SMALL-SCALE ON-SITE ORGANIC WASTE PROCESSING TECHNOLOGIES

Small scale technologies designed for on-site management of organic waste include anaerobic digesters, in-vessel aerobic composters, dehydrators, and liquefiers. These technologies may provide suitable solutions for County facilities, businesses, and commercial establishments to comply with the organic waste recycling requirements of Assembly Bill (AB)1826 and Senate Bill (SB)1383 respectively.

Information for these small-scale technologies has been compiled from readily available public sources. In some cases, supplemental information has been provided by the technology companies. The tables below identify technologies that may be suitable for on-site management of organic waste. Please see the small-scale technologies categorized below:

- **Small-Scale Anaerobic Digesters –** Anaerobic digesters convert food waste and/or green waste to biogas along with a liquid and/or solid fertilizer (digestate) may also produce effluent requiring disposal. The attached table includes three companies offering small-scale anaerobic digesters suitable for use in commercial applications.

- **In-Vessel Aerobic Composters –** In-vessel composters convert food waste and/or green waste to compost. The systems are fully enclosed, continuous-feed operation, and usually specify the use of wood chips or other carbon-based bulking agents to be co-fed with the food waste. Food waste and/or green waste is typically fed into one end of the composter and is slowly agitated and aerated decomposing as it moves along the length of the composter. Compost is removed from the opposite end. The attached table includes seven companies offering small-scale in-vessel aerobic composters.

- **Dehydrators –** Dehydrators use heat to remove moisture from food waste providing a volume reduction of approximately 90 percent and creating a dry, pulpy residual material. Dehydrators slow the decomposition process and allow food waste to be stored for a longer period of time. This technology would require business owners to verify with CalRecycle as to whether it is eligible to qualify for AB 1826 compliance. The attached table includes five companies offering dehydrators.

- **Liquefiers –** Liquefiers typically break down food waste using mechanical grinders or shredders as a first step and then further break down the waste with the use of micro-organisms or enzymes and converts it into a liquid slurry. Liquefiers do not destroy pathogens nor create a stable product, so this technology would require business owners to verify with CalRecycle and the local sewer agency as to

whether it is eligible to qualify for AB 1826 compliance. Due to uncertainties in the ability of food waste generators to permit and utilize liquefiers to recycle food waste, liquefier technologies are not included in the table below.

The information provided herein is not exhaustive. There are also other larger-scale food waste processing technology options and distributors available that are not included here. If you are interested in using a small-scale technology to process organic waste on-site at your business or facility and would like more information, please contact Ms. Kawsar Vazifdar at (626) 458-3514 or kvazifdar@pw.lacounty.gov.

Technology Company (and/or Distributor) and Technology Description	Model(s)	Capacity	Space Requirements/ Approximate Dimensions (LxWxH in Feet)	Inputs[2] and Output[3]	Representative Installations	Equipment Price Range
ANAEROBIC DIGESTERS [1]						
Impact Bioenergy Inc Shoreline, WA www.impactbioenergy.com Containerized anaerobic digester unit that can be trailer, skid or truck mounted (portable and modular). Impact manufactures portable, prefabricated bioenergy systems that convert uneaten food scraps, liquids, and other organic waste materials into renewable natural gas and fertilizer with near zero waste. Energy can be in the form of building heat, hot water, radiant heat, light, electricity, vehicle fuel, and mechanical power Fertilizer can be liquid fertilizer, dried fertilizer, and compost. These systems can be off-grid, or grid-connected. They can be used in resiliency planning (water, heat, electric).	Horse AD 25 Series	Three models available: 135, 550, and 960 lbs/day waste input capacity	160 to 875 square feet	Output – liquid or dry fertilizer and biogas Electricity by engine or fuel cell generators available (1-9 KW) Inputs – pH control as necessary	8 units delivered 85,000 operating hours No odor complaints on record	$133,000 to $383,000 for base systems, inclusive of electricity generation [4]
	Nautilus AD 185 Series	Four models available: 1,000, 2,700, 5,000, and 8,200 lbs/day waste input capacity	650 to 3,400 square feet	Output – liquid or dry fertilizer and biogas Electricity by engine or fuel cell generators available (5-49 KW) Inputs – pH control as necessary	First installation under development in Washington State. Second in California. 4,000 operating hours No odor complaints on record	$449,000 to $1,552,000 for base systems, inclusive of electricity generation or CNG vehicle fueling [4]

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Living Arts Systems Crestone, CO www.livingartsystems.com Small-scale, solar-heated anaerobic digestion system; cast underground with concrete, except the smallest units (up to 2 lb/day) are plastic tanks delivered ready for use; system includes gas storage.	AART1 (Automated Anaerobic Reactive Technology)	Systems range from 1 lb/day to 200+ lbs/day	8'x20' footprint for 200 lb/day digester	Output – biogas, fertilizer, water Inputs – water as needed to slurry the food waste prior to digestion	Prototype (20 lbs/day) installed at Santa Fe Community College since 2012, looking for partner for next installation	Starting from $20,000 up to $75,000 for 200 lb/day unit with photovoltaic for power supply. Cost does not include electricity generation [5]

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SEaB Energy (trade name) **SEaB Power Ltd** London, UK www.seabenergy.com Patented Containerized anaerobic digestion process inclusive of digestate pasteurization. The system is housed in standard 20-foot shipping containers and is stackable and modular. Operation is automated with remote management and annual maintenance. US granted patents.	Flexibuster™ Muckbuster™	1,100 lb/day; expandable to 5,500 lb/day by adding modular digester units	36'x52' for 1,100 lb/day (unstacked orientation) and 36'x39' (stacked orientation) inclusive of mouth unit for loading and managing feedstock and power generation	Output – electricity (8 kW gross), heat, and liquid fertilizer Inputs – water as needed	Continente Supermarket, Gaia, Portugal FB24 installed in June 2016 to process out-of-date/damaged supermarket fresh foods; electricity and heat are used on site Units onsite at St Cloud State University, MN and Fortune 50 office, New York, NY Selected for grant-funded research project with U.C. Davis at Naval Base in Ventura County, CA (not installed)	$181,500 to $605,000 depending on size and configuration [6]

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IN-VESSEL AEROBIC COMPOSTERS						
BioGreen 360 Portsmouth, NH https://biogreen360.com/ Dry, aerobic onsite digester that eliminates 100% of food waste through a patented solution that couples customized microbial formulae with a unique evaporation system incorporating microwave technologies. With a brand name offtake partner, the BioGreen residual is turned into a natural fertilizer making it a fully closed loop solution. Not a batch loading system. Can be continuous feed or slug-loaded depending on needs/wants of end user.	BG300	300 lbs/24 hours, continuous feed	36”x36”x80”	Input – food waste; no bulking agents, additives, or water required. Output – steam, plus a dry, inert soil amendment that is turned into an all-natural fertilizer. Residual output is approx. 8-10% of original waste volume loaded every 24 hrs.	Being released end of Q3 2020. Released Q2 2021 Release Q4 2021	$500/mo or $15,000 capital sale [7]

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Susteco AB Gothenburg, Sweden www.bighanna.com **EC ALL Ltd (Distributor)** **eskil.eriksson@ec-all-ltd.com** In-vessel, aerobic composting machine of stainless steel fabrication. Waste is fed on a regular basis while system runs and is monitored by sensors. Continuous aeration and cycled rotation with automatic compost discharge. Optional equipment includes shredder, macerator/ dewaterer, bin lifter and biofilter.	BigHanna T60 BigHanna T120 BigHanna T240 BigHanna T480	44-79 lbs/day 94-157 lbs/day 126-378 lbs/day 252-756 lbs/day (Capacity varies depending on feedstock composition and characteristics, as well as how the machine is programmed and fed.)	7.5'x3.5'x5' 13'x4'x5' 16'x5'x7' 21'x6.5'x7.5'	Output –compost after 6-8 weeks in composter; company suggests storing compost in a covered bay to allow it to mature and mixing it with loamy soil prior to use. Inputs – wood pellets and/or sawdust	Installations in 30+ countries including at hotels, schools, prisons and housing complexes. U.S. installations for the Ohio Department of Rehabilitation and Correction and Akron Zoo in Akron, Ohio	$48,000 to $168,000 depending on model and excluding optional equipment [8]
FOR Solutions Newton, NJ 07860-4575 www.forsolutionsllc.com info@forsolutionsllc.com Aerobic, in-vessel rotary drum composting systems; stainless steel fabrication; mounted on a concrete pad and heated enclosed structure if necessary. Waste is fed on a regular basis (capacity based on loading five days per week), while the system operates continuously.	Model 500 Model 1000	Up 2,500 lbs./week Up to 5,000 lbs./week	26' x 5' x 11' 30' x 7' x 13'	Output – mature, stable, pathogen-free compost after five days in the digestion vessel; additional curing needed if packaging compost for retail Inputs – dried wood shavings, wood pellets, dried wood chips, or shredded cardboard	Model 500 is installed at Union County Vocational Technical School (NJ) and SYDED (Cahors, France). Model 1000 is installed at Kean University (NJ) and Princeton University	Model 500 - $200,000 Model 1000 - $250,000 Does not include delivery, installation, or site preparation [9]

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Green Mountain Technologies Bainbridge Island, WA www.compostingtechnology.com Green Mountain Technologies Bainbridge Island, WA www.compostingtechnology.com Automated, aerated, in-vessel, mid-size composting system; stainless steel vessel with greenhouse roof or hoop house enclosure; integrated auger shreds, mixes, aerates and moves material through the system; waste is fed on a regular basis while the system operates continuously, or it can be batch loaded to full capacity.	EF-20 EF-24 EF-20-IM EF-2008-SB EF-2010-SB Also, Site-Built Earth Flow systems available in various sizes (EF is short for "Earth Flow", the name of the system, IM is short for "Intermodal" The name of the model, SB is short for "Site Built")	0.8 tons/day 1.0 tons/day 0.7 tons/day 0.8 tons/day 1.1 tons/day Maximum total daily input capacity at 14 days retention	21'Lx8'-4"Wx10'H 25'Lx8'-4"Wx10'H 19'-10"Lx8'Wx9'-6"D 20'Lx7'-6"Wx4'D 20'Lx9'-6"Wx4'D	Output – mulch-like compost in 14-21 days; can be cured for 30-60 days outside of the vessel for use as soil amendment Supplemental Inputs – dry bulking agent such as wood chips, leaves, shredded weeds, wood shavings	38+ installations worldwide; case studies presented include University of Maine, Colorado State University, and Hey Day Farm (Bainbridge Island, WA)	$65,000 and up [10]
HotRot Organic Solutions Christchurch, New Zealand www.hotrotsolutions.com **Global Composting Solutions (Distributor)** Christchurch, NZ karen.ashby@globalcomposting.com In-vessel aerobic composting system; horizontal chamber of stainless steel fabrication; can be configured with feed hopper or bin lifter; periodic feeding (daily on evenly-spaced schedule) with continuous operation.	HotRot 1206	700-1,200 lbs/day	24'x5'x8'	Output – stable compost following 10-12 days residence time Inputs – Wood chips or woody green waste	Numerous installations world-wide; CA installations in Santa Barbara (Peabody's Restaurant, 2014) and Chico (Sierra Nevada Brewing, 2010)	$135,000 to $175,000 [11]

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Tidy Planet Limited Chesire, U.K. www.tidyplanet.co.uk **Food Waste Experts (Distributor)** Tarrytown, NY www.foodwastexperts.com In-vessel aerobic composting system with a central mixing shaft providing continuous and uniform aeration to the mass redistributing heat and moisture as the shaft rotates; stainless steel fabrication; stand-alone (installed under cover) or containerized; equipped with temperature data logger and air extraction system as standard.	Rocket A500 Rocket A700 Rocket A900 Rocket A1200 Rocket B1400 Rocket B2500	114 lbs/day 257 lbs/day 657 lbs/day 1,321 lbs/day 2 metric tons 5 metric tons (Throughputs can be increased by integrating a waste pulper ahead of the composter)	7.5'x2'x4' 9'x2.5'x5' 13'x3.2'x5.4' 23'x4.6'x6' 29'x10'x9' 41'x13'x11'	Output – compost (14 days in vessel); requires additional 2-3 weeks curing Inputs – wood chips	500+ throughout the UK and elsewhere abroad	$23,000 to $1,100,000 (Upper range includes ancillaries) [12]
Wakan Environment Inc. (formerly Vertal) Quebec, Canada www.vertal.ca In-vessel aerobic composter; stainless steel fabrication; optional features based on model size.	CityPod S CityPod M CityPod L CityPod XL	103 lbs/day 220 lbs/day 494 lbs/day 836 lbs/day	10'x4'x4.5' 15'x4'x4.5' 16.5'x4.5'x5.5' 18'x6.5'x7'	Output – compost (6 weeks in vessel) Inputs – Wood chips, wood pellets, wood shavings, sawdust, cardboard, leaves	California Conservation Corps Camarillo, CA	$45,000 [13] $55,000 $85,000 $145,000

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DEHYDRATORS[14]						
Champion Industries Winston-Salem, NC http://www.championindustries.com/ **Pro Reps West (Sales Rep)** Costa Mesa, CA http://www.proreps.com/ The Champion P7-30 Waste Handling System reduces food waste volume up to 70% - 75%. Capable of processing up to 1000 lbs. to 1200 lbs. per hour. The unit is stationary that features a 7.5 Hp grinding motor with a 30' diameter slurry chamber. The unit has two different feed methods: Feed tray with hood and a trough connection. The unit uses re-circulated water to help transport the food waste. Requires an electrical source, water connection, and a drain connection.	P7-30	1000-1200 lbs/hour	5'x4.8'x4'	Output- Organic Food Waste Semi Dry Pulp for composting if material is properly sorted prior to feeding the unit. Input- 80% Organic Food Waste, 20% Paper Products.	Customers referenced are UCLA and USAA.	$72,000[16]
EcoVim USA www.ecovimusa.com **Integrated Veterans Services (Sales Rep)** Santa Fe, NM www.ivsgogreen.com Dehydrates food in batch cycles ranging from 6-23 hours, with the use of heat and mechanical agitation. Achieves 85-93% reduction by weight. Capable of processing about 15% uncoated cardboard and paper	Eco 66w	66 lb/batch 6-9 hour batch cycle	2.7'x2.3'x2.7'	Output – soil amendment and wastewater (can be reused) Inputs – no bulking agents or additives required, 15% uncoated cardboard and paper	365 in USA including installations at hotels, educational institutions, the military, the Anaheim Convention Center, and Loreal.	$19,500[17]
	Eco 250w	250 lb/batch 12-15 hour batch cycle	3.8'x3.3'x3.4'			$29,500[17]
	Eco 650w	650 lb/batch 18-20 hour batch cycle	5.3'x4.2'x5'			$75,500[17]

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along with food waste. Unit is portable and of stainless-steel fabrication; requires an electrical source and a condensate drain line. Larger systems available but were not listed due to research parameters.	Eco 1100	1100 lb/batch 18-22 hour batch cycle	7.3'x4.8'x5.8'			Requires site-specific quote[17]
Somat Waste Reduction Co. Lancaster, PA www.somatcompany.com **Foodservice Equipment Agents (Sales Rep)** Anaheim, CA http://feallc.com/ Dehydrates food in batch cycles ranging from 12-18 hours, with the use of heat and mechanical agitation. Achieves 83-93% reduction by weight. Can handle compostables with food waste. Unit is portable and of stainless-steel fabrication; requires an electrical source and a condensate drain line.	DH-100w	50-220 lb/batch 8-18 hour batch cycle (varies by batch size)	3.8'x3.2'x3.8'	Output – dehydrated and sterilized biomass for composting (mulch-like); wastewater Inputs - no bulking agents or additives required	Southern CA sales rep references 50 units installed over the past several years 4 dehydrators installed at Loyola Marymount University, Los Angeles	$42,000[18]
GAIA Corporation Korea https://www.gaia21-en.com/ **OnSite Waste Solutions (USA Distributor)** Phoenix, AZ. http://www.onsitewaste.org/index.html Dehydrates food in batch cycles ranging from 9-10 hours, with the ability to run two cycles per day. Automated operation with minimal	GAIA GC-100	110 lbs/cycle 220 lbs/day 9-10 hour cycle / batch	4.8'x3.1'x4.2'	Output – highly concentrated organic substrate Inputs – no bulking agents or additives required	400+ systems installed in the U.S. Clients cited on the website include various hotels and resorts, retirement centers, corporate cafeterias, colleges and	$32,000[19]
	GAIA GC-150	165 lbs/cycle 330 lbs/day 9-10 hour cycle / batch	5.3'x3.4'x5'			$45,000[19]

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labor. Typically achieves 85-90+% reduction by weight and volume. Capable of processing small amounts (10%) of compostable tableware along with food waste. Color-coated steel fabrication; requires electrical source and condensate drain line. Smaller units (GC-300 and smaller) are portable. Larger units (GC-400 and larger) can be equipped with automatic lifters. GC-600 and larger can be equipped with a discharging screw conveyor. The GAIA system is marketed by OnSite Waste Solutions under the branding DaRT (Dehydration and Recovery Technology). Additional models available up to 2,600 pounds per day.	GAIA GC-200	220 lbs/cycle 440 lbs/day 9-10 hour cycle / batch	5.6'x4'x5'		universities as well as other food service establishments. References and site installation information available on request through OnSite Waste Solutions.	$60,000[19]
	GAIA GC-300	330 lbs/cycle 660 lbs/day 9-10 hour cycle / batch	6.3'x4.3'x5.8'			$75,000[19]
	GAIA GC-400	440 lbs/cycle 880 lbs/day 9-10 hour cycle / batch	8'x5'x6.1' (excludes lifter)			$100,000[19] (includes lifter)
	GAIA GC-600	660 lbs/cycle 1,320 lbs/day 9-10 hour cycle / batch	8,5'x5.6'x6.1' (excludes lifter and discharger)			$130,000[19] (includes lifter and discharger)
Hungry Giant Waste Systems LLC Austin, TX http://hungrygiantrecycling.com/ **Chris O'Brien** chris@hgrecycling.com Accelerated dehydration and agitation, reducing the original waste volume by between 80 and 93%. Small models capable of up to 2 cycles every 24 hours. Can process food waste and some green waste. Requires an electrical source and a condensate drain line. UL508A panels, anti-jamming functions, sealed bearings all come as standard. 100% 304 Stainless steel construction. PLC controlled. Large models can come with	HGF70ML	8-10 hour	2.7'x2.7'x3.2'	Output – soil amendment and clear condensate wastewater Inputs – no bulking agents or additives or consumables required	Mission food service, Boulter Florida Blue (BCBS), St Norberts College, Mt Holyoke university, Merck Pharma, Google Boulder, Westin Hotel Napa, Navy Federal credit union, Loreal NYC, PCL	$19,500[20]
	HGF110ML	10-12 hour	2.7'x2.7'x4'			$23,500[20]
	HGF250ML	12-14 hour	3.6'x3.6'x3.7'			$32,500[20]
	HGF320ML	14-18 hour	4.4'x4.4'x3.8'			$35,400[20]
	HGF450ML	14-19 hour	4.8'x4.8'x4'			$43,500[20]
	HGF700ML	15-19 hour	5.4'x5.4'x4.2'			$55,500[20]
	HGF700AL	15-19 hour	5.4'x5.4'x4.5'			$66,700[20]
	HGF900ML	17-20 hour	7'x7'x5.3'			$75,000[20]

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automated loaders. Modular dehydration system can be connected to grinding, transfer and dewatering systems.	HGF900AL	17-20 hour	7'x7'x5.3'			$89,000[20]
	HGF1400AL	18-22 hour	7.3'x7.3'x5.4'			$115,000[20]
	HGF2400AL	18-22 hour	7.3'x7.3'x6.1'			$153,000[20]

1. This table focuses on anaerobic digestion and in-vessel composting technologies developed for on-site processing of food waste at capacities ranging from approximately 1 lb/day to 1,200 lbs/day. Information was compiled in October 2015 and updated in August 2016, July 2017 and March 2020, from readily-available public sources (including technology websites and third-party published reports) and has not been independently verified. Companies should be contacted for the most recent information regarding models, reference projects, pricing, and project-specific applications.
2. Inputs listed are supplemental inputs required for operation, i.e., in addition to food waste, to serve as a bulking agent and/or carbon source.
3. The output of an anaerobic digestion or in-vessel composting system is dependent on feedstock, type of technology, and operating parameters. The amount of digestate and/or compost resulting from anaerobic digestion and in-vessel composting systems can be affected by several factors, including but not limited to: the level of contamination in the feedstock, moisture present in the feedstock (including the addition or removal of water), carbon and nutrient availability, the organic loading rate (amount of volatile solids), and the addition of bulking agents or other additives. Many systems also include settings to adjust retention time, which can be used to optimize process operations for specific needs and can result in variable rates of volume reduction.
4. Pricing information for Impact BioEnergy obtained from company's website in March 2020.
5. Pricing information for Living Arts Systems provided by the company in October 2015.
6. Pricing information for SEaB Energy's Flexibuster provided by the company in March 2020.
7. Pricing information for BioGreen obtained from company in March 2020.
8. Pricing information for Susteco provided by company in March 2020.
9. Pricing information for Solutions obtained from company in March 2020.
10. Pricing information for Green Mountain Technologies obtained from company in March 2020.
11. Pricing information for HotRot Organic Solutions provided by company March 2020 and does not include delivery.
12. Pricing information for Tidy Planet obtained in March 2020.
13. Pricing information for Wakan provided by company March 2020.
14. The use of dehydrators may not ensure full compliance with AB 1826, unless coupled with composting or anaerobic digestion. Business owners should verify application-specific compliance with CalRecycle.
15. Equipment pricing is presented as order-of-magnitude costs for general information purposes only. Pricing is expected to change over time and can be highly variable based on model sizes, add-on and optional equipment, and project-specific applications (including installation costs). Interested parties are encouraged to directly contact equipment providers for up-to-date and project-specific pricing information.
16. Champion Phoenix pricing information provided by Pro Reps West in March 2020.
17. EcoVim equipment pricing provided by the company in March 2020
18. Somat DH-100w pricing information confirmed by company March 2020

19. GAIA pricing information is MSRP provided by Onsite Waste Solutions as of January 2019; lease options are also available.
20. Hungry Giant pricing information provided by Hungry Giant and effective as of January 1, 2020 and excludes taxes, delivery, installation and training.