.gov/agstar

All of the opportunities presented will not be appropriate for all digester systems based upon technical and financial constraints.



Benefits of Anaerobic Digestion

- ✧ Can handle a wide variety of materials on a large scale
 - ✧ Food waste
 - ✧ Animal excretions
 - ✧ Biosolids
- ✧ Low maintenance
- ✧ 24 hour operation
- ✧ Biological pathogens eliminated through process
- ✧ Capture methane to generate renewable energy (CNG, Electricity)
- ✧ Inert digestate can be used for composting and other uses



DVO Mixed Use Digester

Alternative Processing Methods

Feeding Animals



Vermicomposting



In-Vessel, Rapid Decomposition



Path to Zero Waste

- Zero Waste is often thought of as a pipe dream, but the possibility is closer than ever
- Municipalities are engaging in new collection and processing systems
- Zero Waste can never be achieved without the diversion of food waste and organics from the rest of the waste stream
- Infrastructure for getting to Zero Waste is becoming available in new regions and is growing in popularity
- Anaerobic Digestion will be a growing process for handling organics and food waste along with many other waste streams
- AD compliments composting to handle larger volumes of material

Call to Action

- Education of advancements in waste diversion is critical
 - Legislators need to know what is available today
 - Failed systems and technologies of the past must be left behind
 - Waste generators find this to be a very easy transition process
 - Wet / Dry separation has been proven very successful and must be duplicated nationwide
 - We must support pending legislation like HR4184 – Food Recovery Act of 2015. Contact your Senator and Representative
 - EPA has a goal of 50% Food Waste diversion by 2030
 - With Anaerobic Digestion and Composting processing all of our “Wet” waste, we can eliminate the need for landfills in the future.



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