Co-Digestion Economic Analysis Tool (CoEAT)

United States Composting Council

January 25, 2011

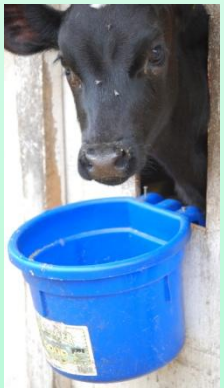
Santa Clara, CA

“Because you have to CoEAT before you co-digest…”

- EPA Focus on Co-Digestion
- Overview of CoEAT
- How CoEAT Works

EPA Region 9 and Organic Waste

- Focus on food waste
  - Anaerobic Digestion
  - Composting
  - Source Reduction
- Internal Biogas Work Group
  - Focuses on cross-media environmental benefits and issues




Why Divert Food Scraps and Fats, Oils, & Grease (FOG)?

- Food is over 20% of materials reaching landfills
- Diverting FOG from sanitary sewer system reduces overflows
- Reduce GHG Emissions
- Use materials as resource to create compost or renewable energy

Anaerobic Digestion

Stand-Alone

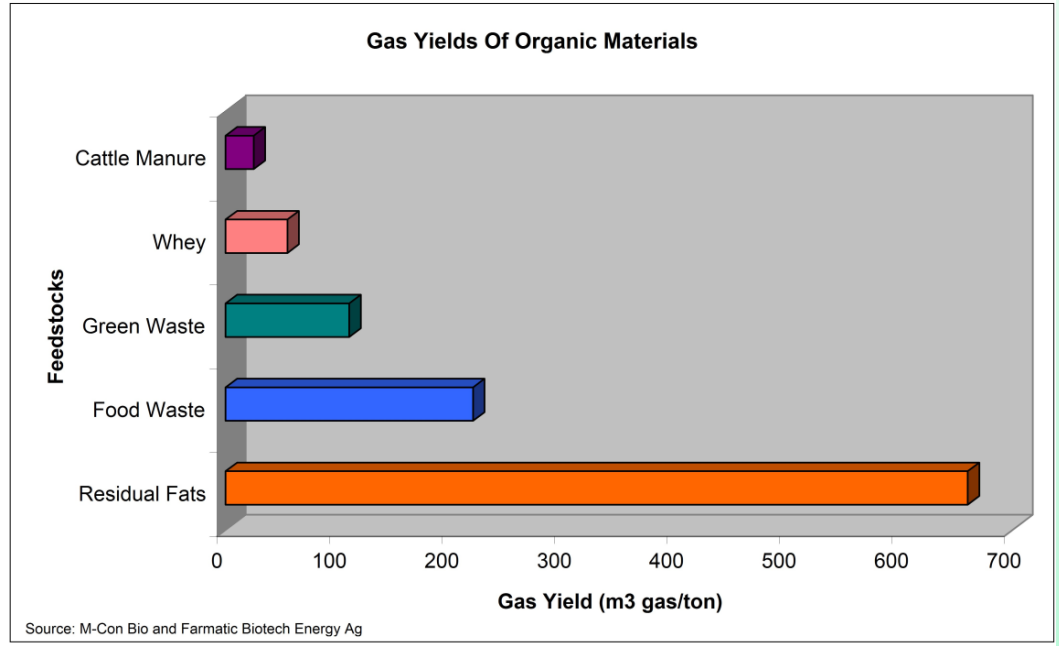
- Permitting Tool-Kit (Humboldt Waste Management Authority)
- Waste to Biogas Mapping Tool

Co-Digestion

- Co-Digestion Economic Analysis Tool (CoEAT)
- Waste to Biogas Mapping Tool
- EBMUD Project

Why Co-Digestion?

- Existing infrastructure with excess capacity
- Existing expertise
- Renewable energy



Purpose of CoEAT

- ***Initial*** economic feasibility of co-digesting food scraps and FOG at wastewater treatment plants

- Model intended for WWTFs with excess capacity, but pre-existing digesters are not required

- Designed for decision-makers with significant technical expertise

http://www.epa.gov/region9/coeat

Co-Digestion Economic Analysis Tool (CoEAT)

GENERATION

Feedstock Quantity
- **Food Waste**
  - Commercial
  - Industrial
  - Residential
- **Fats, Oils, & Grease (FOG)**

Contamination Rate

Avoided Methane Emissions from Landfill

COLLECTION

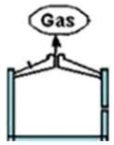
Collection Infrastructure
- Fuel Costs
- **Collection Bins**
- **Collection Trucks**

Feedstock Disposal/ Access Fees
- **Landfill Tipping Fees**
- **Feedstock Access Costs**
- **Tipping Fee at Digester**

PRE-PROCESSING

Pre-Processing Infrastructure
- Equipment
- Operations & Maintenance

DIGESTION



Digestion Infrastructure
- Excess Capacity
- Needed Capacity
- Ancillary Equipment

Operations & Maintenance
- **Repair, Cleaning, etc.**
- **Labor**

DISPOSAL

Residual Management
- Landfill
  - Tipping Fees
- Land Application/Composting
- Fuel Costs

ENERGY GENERATION

Biogas Quantity On-Site Use (IC Engine)
- -Replacement of On-Site Energy
  - -Electricity
  - -Natural Gas

NOT INCLUDED IN MODEL

Avoided Transportation to Landfill

O&M of Collection Vehicles

Off-Site Pre-Processing

Additional Water Costs

Note: This tool models wet digestion at a wastewater treatment plant. Dry digestion is not included in this model.

Biogas Off-Site Use

Biogas Cleaning

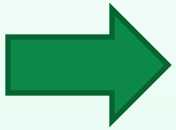
Air Emissions Reduction

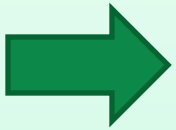
Greenhouse Gas Emissions Reductions from Renewable Energy Generation

http://www.epa.gov/region9/coeat

Inputs and Outputs

- Food Waste Feedstock
- Existing Infrastructure
- Pre-Processing Needs
- Financial Data





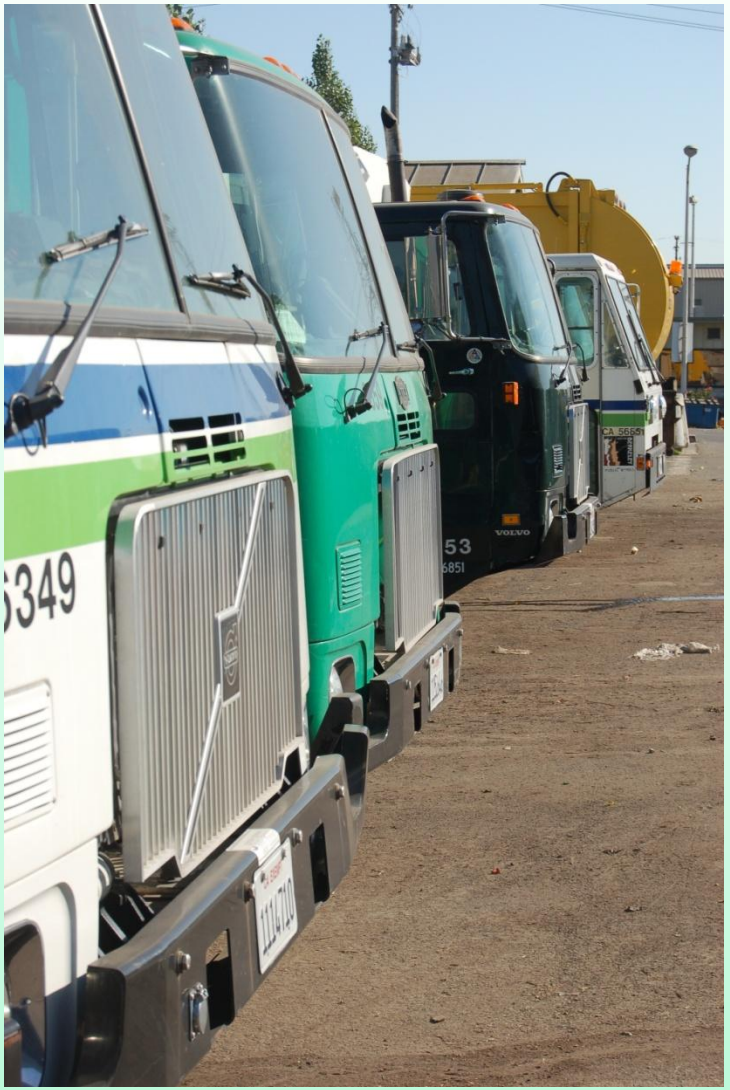
- Fixed and Recurring Costs
- Solid Waste Diversion Savings
- Capital Investments
- Biogas Production & Energy Value
- Methane Reductions from Landfills

Input - Food Waste Feedstock

- Residential Food Scraps
- Commercial Food Scraps
- Fats, Oils, and Grease (FOG)
- Food Processing Wastes

Input - Existing & Needed Infrastructure

- Existing Digester Information
  - Excess capacity?
- Feedstock Collection
  - Bins, Trucks, Tipping Fees, etc.
- Labor Costs



Input - Pre-Processing Needs

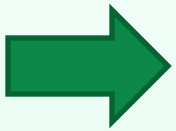
- Needed Equipment
  - User can select equipment needed

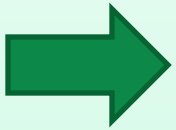
Input - Financial Data

- Investment Rates
- Current Electricity Costs
- Current Natural Gas Costs

Inputs and Outputs

- Food Waste Feedstock
- Existing Infrastructure
- Pre-Processing Needs
- Financial Data





- Fixed and Recurring Costs
- Solid Waste Diversion Savings
- Capital Investments
- Biogas Production & Energy Value
- Methane Reductions from Landfills

Not Included in the Model

- Avoided Transportation to Landfill
- O&M of Collection Vehicles
- Off-Site Pre-Processing
- Additional Water Costs
- Biogas Cleaning
- Biogas Use other than IC Engine
- GHG Reductions from Renewable Energy Production

NOTE: Additional costs can be added to misc. cost section

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#DIV/0!	[ft³ of biogas/day]	>>For informational purposes, this is the potential cubic feet per day of biogas available
#DIV/0!	[MMBtu/yr]	>>For informational purposes, this is the potential MMBtu per year available

Part 2 - Solid Waste and Wastewater Infrastructure

Existing Anaerobic Digester

>>Does your wastewater treatment plant already have an **anaerobic digester**?

No >>If **no**, skip this section and go to the next section. Also select "No" if you will build a separate digester to process food waste.

Please scroll down for more user inputs

>>If **yes**, enter the **size, effective capacity and number** of existing anaerobic digester(s):

Diameter [ft]	Height [ft]	Effective Operating Capacity [%]	Number
0	0	0%	0

>>If **yes**, enter how many million gallons of municipal wastewater are available per day. Enter specific amount for your facility or an amount based on tthe US average range of between 75-150 gallons per capita/day.

0 [million gal/day]

Avoided Greenhouse Gas Emissions at the Landfill

>>In the absence of co-digestion, does your food waste go to landfill?

No >>If **no**, skip the rest of this section and go to the next section.

Scroll down for more user inputs

>>If **yes**, indicate what type of landfill gas control technology exists at the landfill where the food waste is disposed.
>>If you do not know, please choose the first option which is the weighted national average for landfill gas recovery (approximately 44%).

National Average	No Landfill Gas Recovery	Landfill Gas Flared	Landfill Gas Recovery
No	No	No	No

0.00 >>**This is the quantity of avoided greenhouse gas emissions from landfill according to the U.S. EPA WARM model and expressed as metric tons of carbon dioxide equivalents [metric tons CO2e] for the lifetime of the material**

>>If you would like to calculate a *preliminary* estimation of carbon offsets available according to the Climate Action Reserve's Organic Waste Digestion (OWD) protocol, please indicate the regional climatic conditions.

Temperate, Dry	Temperate, Wet	Tropical, Dry	Tropical, Wet
No	No	No	No

0.00 **period**

Food Waste Pickup

>> If you are sourcing household food waste, you need to provide collection bins. Input the cost of providing green bins to *each household*.

No >> $0 *[$/household]* ***Should be zero if bins have already been provided to households.***

Yes/No *$###,###,###*

$0 >>**This is the cost of providing green bins to households.**

>>If you are sourcing food waste from the establishments indicated in Option 2 of the Food Waste Feedstock Estimate, then you need to provide collection bins.
Input the cost of providing an *appropriate number (may be more than one bin)* of collection bins to *each establishment*.

USER INPUTS PAGE

Overview | **User Inputs** | 1. Feedstock Parameters | 2. Food Waste Feedstock Data | 3. Transportation & Processing | 4. Preproc. & Ancillary Equip. | 5. Digester Sizing | 6. F

Ready | 70%

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Co-Digestion Economic Analysis Tool (CoEAT)

EPA Region 9 - Pacific Southwest Region

Digester Sizing

This worksheet calculates the number of digesters needed to support feedstock input and potential biogas production from two feedstocks: (1) food waste and (2) waste

The numbered worksheets contain assumptions and default values that provide the underlying functionality of the Model. Once familiar with the inputs, outputs and data used to calculate values, users can customize the Model by modifying data in the rest of the worksheets.

VS = volatile solids
TS = total solids
MCRT = mean cell residence time

SUPPORTING WORKSHEET

Feedstock Parameter	Value	Units	Source
Food Waste Mass	-	short tons/day	
Food Waste Biogas Yield	6.65	ft³ CH^4/lb TS	
Food Waste Total Solids	#DIV/0!	solids	
Food Waste VS	#DIV/0!	of total solids	
Food Waste % of Total Waste	#DIV/0!	total substrate	
Weighted Total Feedstock Loading (TS)	-	lbs/day	
Weighted Total Feedstock Loading (VS)	#DIV/0!	lbs/day	
Wastewater Solids Mass	-	short tons/day	
Wastewater Solids Yield	2.12	ft³ CH^4/lb TS	
Wastewater Total Solids	1.00%	solids	
Wastewater VS	70.00%	of total solids	
Wastewater % of Total Waste	#DIV/0!	total substrate	
Weighted Total Feedstock Mass	-	short tons/day	
Weighted Total Feedstock Yield	#DIV/0!	ft³ CH^4/lb TS	
Weighted Total Feedstock Concentration (% TS)	#DIV/0!	solids	http://www.epa.gov/region09/waste/organics/ad/EBMUDFactSheet.pdf
Weighted VS Content of Total Feedstock	#DIV/0!	volatile solids	

Why Use CoEAT?

- Gives initial economic feasibility
  - Is a project financially feasible? Should more resources be put in to better understand viability?

- Gives list of different things to consider for a co-digestion project

- Helps provide estimate of available feedstock (food and FOG).

QUESTIONS?

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