P. Ulloa, "Overview of Food Waste Composting in the U.S." Internal Report, Earth Engineering Center, Columbia University, July 2008.

Overview of Food Waste Composting in the U.S.

According to the State of Garbage, in 2006, forty-six of the fifty states reported tonnage data for "recycled" (composted or mulched) organics, including yard trimmings and food residuals, and/or wood (non-C&D). The total tonnage of organics composted or mulched was 20,368,139 tons in 2006 [1]. This amount represented 5% of estimated Municipal Solid Waste (MSW) generated in the U.S. (387 million tons).

Food Waste in the United States

Residential Food Waste

Waste composition analyses show that food waste is 12.4% of the total municipal solid waste as Figure 1 shown [2].

Table 1 provides the quantity of organic waste composted currently in the U.S. Also, it shows the quantity of food waste generated about 48 million tons per year, but only 0.68 million tons of food waste is composted annually, which represents only 1.4% of the total food waste generated in the United States.

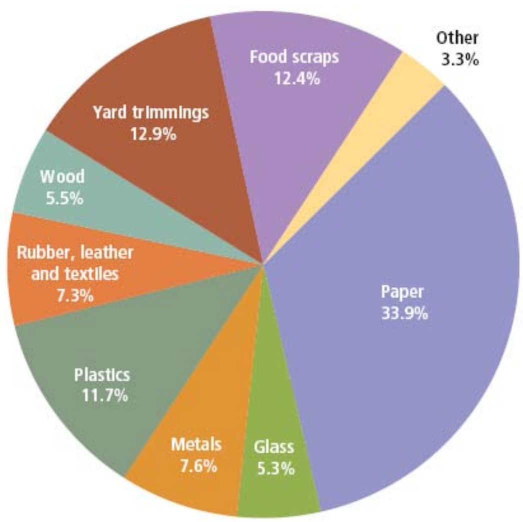

Figure 1. Current MSW Composition by Material (before recycling)

Table 1. Data and Estimates of Residential Food Waste in the Unites States

MSW Generated[1]	tons	387,855,461
Total Quantity of Organics Composted (including yard trimming, MSW, and SSO)[1]	tons	20,368,139
Percentage of Organics Composted of the total MSW Generated	%	5.3%
Percentage of Food Waste[2]	%	12.4%
Estimated Quantity of Food Waste	tons	48,094,077
Reported Quantity of Food Waste Composted[2]	tons	680,000
Proportion of Food Waste Captured	%	1.4%

[1] Simmons et.al., BioCycle, SOG 2006; [2] EPA, 2006

EPA Food Waste Challenge

EPA reported that the amount of food waste composted was 680,000 tons in 2005. And, EPA expects to double the amount of composted food waste at 1.28 million tons in 2008 [2, 3].

Commercial Food Waste

The amount of commercial food waste that is composted has not been found. However, the waste composition of several commercial food waste generators is presented as follows [3]:

- Full Service
  - 66% are food scraps
  - 5% "compostable paper"
- Fast Food
  - 52% food scraps
  - 12% "compostable paper"
- Grocery Stores
  - 65% food scraps
  - 6% "compostable paper"
- Large Hotels
  - 44% food scraps
  - 7% "compostable paper"

According to Goldstein food waste, by weight, is one of biggest categories in waste composition surveys. Also, food waste is highly putrescible, and when food waste is disposed in a landfill is a greenhouse gas contributor [3]. Therefore, it is necessary to divert food waste from landfills using the most efficient and reliable technology currently available, e.g. in-vessel composting or anaerobic digestion technology.

Mixed Municipal Solid Waste Composting Facilities

Currently, there are twelve operating composting facilities that process Municipal Solid Waste (MSW) in the United States according to Spencer [4]. In 2007, two MSW composting facilities switched to source separated organics: Pinetop-Lakeside, Arizona; Dodge County, Minnesota. Besides, Sevierville MSW composting facility is currently not composting due to major facility fire in May 2007.

All MSW composting facilities are owned by a municipality and three of them are privately operator. Also, MSW composting facilities use different composting systems. Seven of these facilities use rotary drum digesters upfront. Some MSW composting facilities co-compost with biosolids, e.g. Delaware County.

Table 2 shows location, composting system and tonnage of each operating MSW composting facilities in the U.S. Their tonnage varies from 3,000 to 92,400 tons annually. Their total tonnage was 393,475 tons in 2007. However, the total amount of food waste processed would be only 48,791 tons considering the percentage of food waste in MSW, i.e. 12.4%.

Table 2. Mixed MSW Composting Facilities in the United States

Location	State	Ownership/ Operator	System	Throughput tons MSW/yr
Gilroy	CA	Private/Z-Best	Enclosed ASP (Ag Bag)	92,400
Mariposa County	CA	Municipal	In vessel (SV Composter/ECS)	19,800
Cobb County	GA	Municipal	Rotating drum/aerated windrow (Bedminster)	66,000
Marlborough	MA	Municipal/WeCare Environmental	Rotating drum/aerated windrow (Bedminster with Allu turner)	34,000
Nantucket	MA	Municipal	Rotating drum/aerated windrow (Bedminster)	25,575
Truman	MN	Municipal	In-vessel (OTVD)	21,450
West Yellowstone	MT	Municipal	In-vessel (SV Composter-ECS)	3,000
West Wendover	NV	Municipal	Rotating drum/aerated windrow	8,250
Delaware County	NY	Municipal	Rotating drum w/agitated bays (Conporec/IPS-Siemens)	24,000
Medina	OH	Municipal/Norton Enviromental	Windrow	14,850
Rapid City	SD	Municipal	Rotating drum/agitated bays (Daro/IPS-Siemens	59,400
Columbia County	WI	Municipal	Rotating drum/windrows	24,750
Total				393,475
Food Waste (@12.4%)				**48,791**

Source: Spencer (2007), BioCycle, Nov. 2007, Vol. 48, No. 11, p. 22. The throughput was originally reported tons/day; hence, the tonnage was converted to tons/year by multiplied by 330 days/yr.

Source Separated Organics Composting Facilities

Currently, there are 30 municipalities with source separated organics (SSO) programs in the United States:

- 15 in California
- 10 in King County, including Seattle
- 4 in Minnesota
- 1 in Michigan

Also, there are twelve operating composting facilities that process residential source separated organics (SSO) that include household organics beyond yard trimmings in the U.S. [5]. Most of these facilities are yard trimmings composting facilities receiving SSO. Table 3 shows location, composting system and tonnage of each operating residential SSO composting facilities in the U.S. Their tonnage varies from 24 to 264,000 tons of SSO (including yard trimmings) processed annually. The total tonnage was approximately 0.56 million tons of SSO in 2007. The largest composting facility that process residential SSO is Community Recycling and Resource Recovery, Lamont, California. It should be noted that the total amount of food waste processed would be lower because most tonnages reported included yard trimmings. However, three facilities reported the amount of food waste: Creekside Organic Materials Processing Facility (2,500 cubic yards of SSO and 30,000 cubic yards of yard trimmings), Western Lake Superior Sanitary District (24 tons food waste, 297 tons yard trimmings, 1000 tons OOC), and Cedar Grove Composting Everett (50,000 tons of food waste and 300,000 yard trimmings).

Table 3. SSO Composting Facilities in the United States

Name Facility	Location	State	System	Throughput tons SSO/yr
Z-Best Composting	Gilroy	CA	Versa aerated bags; windrow	74,250[1]
Allied Newby Island	San Jose	CA	Green Mountain Tech in-vessel	16,500[1]
Community Recycling & Resource Recovery	Lamont	CA	Windrow	264,000[2]
Grover Environmental	Modesto	CA	Windrow	69,000[3]
Jepson Prairie Composting Facility	Vacaville	CA	Ag-Bag; windrow	45,000[3]
Mackinac Island Facility	Mackinac Island	MI	Aerated static pile	836[4]
Resource Recovery Technologies	Empire Township	MN	Versa aerated bags; windrow	630[5]
Creekside Organic Materials Processing Facility	Hutchinson	MN	Green Mountain Tech in-vessel; windrow	613[5]
Swift County	Benson	MN	Windrow	2,000[5]
Western Lake Superior Sanitary District	Duluth	MN	Windrow	24[5]
Cedar Grove Composting	Maple Valley	WA	Gore Cover System/ Aerated static pile	40,000[6]
Cedar Grove Composting	Everett	WA	Gore Cover System/ Aerated static pile	50,000[7]
Total				**562,853**

Source: [1]BioCycle Dec. 2006, Vol. 47, No. 12, p. 26; [2] BioCycle Dec. 2007, Vol. 48, No. 12, p. 23; [3]http://www.sacgreencycle.com/reports/green%20waste%20study/Table_4-FacilitiesTable.pdf; [4]http://www.aqmd.gov/rules/doc/r1133/app_a_aspcomp.pdf; [5] BioCycle Dec. 2007, Vol. 48, No. 12, p. 27; [6] Gore Cover System facilities information sent by Brian Fuchs, April 14, 2008;[7]Morton Barlaz, NCSU Trip Report, June 8, 2008.

Enclosed Aerated Static Piles

Table 4 summarizes eight vendors that offer two different approaches to aerated static pile composting contained in some type of vessel. The simplest systems are those that use some type of plastic bags or breathable fabric cover to contain the organic material, and provide mechanical aeration. The other subgroup is mechanically aerated rigid containers, such as metal rolloff container modified for composting, or a larger concrete or metal chamber or tunnel. These containers got their start in the mushroom growing industry. There are also vertical containers, with one vendor offering a passively aerated system, and the other a mechanically aerated system [6].

Table 4. Enclosed Aerated Static Piles

Vendor	*Years On Market*	*Description*	*Distinguishing Characteristics*	*New Features/ Applications*	*Materials Processed* [2]	*Dimensions*	*Load/ Unload*	*# Of Plan*
Christiaens Group	30[1]; 17 w/ MSW[2]	Tunnels, aerated through floor	PLC[3] tunnel climate control of temperature, oxygen, and moisture	Partnership with Canadian company for turnkey operations	MSW, BS,FW, GW, AW	4m x 20m, and 8m x 56m	Loaders, or automated	13 since 1994
Engineered Compost Systems	10	Stationary vessel, containerized vessel, and fabric covered aerated static pile systems	Modular systems customized to site and application	Cold weather package for -30°C; Stainless steel interiors; Wireless temperature probes	MSW, BS, FW, GW	SV Composter: 35 ft wide x 120 ft long	Semiautomated vessel loading conveyor system	14
Gore Cover System	15	Fabric windrow cover, aeration system, computer controlled	Breathable, waterproof, windproof fabric covers with cover handling system	Ice/snow melt system in concrete pad	MSW, BS,FW, GW, AW, MBT, AD digestate	Each windrow is 165 ft long x 26 ft wide x 10 ft high	Loaders	150
NaturTech	13	Sequential intermittent containerized batch system	Temperature controlled aerobic process; dual neg./pos. aeration system	Used as shipping containers to compost in transit; Plastic aerated flooring; Replaceable insulation liner	BS, FW, AW, forest products, DAF[2] solids.	20 ft or 40 ft intermodal shipping containers	Loaders and rolloff truck	11
Poly-Flex	6	Large plastic "tubes" filled with organic waste	Positively aerated with two perforated plastic pipes	na[4]	Residential, commercial organics	5 ft x 200 ft, and 10 ft x 200 ft	Loaded by means of a moving press	na
Transform	8	Aerated bunker system	2-3 weeks in 1st bin, 2-3 weeks in 2nd bin	Airfloor aeration system w/ leachate collection	BS, FW, animal by-products	Custom built	Loader or conveyor	1
VCU	10	Vertical, aerobic reactor; 7 to 14 day retention time.	Passively aerated by heat rising through chamber, pushing temperatures in the top to over 70°C	Two new solar-powered models to come on market in 2007	BS, FW, GW, WWTP grit, animal by-products, AD sludge	3m x 3m x 5m	Automated loading into top of chamber, automated harvest from bottom	38
Versa	17	Elongated plastic bag with aeration	Diesel-powered bagger fills bags	na	MSW, BS, FW, GW, AW	350 ft long x 10-14 ft diameter	Loaded by compost bagging machine; unloaded by wheel loader	4

[1]Started in 1977 with mushroom industry. System started being used for MSW 17 years ago; [2] MSW=municipal solid waste; BS= biosolids; FW= food waste; GW= green waste; AW= agricultural waste; MBT= mechanical-biological treatment; AD=anaerobic digestion; DAF= dissolved air flotation, Vol. 48, No. 12, p. 23; [3]PLC= programmable logic controller; [4]na=not available

APPENDIX

1. GORE Cover System

W.L. Gore & Associate's "GORE Cover System" experience gained through installations in more than 150 plants in more than twenty different countries worldwide. In total, more than two million tons of organic wastes are treated in sites with annual throughput capacity of 3,000 to 260,000 tons. Currently, GORE Cover System has four facilities in the Unites States as Table 1 shown. The largest facility is located in Everett, Washington. And, another facility is going to be built in Los Angeles, California, with a capacity of 200,000 tons of biosolids per year to enter in operation in 2010 [GORE Cover Systems Facilities information sent by Fuchs, GORE Cover Systems, bfuchs@wlgore.com, April 14, 2008].

Table 1. GORE Cover Systems SSO facilities in the United States

Location	Capacity (tons/yr)	Start-up	Partner Company	Feedstock
Lynden, WA	10,000	2002	UTV	Green, Food & SSO
Maple Valley, WA	40,000	2003	UTV	Green, Food & SSO
Everett, WA	160,000	2005	UTV	Green, Food & SSO
Delaware, DE	3,000	2006	UTV	Green, Food & SSO
TOTAL	213,000			

SSO: Source Separated Organics

2. Siemens IPS Composting System

The IPS Composting System (IPS) is an enclosed automated, agitated bin technology that converts biosolids, Source Separated Organics (SSO), Municipal Solid Waste (MSW), and other organic residuals into high quality compost products. IPS also stabilizes residual waste in Mechanical Biological Treatment.

> IPS provides the primary active composting system for biosolids, SSO, and green waste. When combined with pre-processing equipment, IPS is used as the fermentation or maturation stage for MSW composting and as the reduction and stabilization process in Mechanical Biological Treatment. And, there are 27 IPS composting facilities worldwide that includes eight facilities in the U.S. as Table 2 shown, but only one facility processes food waste and kitchen scrap, and the Delaware County processes MSW [Siemens website, IPS technology, http://www.water.siemens.com/en/Product_Lines/Microfloc_Products/Microfloc_Products/Pages/ips_composting_system.aspx]

Features:

- Automated, agitated bin process
- Totally enclosed composting system
- Modular system
- Multiple deep aerated bays utilizing smaller footprint
- CompMaster® Computer Control
- Meets US EPA Class A and Vector Attraction Reduction
- Composts biosolids, manure, green waste, MSW, food residuals and other SSO
- Stabilizes residual waste in Mechanical Biological Treatment

Table 2. IPS System Facilities in the United States

Location	**Owner**	**Capacity (cu. yd./day, unless noted)**	**Start-up**	**Feedstock**
Bennington, VT	Town of Bennington	60	Oct. 1992	Biosolids w/sawdust
Burlington, NJ	Burlington County Board of Chosen Freeholders	700	May. 1998	Biosolids w/wood waste & yard waste
Delaware, NY	Delaware County Dpt. of Public Works	200	Sept. 2005	MSW (42,000 tons/yr) & biosolids
Goldsboro, NC	City of Goldsboro	250	Dec. 2002	Biosolids w/yard waste
Calabasas, CA	Las Virgenes Municipal Water District	120	Feb. 1994	Biosolids w/shredded wood waste
Rikers Island, NY	New York City Department of Sanitation	30	Oct. 1996	Food waste & kitchen scraps
Rockland, NY	Rockland County Solid Waste Management Authority	110 wet tons biosolids	Feb. 1999	Biosolids w/clean wood
State College, PA	University Area Joint Authority	75 wet tons/day	Feb. 1992	Biosolids w/ waste sawdust

P. Ulloa, "Overview of Food Waste Composting in the U.S." Internal Report, Earth Engineering Center, Columbia University, July 2008.

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2. EPA (2006), Municipal Solid Waste Generation, Recycling and Disposal in the United States, Facts and Figures for 2006, http://www.epa.gov/garbage/pubs/msw06.pdf].
3. Nora Goldstein (2007), Executive Editor BioCycle, "State of Organics Recycling in the United States", October 18, 2007, presentation for US EPA, http://www.scribd.com/doc/1978815/Environmental-Protection-Agency-Oct18-2007-Organic-Recycling
4. Robert Spencer, Rhodes Yepsen and Nora Goldstein (2007) BioCycle, "Mixed MSW Composting in Transition", Part I, November 2007, Vol. 48, No. 11, p. 22
5. Rhodes Yepsen and Nora Goldstein (2007), BioCycle, "Source Separated Residential Composting in the US", Part II, December 2007, Vol. 48, No. 12, p. 27

Robert Spencer (2007), BioCycle, "What's New In-Vessel Composting", May I. Introduction and Objectives

II. Residential and Commercial Generation of Food and Green Wastes

III. Technologies for Green and Food Waste Biodegradation

A. Aerobic Technologies

B. Anaerobic Technologies

IV. State-of-the-Practice in North America

Describe and critically analyze facilities visited as well as other major facilities that are important. Do they generate a saleable product and is it sold? What benefit does it provide? Are there odor issues? Are there residuals and how are they managed? Is there a need to calculate/sell carbon and diversion credits? What policy incentives are in place?

V. Market Analysis

VI. Life-Cycle Analysis of Green and Food Waste Diversion

VII. Review of Greenhouse Gas Emissions from Green and Waste Composting.

VIII. Research Needs

P. Ulloa, "Overview of Food Waste Composting in the U.S." Internal Report, Earth Engineering Center, Columbia University, July 2008.

6. 2007, Vol.48, No. 5, p.21.