Update on Anaerobic Digester Projects Using Food Wastes in North America

By Institute for Local Self-Reliance

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ILSR

The Institute for Local Self-Reliance (ILSR) is a nonprofit research and educational organization that provides technical assistance and information on environmentally sound economic development strategies. Since 1974, ILSR has worked with citizen groups, governments and private businesses in developing policies that extract the maximum value from local resources.

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Executive Summary

Food waste diversion from landfills is seen with increasing importance and represents an important tool to extend landfill capacity, reduce methane (CH_4) emissions and create clean energy technology development. Food discards have a large potential energy content (up to 2% of U.S. energy consumption) and firms have developed new techniques to utilize this waste stream in anaerobic digesters (AD). Some existing projects are using food wastes to supplement existing anaerobic digestion technologies being used in wastewater treatment facilities. Other projects are digesting food waste in stand-alone digesters. Gas from the digestion process can be used for a variety of end uses including generating electricity (and process heat), pipeline quality natural gas, or natural gas for fleet vehicle use. The leftover waste from the digestion process can be added as feedstock for existing composting systems.

With relatively few operating AD projects using food wastes in North America, ILSR contacted these projects and this report attempts to summarize our discussions to illustrate some potential avenues to address the situation in and around Atlanta. ILSR also contacted principles in a handful of the AD projects currently in some stage of pre-operational development that are expecting to use food discards in their systems. It should be noted that in Europe, AD systems using food wastes are quite numerous but many are not at the same scale as those envisioned in the U.S.

Since Atlanta has an existing anaerobic wastewater treatment facility already in place, it may make economic sense to add a food discard waste stream to that facility. Food waste will help increase the methane production from the existing AD system. Alternatively, Atlanta could seek out a developer to construct a stand-alone digester for handling diverted food discards. Based on other projects, starting with the commercial sector food discards and then expanding to the residential sector seems to be the best strategy.

Based on our surveys of existing and planned AD projects using food waste, it appears that job creation will be in the range of 2-4 FTEs for projects using up to 10,000 tons of food waste per year. One project planned for 280,000 tons/yr will require 16 new employees. Capital costs range from about $5 million for a 10,000 ton/yr facility to about $86.5 million for the 280,000 ton/yr plant. Tipping fees to cover capital and operational costs seem to be landing around $60/ton.

Introduction

Food waste diversion from landfills is seen with increasing importance and represents an important tool to extend landfill capacity, reduce methane (CH_4) emissions and create clean energy development. Food discards have a large potential energy content and firms have developed new techniques to utilize this waste stream in anaerobic digesters (AD). A recent study by staff at the University of Texas' Center for International Energy and Environmental Policy calculated that the energy embedded in wasted food represents approximately 2% of annual energy consumption in the United States (pubs.acs.org/doi/pdf/10.1021/es100310d). In some locations food waste makes up 30 percent of the material going to landfills and dealing with this material will be critical for any jurisdiction seeking a path towards zero waste.

Some existing projects are using food scraps to supplement existing anaerobic digestion systems being used in wastewater treatment facilities. Other projects are digesting food waste in stand-alone digesters. Biogas from the digestion process can be used for a variety of end uses including generating electricity (and process heat), pipeline quality natural gas, or natural gas for fleet vehicle use. The leftover waste from the digestion process can be added as feedstock for existing composting systems.

Many cities are currently investigating how best to incorporate large quantities of food waste into their existing treatment facilities or how they can build stand-alone AD projects for food waste. Existing wastewater treatment facilities with AD are attractive since they sometimes have excess capacity that could be utilized. Stand alone systems also have their own set of benefits that need to be considered and are sometimes better suited to deal with feedstocks that are contain a high percentage of solids. In either case, there is an opportunity for substantial amounts of food waste to be collected, processed and digested instead of landfilled.

We also found some cities like Milwaukee where their Metropolitan Sewerage District recommends that residents grind up their food waste and send it into the sewage system rather than putting it in the garbage (See http://v3.mmsd.com/foodisfuel.aspx). It goes to their anaerobic digester.

Below we'll take a closer look at a couple of the existing AD projects that have a history of operational success and then profile some of the projects that are close to coming online.

Details on Existing AD Facilities Using Food Discards

East Bay Municipal Utility District – Oakland, CA

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Summary/Background: The AD system at the East Bay Municipal Utility District (EBMUD) is at an existing wastewater treatment facility and was the first AD system to utilize source separated organic (SSO) commercial food discards in the United States (their food waste pilot project started in 2004). EBMUD currently receives about 7,000-15,000 tons of food discards per year, and with recent agreements this will increase to approximately 35,000 tons or more delivered to EBMUD in 2011. EBMUD owns the food waste processing systems and the food waste once it is accepted on site. EBMUD collects a tipping fee for the food waste entering the facility. Since the AD facility already existed, adding food waste stream did not have any new space requirements. Significant excess capacity exists at EBMUD's wastewater treatment plant due in part to the decline of regional food processors.

Gas from the digester is used to supplement gas supply used produce energy in on-site electric generators (6.5 MW total) and power/heat is used on-site. Excess electricity is sold to local utility. EBMUD is considering expansion of food waste utilization and is evaluating options on constructing a stand-alone digester. Food discards used by EBMUD come from regional commercial sources. EBMUD receives the ground, source-separated food waste and pre-treats the material with their patented process (includes pumping the food waste slurry through a rock trap and grinder to remove any remaining large debris, and then passing the food waste slurry through a paddle finisher to remove grit and smaller debris, such as plastics, rubber bands, chopsticks).

Digestate is dewatered to about 25% solids and either land applied on agricultural fields or used as alternative daily cover at a landfill-both considered recycling by State of California. EBMUD uses excess capacity from its existing wastewater treatment plant digesters, and they are planning in the future to dedicate a digester for SSO food waste. This will allow for a digestate free of municipal biosolids (sewage sludge) and that will give it "organic" status and create a more valuable byproduct. Their dedicated digester will be able to handle and estimated 300 tons of food waste per day in about a 1.5 million gallon digester.

The current process integrating food waste has inefficiencies that limit direct imitation of the EBMUD model. The main drawback is that green wastes are first transported out of the Bay area to Vacaville composting facility (50 miles one-way), separation takes place and food waste is transported back to EBMUD's AD facility. The availability of feedstock could be expanded in the future as policy requiring food waste to be separated and collected from the residential sector is under consideration and seems to have strong support in the region.

Companies/Organizations Involved in Project
Recology (www.recology.com) is the waste hauler that collects source separated food wastes from commercial sources in the San Francisco Bay area, grinds, and delivers them to EBMUD. Additionally, the Central Contra Costa Solid Waste Authority (www.wastediversion.org), oversees the collection and recycling of solid wastes in Central Contra Costa County and holds the contract with Allied Waste Systems (www.alliedwasteservicesofcontracostacounty.com) that collects SSO food waste, grinds and delivers them to EBMUD.

Type of Anaerobic Digester Technology
Standard, wet digestion found at most municipal wastewater treatment plants.

Capital, Operational Costs and Jobs
Approximately $2-5 million capital investment was needed to add food waste capability into the existing digester. Operating costs equivalent to approximately $40-$55/ton (7,000 – 15,000 tons/yr of food waste). The food waste processing component added about 2-3 jobs at EBMUD.

Energy Generated (electricity)
Energy generation from the food waste depends on the quality received. For good quality food waste, EBMUD is seeing electricity generation of 220 kWh/ton. Digester gas is used to supplement the fuel used in three 2.2 MW generators. The energy is used to meet the wastewater treatment plant's power demand first and then additional power is sold via an agreement to a local utility. According to EBMUD, using food waste in the digesters increases methane production at a low cost. The food waste results in 3.5 times the amount of energy as municipal sludge[1].

[1] A detailed report on the EBMUD system was completed in 2008 and offers readers a large number of technical conclusions about using food wastes in an existing AD system at a wastewater treatment facility. See *Anaerobic Digestion of Food Waste, Final Report*, prepared for U.S. EPA by East Bay Municipal Utility District, March 2008. [http://www.epa.gov/region9/organics/ad/EBMUDFinalReport.pdf]

Toronto, Ontario – Dufferin Organics Facility

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www.toronto.ca/greenbin/organics_processing/

Summary/Background: Dufferin's AD system was designed in 1997 to explore mixed waste and source separated organics processing and digestion. The facility was fully commissioned in 2002. Food waste stream from Toronto's residential "Green Bin" program of source separated organics (SSO) helps provide some of the feedstock for the AD unit (www.toronto.ca/greenbin/) with remainder going to other public and private processing facilities. Maintaining and expanding the residential and commercial SSO diversion programs is a key component of the City's plan to achieve goal of diverting organics from landfills. Existing SSO collection programs generate approximately 110,000 tonnes per year with program expansion and population growth increasing the quantity to as much as 180,000 tonnes per year in the coming years.

The existing AD system (volume is 3,600 cubic meters) utilized about 23,000 tonnes per year in 2004 and nearly 36,000 tonnes/yr in 2007. Biogas produced is flared and production in 2004 was about 123 m^3/tonne and in 2007 it was 107 m^3/tonne. The City is installing gas clean-up equipment so that the gas can be injected into the nearby natural gas pipeline. Digested solids go to composting facility[2].

The facility is owned by the city but the plant is operated by a partnership between Canada Composting Inc.'s company CCI and a consortium made up of Trow consultants, BTA, and Nichols Construction. The facility covers an area of around 4 acres and employs 12 people. The digester is using AD technology from the German company, BTA (www.bta-technologie.de). The plant was built under a design/build turnkey contract and then an operating contract was entered into on a cost per tonne basis.

Toronto's Future Plans
With SSO collection to increase to around 180,000 tons per year (110,000 from city program and 70,000 from private sources), the city is envisioning expanding SSO processing on the Dufferin AD model. The city began seeking companies to develop two 55,000 tonnes per year facilities. In February 2010, Toronto City Council approved plans for a new anaerobic digester at the Disco Rd. site. Project agreements and Ministry of Environment permitting will take place from March to November 2010, followed by site excavation, remediation and foundation through to spring 2011. Construction and commissioning will take place between spring 2011 and fall 2012. Operation of the new facility is expected to begin in the first quarter of 2013.

Companies Involved
BTA Technology (via CCI Bioenergy a wholly owned subsidiary of Canada Composting Inc.)

[2] More information available in Brian Van Opstal presentation, November 2009, http://www.sjrecycles.org/organics/pdf/SpeakerPresentation5BVan%20Opstal_TorontoCaseStudy.pdf

(www.bta-technologie.de/ and www.canadacomposting.com) will provide the pre-processing technology, converting and cleaning up the SSO waste stream for digestion. RosRoca SA – (www.rosroca.de) will also provide AD technology for the new facility.

Type of Anaerobic Digester Technology
BTA and RosRoca will be using a wet digestion process.

Capital, Operational Costs and Jobs
The existing facility at Dufferin had a capital cost of about $18 million and operating costs equivalent to about $90/tonne. The city of Toronto conducted a feasibility study[3] on AD expansion and found that a new 55,000 tonnes per year facility with both pre-processing and AD systems would have capital costs of between $33 million and $36 million depending on the site chosen (see table below). Annual operating costs for system include AD is estimated at about $3.8 million ($69/tonne tipping fee)

Feasibility Findings: Capital Costs for Sites for AD System in Toronto ($ Canadian)

Capital Cost by Capacity	Annual Capacity (tonnes)			
	27,500	55,000	82,500	110,000
Pre-processing only				
Dufferin	4,513,000	20,628,000	28,756,000	35,447,000
Disco	15,927,000	22,828,000	31,956,000	38,647,000
Ingram	14,627,000	21,028,000	29,156,000	35,847,000
Markham	15,227,000	21,628,000	29,756,000	NA
Morningside	15,227,000	21,628,000	29,756,000	36,447,000
Pre-processing + Anaerobic Digestion				
Dufferin	7,452,000	32,972,000	NA	NA
Disco	24,093,000	35,772,000	NA	NA
Ingram	22,293,000	32,972,000	NA	NA
Markham	22,893,000	NA	NA	NA
Morningside	22,893,000	33,572,000	NA	NA

Note: Figures are in Canadian dollars (nearly 1 to 1 exchange rate as of Sept. 2010)

[3] http://www.toronto.ca/teo/pdf/anaerobic_fulldoc.pdf

Davis, CA – University of California - Biogas Energy Project

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[NOTE: We were unable to speak directly to the principles in this project. Information below is from other sources] Starting in October 2006, about eight tons of food waste per week from the San Francisco area's restaurants were processed through the Biogas Energy Project at the University of California, Davis. Professor Ruihong Zhang, of biological and agricultural engineering at the university, has been leading UC Davis' efforts. The system has been expanded and can handle almost 60 tons of waste per day, and its series of digester tanks can treat 8 tons of solid waste per day—which in turn produces enough biogas to power 80 homes.

The digester technology and process has been licensed from the university and adapted for commercial use by Onsite Power Systems Inc. (www.onsitepowersystems.com/).

Recology of San Francisco is supplying the waste, valued at $50,000, for the project. Recology already collects restaurant leftovers for a composting operation near Vacaville.

Details on Select AD Facilities Proposing to Using Food Discards

Humboldt County, CA – Proposed AD System

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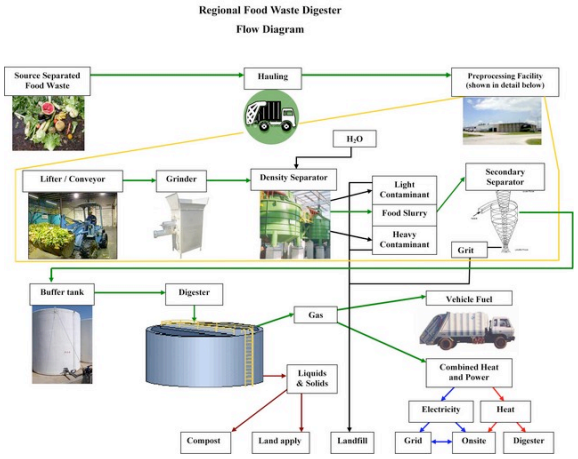

Summary/Background: A feasibility study for an AD system to handle food discards throughout Humboldt County was completed in 2009 (by Juliette Bohn, published in May 2010), for the Humboldt Waste Management Authority (www.hwma.net/counter.php).

The feasibility study concluded that an AD system for handling food discards would be a sound investment for HWMA to make from both economic and environmental perspectives. HWMA envisions a facility to initially handle about 10,000 tons/yr of food discards from commercial/industrial sources and then expanding collection to residential sector. A food waste AD system will reduce the overall cost of waste management by $12 to $16 million over a 20 year time horizon and would offer the greatest greenhouse gas emissions reduction potential compared to other strategies for dealing with food waste stream.

Humboldt County's Future Plans
As of September 2010, a potential AD project appears to be on track towards coming online in 2-3 years. The HWMA is currently involved in the California Environmental Quality Act (CEQA) permitting process. The full permitting application was scheduled to be released to the regulatory agencies in October 2010. Based on its experience, HWMA is preparing a permitting toolkit for these types of AD systems that could be adopted by the state to streamline regulatory review.

HWMA is planning to develop the digester facility on a city-owned property (Eureka, CA) and have recently commissioned (and received the reports from) a biological and archaeological survey of the site. They are hoping to apply for permits by the end of the year and if they get through this hurdle, an RFP for construction and/or operation of a new AD plant would be issued early next year.

Concurrently, HWMA is exploring financing options and assessing the organic waste resources in their region. The resource assessment includes a survey that was sent to all commercial entities in the county and a waste characterization study to be initiated in November 2010. They have been vetting pre-processing and digester technologies on the market, and are involved in shaping statewide AD regulations in California. HWMA noted that these projects take a long time to get off the ground.

HWMA is planning on owning the system since it will be able to offer lower rates to its customers. HWMA says that financing in part with federal Clean Renewable Energy Bonds (CREBs), where 70 percent of interest rate is covered, is attractive option since the eligible bond buyers has been expanded under current CREB program (www.bit.ly/aH47PU).

Companies Involved
Humboldt Waste Management Authority is the lead on the future project in partnership with the City of Eureka where the digester will be sited on land adjacent to existing water treatment plant. Arcata, CA, is supporting the project and reviewing city policies to ensure waste stream available to digester. Recology (www.recology.com formerly NorCal) would be the hauler of the waste stream. EPA Region 9 staff is helping HWMA with studies and permitting and commercial businesses are engaged with HWMA on planning and have expressed a willingness to adopt strong source separated organics collection policies.

Type of Anaerobic Digester Technology
Dry digestion technology appears to be the preference for Humboldt County. Their plan is to use high solids, high temperature system. They are looking for relatively simple pre-processing system. Wastes from the digestion process will qualify to be used by local liquid organic fertilizer companies. Solid residuals can go to supplement existing compost stream.

Capital, Operational Costs and Jobs
The HWMA feasibility study indicated a start up capital cost estimate of nearly $8 million and annual operational costs of about $340,000/yr for a 10,000 tons/yr operation sited on about 2.2 acres. This would be equivalent to a tipping fee of around $95/ton. More recent evaluations and discussions with potential vendors have indicated that costs might be lower than initially expected perhaps in the $5 million to $6 million range. HWMA now believes that it will be able to complete an AD project resulting in tipping fees of around $60/ton. Jobs at the facility will be related to the receiving, pre-processing, monitoring and post-processing of organic waste. It is likely that this project will result in additional local waste hauling jobs as well. It is estimated that 4-6 new jobs would be created.

Energy Generated (gas to electricity)
Electricity will be used to provide power to the City of Eureka's wastewater treatment plant and excess energy will be sold to the grid. Upgrades of existing electricity generators at their treatment plant are likely since they are aging. Gas produced will be used to generate about 2,400 MWh/yr of electricity and waste heat will be used onsite. Gas production estimated at 48,300,000 ft^3/yr.

Additional Comments from HWMA
HWMA noted that the project isn't a sure thing and barriers for the project include no strong local/state policy requiring that food waste be captured and sent to the digester. Outreach and public education on the need for food waste recycling needs to be done. The project is completely replicable in other jurisdictions but financing might be harder without access to CREBs. HWMA believes that state regulators in California are slowly coming around as to the minimal impacts of these facilities. A strong feed in tariff (a standard price for renewable energy) recognizing the renewable attributes of the electricity generated from these AD systems would enhance economic payback substantially and lower the tip fee needed to cover capital/operating costs.

Everett, WA – AD Project Under Development

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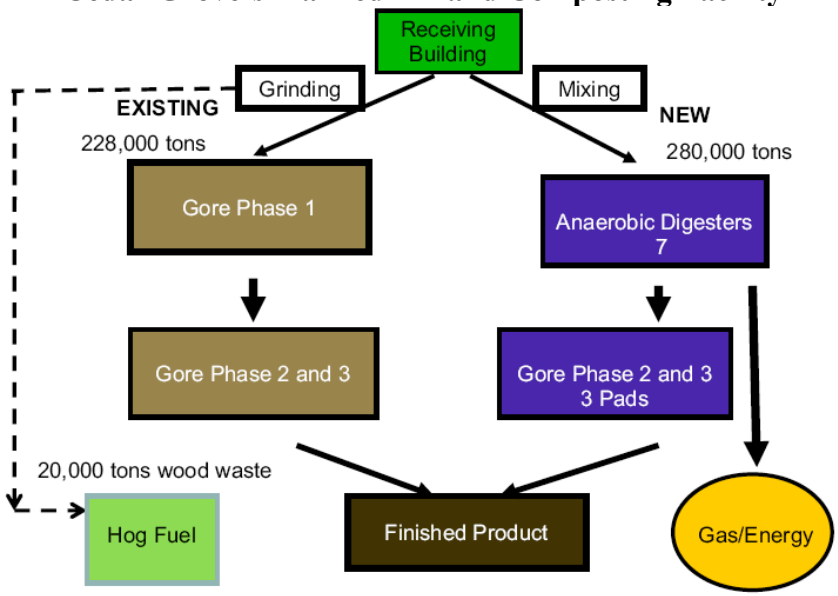
Steve Banchero, Cedar Grove Composting CEO, 206-832-3000
www.cgcompost.com

Summary/Background: Cedar Grove Composting, Inc., is a family-owned waste management firm that has served the Puget Sound area of Washington since 1938. In 1989, Cedar Grove began large-scale composting operations that include collection and aerobic composting of about 50,000 tons per year of food scraps (in addition to other organic materials). Cedar Grove uses the GORE Cover™ System composting system. With increased focus on diverting greater quantities of food wastes and yard trimmings from landfills in Washington, Cedar Grove has proposed doubling the amount of material they handle from 248,000 tons/yr to 528,000 tons/yr.

Cedar Grove is seeking approvals to integrate dry digestion technology into the composting operations at their Smith Island site near Everett, WA. The project is currently in the engineering, design and permitting phase, but could become one of the largest of its kind in the United States.

The full project as envisioned in Cedar Grove's land use permit request before the City of Everett, WA, would double the capacity of the existing compost facility and add up to 7 anaerobic digesters capable of processing 280,000 tons/yr of organic wastes including food and yard wastes (see www.everettwa.org/default.aspx?ID=1889). Here is a diagram of their proposal:

Cedar Grove's Planned AD and Composting Facility



Companies Involved
The German firm, BIOFerm Energy Systems (www.biofermenergy.com/), part of the Viessmann Group, is the planned technology provider and Cedar Grove Composting (www.cedar-grove.com) will own and operate the new facilities.

Type of Anaerobic Digester Technology
BIOFerm's system is a dry fermentation, high-solids anaerobic digester. Organic material is loaded into an air and gas tight concrete fermentation chamber and ferments for 28 days while producing biogas. The remaining digestate material will be composted.

Capital, Operational Costs and Jobs
The full build-out of Cedar Grove's planned AD systems that utilize up to 280,000 tons/yr would have a capital cost of about $86.5 million according to cost figures and statements contained in Cedar Grove's land use permit application documents filed with the City of Everett, WA (www.everettwa.org/default.aspx?ID=1889). Cedar Grove is projecting that they will need 16 new employees. We don't have any operational cost estimates for the new operations, but the company currently collects a tipping fee for food waste at a rate of $58.50/ton and we've seen no evidence that they plan to change that rate in the future.

Energy Generated (gas to electricity)
Under its current proposed configuration, the energy potential from methane produced by the AD units would be sufficient to power all of the facility's electrical needs, plus provide enough fuel for approximately 8 to 12 MW of electrical generation that could be sold to Snohomish County PUD or another utility.

Oshkosh, WI – University of Wisconsin – AD Project Under Construction

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Summary/Background: On September 15, 2010, the University of Wisconsin-Oshkosh began breaking ground of what will be the first dry digester to become operational in the United States. The system will be sited on 1.2 acres and utilize high solids organic material (25% solids or higher) in a batch process that eliminates moving parts, according to the University. The AD will convert local yard trimmings and food waste into biogas (final composition of waste stream still being determined by the University). The majority of the 6,000 tons of waste per year (Note: some news reports have said 8,000 tons/yr. Our figures came from BIOFerm.) will be provided by campus and community sources with the remainder being supplied from other area partners. The project is partially funded by a $232,587 grant from Wisconsin Focus on Energy and a $500,000 grant from the federal stimulus program. The plant will be built on land of the project owner, the UW Oshkosh Foundation. The plant is expected to be operational in April 2011.

Companies Involved
The German firm, BIOFerm Energy Systems (www.biofermenergy.com), part of the Viessmann Group, is the AD technology provider, University of Wisconsin Oshkosh Foundation (www.uwosh.edu/foundation/) is the owner and will be the operator of the facility, the University of Wisconsin-Oshkosh (www.uwosh.edu) itself is building a research lab to go along with the facility, and Boldt Construction is doing the construction of the facility.

Type of Anaerobic Digester Technology
BIOFerm's system is a dry fermentation, high-solids anaerobic digester. Organic material is loaded into an air and gas tight concrete fermentation chamber and ferments for 28 days while producing biogas. The remaining digestate material will be likely be composted but may end up being land applied on a nearby farm that is also supplying feedstock.

Capital, Operational Costs and Jobs
The AD project has an approximate capital cost of $2.3 million with $750,000 in grant money going to the project (Note: UW-Oshkosh Foundation has been authorized by the City Council to issue up to $5,000,000 in bonds for the project). Construction will require an average sized crew and there will be 2-3 permanent employees needed to run the plant. For waste used in the AD system that is not generated on campus, a tipping fee is being considered but no details are yet available.

Energy Generated (gas to electricity)
Under its current proposed configuration, gas from the digester will be used to fuel a 370 kW electric generator. Electricity will be sold to the local utility, Wisconsin Public Service. The output will represent from 5-10 percent of the University's consumption on the campus. Waste heat from the generators will be used for heating in a couple of the buildings on campus.

Brief Descriptions - Potential AD Projects Using Food Discards

The project descriptions below are more limited in the amount of information we were able to obtain. For more detailed and accurate data we suggest contacting the listed people under each project.

Richmond, British Columbia –AD Project Under Development

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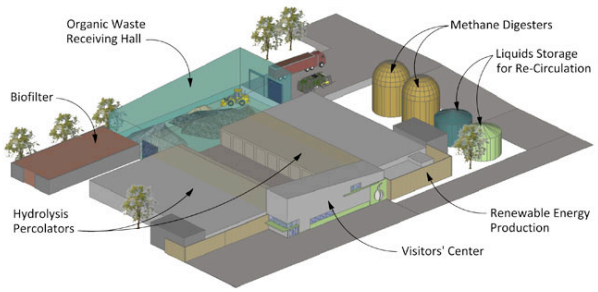

Summary/Background: The Massachusetts-based company, Harvest Power is about to break ground on a digestion facility (high solids AD system), just south of Vancouver, BC in Richmond, BC. The site will be at the facility of Fraser-Richmond Soil & Fibre (www.fraserrichmond.ca), an existing mixed waste composting operation that processes 230,000 tons per year (now a wholly owned subsidiary of Harvest Power.

The proposed dry, high solids AD (using a batch system) will have the capacity to process 30,000 tons per year of commercial and multi-family organic waste (food and yard). The new plant is expected to be operational in summer 2011. Estimate is for 3 additional jobs on top of the 40 currently involved in the composting operations. Capital costs are not available for public disclosure at this time.

San Jose, CA – AD Project Under Development

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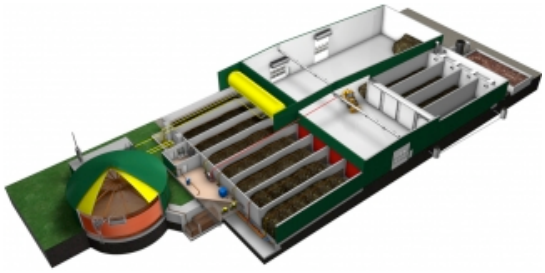
www.greenwaste.com



Summary/Background: Zero Waste Energy Development Company (ZWED) is the process of developing an AD system for digesting food waste and yard trimmings from in and around the City of San Jose, California. ZWED (www.zerowasteenergy.com) is a joint venture between two local companies, GreenWaste Recovery (www.greenwaste.com) and Zanker Road Resource Management (www.zankerrecycling.com). ZWED will be using AD technology developed by the German firm, Eggersmann Anlagenbau. Eggersman developed the Kompoferm® system, a modular dry, high-solids AD system (www.f-e.de/plant-engineering-and-construction-the-expert.html). The AD proposal is known locally as the Zanker Road Biogas project. ZWED is awaiting permitting

approvals and is projected to come on-line in late 2011.

ZWED is also partnering with Bulk Handling Systems (www.bulkhandlingsystems.com) of Eugene, Oregon, a manufacturer of recycling processing equipment. BHS is the exclusive distributor in the United States of Eggersmann Anlagenbau's AD system components.

Once the three-phase project is fully built out, the AD facility will be capable processing 150,000 tons per year of organic waste. It is not clear how much waste the first phase of the project will be able to handle. Biogas generated will be used to generate electricity and heat for on-site use with excess electricity sold to a local utility.

Madison, WI – Dane County - AD Feasibility Study

Contact Information:
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AECOM (www.aecom.com) is in an early stage of a feasibility study related to a potential AD system to be located at Dane County's Rodefeld landfill near Madison, WI. They are currently evaluating potential feedstocks and the study will be completed in early 2011.

AECOM's feasibility study will look at financial implications to Dane County residents and businesses as well as the renewable energy potential of diverting food wastes from commercial, industrial and institutional sources. The study costs are being paid for from an Energy Efficiency and Conservation Block Grant that Dane County received from the U.S. Department of Energy.

Sacramento, CA – Sacramento Municipal Utility District (SMUD) Proposed AD Facilities

Contact Information:
Michael DeAngelis, SMUD Manager, Advanced Renewable and Distributed Technologies, mdeange@smud.org, 916-452-3211

The Sacramento Municipal Utility District (SMUD) is currently investigating two potential AD projects within its service territory. One would include adding food waste to the sewage going to the existing AD system at the Sacramento Regional Wastewater Treatment Plant. From December 2008 to September 2009, SMUD conducted a "biogas enhancement" pilot project with the objectives to pump food processing waste and brown grease directly into the digester instead of into primary and secondary treatment systems. SMUD obtained clear data on the economic and operational factors needed to assess the feasibility of a full-scale project. Based on the successful results there is a desire to create a permanent facility for accepting restaurant grease and food waste that would be digested and the resulting biogas used to generate electricity.

The other project that SMUD is investigating is an AD system for biogas production at a local food processing facility.

Proprietary U.S. Locations – Organic Waste Systems

Contact Information:
Norma McDonald, Organic Waste Systems,
513-535-6760, norma.mcdonald@ows.be
www.ows.be

Organic Waste Systems (www.ows.be) is a Belgium company and the developer of the DRANCO process, converting solid and semi-solid organic waste into renewable energy, biogas, and a stable endproduct. OWS has dozens of operational AD plants across Europe.

They were able to tell us that they are pursuing at least 5 AD facilities in the United States that would be utilizing food wastes. They hope to begin construction on these facilities in 2011. The project size ranges from 25,000 tons/yr to 75,000 tons/yr with food scraps comprising up from 10 percent to 80% of the total depending on the project. OWS plans on using their DRANCO dry digestion system in each of the proposed projects with biogas being used for electricity production in a couple projects. In one case, they plan to clean up the gas for sale to natural gas utility. The company did not provide and cost information for this report.

Appendix A: Companies offering commercially available anaerobic digestion facilities

Company	Contact	Digester Type
Enbasys Parkring 18 8074, Grambach Austria http://www.enbasys.com/ (Tel.) 43 (0) 316 4009-5600	Dr. Stefan Kromus office@enbasys.com	liquid - UASB
Entec Biogas Schilfweg 1 6972 Fussach Austria http://www.entec-biogas.com/ (Tel.) 43 5578 7946	Bernhard Schulz office@entec-biogas.at	several types
Solum Gruppen Vadsby Straede 6 DK-2640 Hedehusene Denmark http://www.solum.com/ (Tel.) 45 4399 5020	Martin Hansen mwh@solum.com	dry fermenter
Bekon Feringastraße 9 D-85774 Unterföhring Germany http://www.bekon.eu/ (Tel.) 49 89 9077959-0	Nathan Dietz nathan.dietz@bekon.eu	dry fermenter
BTA International GmbH Färberstraße 7 85276 Pfaffenhofen Germany http://bta-international.de/ (Tel.) 49 8441 8086-600	info@bta-international.de	slurry plug flow
Arrow Bio HaCarmel St. Yoqneam 20692 Israel http://www.arrowbio.com/ (Tel.) 972-484-11100	arrowbio@arrowecology.com	liquid - UASB
Ros Roca Av. Cervera, s.n. Terrega Spain http://www.rosroca.com/ (Tel.) 34 973 50 81 08	Ramon Sentis rsentis@rosroca.com	liquid - plug flow

GaiaRecycle 125 University Ave., Suite 150 Palo Alto, CA 94301 USA http://www.gaiarecycle.com/ (Tel.) 650-585-4416	Young Song info@gaiarecycle.com	liquid - plug flow
OWS/ Dranco 7155 Five Mile Road Cincinnati, OH 45230 USA http://www.ows.be (Tel.) 513-535 6760	Norma McDonald norma.mcdonald@ows.be	slurry plug flow
Qasar Energy Group 7624 Riverview Road Cleveland, OH 44141 http://www.schmackbioenergy.com (Tel.) 216-986-9999	Harlene Clemens sales@quasarenergygroup.com	liquid - plug flow
BHS/Kompoferm 3592 West 5th Avenue Eugene, OR 97402 USA http://bulkhandlingsystems.com (Tel.) 541-485-0999	Steve Miller stevem@bhsequip.com	dry fermenter
BIOFerm Energy Systems P.O. Box 5408 Madison, WI 53705 USA http://www.biofermenergy.com (Tel.) 608-467-4241	Daniela Rumpf RumD@BiofermEnergy.com	dry fermenter
GHD P.O. Box 69 Chilton, WI 53014 USA http://www.ghdinc.net/ (Tel.) 920-849-9797	Steve Dvorak corporate@ghdinc.net	liquid - plug flow