

Compost production for the landscape industry has been a typical target market. A wider opportunity base has been created through the emergence of other markets, such as biofuel, agriculture, erosion control, department of transportation work, rain gardens, bioretention ponds, and stormwater mixes.

According to USEPA in 2010, such greenwaste products as yard trimmings and food scraps comprised about 27% of the 250 million tons of municipal solid waste generated in the US.

In Pennsylvania, the Lancaster County Solid Waste Management Authority (LCSWMA) points out that many municipal curbside recycling programs are expanding to include yard waste while some communities offer dropoff locations. On its website, LCSWMA educates the public on home or backyard composting as an alternative for recycling yardwaste.

More composting programs are gearing up with established programs picking up speed. Dry and wet anaerobic digestion programs are taking a greater foothold as processing options.

One of the most successful greenwaste processing programs in North America is in King County, WA. The program collects organics curbside at single family homes.

From 2003 to 2005, King County's Solid Waste Division—in partnership with county garbage haulers, suburban cities, and health and ecology departments—ran several studies to pilot different collection frequencies and scenarios to determine the necessary require-

Optimizing Green

Municipal solid waste experts are noting a growing trend in composting activities, and with it, increasing numbers of market opportunities for turning that nitrogen-rich wastestream into compost and energy production.

BY CAROL BRZOZOWSKI

ments for health department approval for collection of food scraps and food-soiled paper in the curbside yardwaste cart.

In 2006, the solid waste division launched a regional campaign to recycle food. Up to that point, protein materials were not included in organic collection.

The county engaged in an education effort for the requirement that a single-family household had to have a commercial garbage cart manufactured for curbside collection of protein fruit and vegetable scraps with yardwaste that could be tipped.

By early 2011, King County was doing

curbside collection of all food scraps and food-soiled paper—including protein—with curbside yardwaste collected every other week year-round.

A recent county study showed that single family households generate up to 10 pounds of food scraps or food soiled paper per week.

"People do what they know how to do, and are quite busy, so taking on a new recycling behavior can be challenging," says Gerty Coville, project manager for the King County Solid Waste Division. "We've found that once they begin recycling their food scraps, and get over the 'ick,' they recycle a lot of their food scraps and food-soiled paper."

Today, of the 308,032 households with garbage collection, 99.5% of those households have organic service available. The yardwaste subscription rate is 67%.

In 2005, King County began to reach out to all of the approved compostable bag vendors, which had undergone a testing process with Cedar Grove Composting. The company wanted to ensure the bag that would be promoted in the retail market by King County and other municipalities as a recycling tool would completely decompose in the composting process, says Coville.

The county lists the five approved vendors on its website.

"We wanted to start promoting the compostable bag as one of the first tools that a person would use to reduce that 'ickiness' in the kitchen," says Coville. "We've been promoting the use of this bag as much as we would promote putting a recycle bin in the kitchen



Artec Industries

next to the garbage can. It's a fundamental recycling tool."

When residents sign on to the program, they receive a free sample from King County with 10 compostable bags, enough to last up to six weeks. After that, they can purchase bags from local retailers listed on the county's website.

Among the several vendors whose bags are sold retail, BioBag penetrated the retail market the most deeply, says Coville, adding that the county is presently in a retail partnership with BioBag.

BioBag manufactures certified compostable bags and films made from Mater-Bi, consisting of starches derived from plants, vegetable oils, and compostable polymers from renewable raw materials and fossil raw materials, with no polyethylene used in the production process.

The bags are used to collect organics in those municipal entities operating greenwaste processing programs in conjunction with such waste generators as grocery retailers and food-service distributors.

"Despite the economy, we're seeing continued growth in our business," notes Mark Williams, vice president of sales for BioBag. "Each year, more municipalities are going after the organic sector of their waste, recognizing organics as a resource instead of garbage. Just like we recycle cans, bottles, and paper, we're recycling food and lawn waste, and there are infrastructures developing that are recognizing it as a resource instead of garbage."

"It's a huge chunk of the wastestream that hasn't really been addressed by a lot of cities. After they develop their recycling programs, it's the biggest chunk left for them to go after," he says.

Food scraps and food-soiled paper comprise about 30% of the wastestream. Paper is just under 23%.

King County's greenwaste goes to Cedar Grove Composting, which has two locations in King and Snohomish counties. The company sells the end product to consumers and to the landscape trade.

"It's a high-quality product if you look at the front end of feedstock and how hard we work on reducing contamination and see that in the product end," says Coville.

Like many other municipal solid waste operations, King County faces a lack of control sometimes over what comes through the wastestream.

The county has a "curbside enforcement" program. "We're working with the haulers to have them look in the yardwaste cart, and if somebody's got something in there that

shouldn't be in there, then it should be tagged," Coville says.

The tag informs the resident they put the wrong item in the cart and after they take it out, the hauler will come back to take the cart.

"If they don't change their ways, they are subject to an additional fee," Coville adds. "It's not just negative feedback, but positive feedback too. They thank them when they've done a good job, when there's nothing wrong with what's in the cart. That will change the face of the contamination issue."

Ron Alexander of R. Alexander Associates, Inc., an environmental consulting company specializing in composting and organics recycling, notes that the greenwaste composting industry continues to mature, even as the economy slowed down significantly.

Alexander works with many companies that have anaerobic digestion programs, helping them in product and market development.

"We are having to fight some battles in certain states with landfill ban repeals," he points out. "Some companies are actively trying to get rid of bans that currently exist. There is a lot more talk about foodwaste collection; I expect that to be a strong growth area for the industry."

That topic emerged in a conversation Alexander had with an EPA official a year ago in which they discussed how recycling markets had been crushed by the recession.

"A lot of it was because China wasn't purchasing as much traditional recyclables," Alexander says. "I told them people managing organics don't have that same problem. We can only ship our stuff so far. We have had to work very hard at building local markets."

Since the onset of the recession, Alexander has preached about the importance of market diversification.

In the industry since 1984, Alexander has seen a few recessions ("Not as bad as this," he notes) and worked hard to diversify and push markets of growth during those downturns.

One such market that has mushroomed as a result of the Great Recession is that of the residential homeowner who prefers to spend money sprucing up a backyard instead of going on vacation. That creates an opportunity for landscaping, which uses compost.

"If you're not actively marketing, you're behind the curve," Alexander says. "The people actively marketing understood the market and saw these things coming. They were able to adjust that much better."

Newly emerging environmental products markets for greenwaste compost include stormwater mixes, bioretention ponds, rain

gardens, and erosion control.

"In most states, the No. 1 market is still the lawn and garden industry, including landscape, turf, and topsoil blending," Alexander says. "Those markets are still the dominant paying markets for compost. We see less product being given away or dumped, which is very good. We continue to see growth and expansion into selling a product through retail establishments."

Alexander, the vice president of the US Composting Council, notes that "we are going to have an interesting new promotion coming out for the spring market that will brand compost nationally. I'm excited about what that's going to do for the industry."

Among the various collection methods that take place at municipal solid waste operations, curbside collection attracts the greatest participation, Alexander says.

The biggest challenge with foodwaste collection is how clean are the feedstocks going to be and whether they can be cleaned up, Alexander says.

Alexander points out that foodwaste in general is "just another nitrogen source, so as long as it's clean, you're going to make a very, very nice product and use it in any of the markets. The problem is that there can be a lot of contamination. You have to screen very finely. There are markets to be developed with coarser materials—like mulches and erosion control products—so if you have a contaminated feedstock with inert materials such as glass and plastic, you're not going to be able to go to those markets or sell retail. You can't use it in erosion control."

And while it may not hurt its ability to function for stormwater and erosion control, "the simple fact is that people buy these products with their eyes, so they want to see a pretty product," he adds.

Alexander agrees public communication is the key to ensuring a clean greenwaste and foodwaste collection.

"If you think you're going to do this and you're not going to take care of the education factor, then you're going to have major contamination issues," he says. "Communities have to step up and educate the people who live in their communities. Composters can't do that. They're not getting a big enough tip fee to go out there and be able to do all of that educational work."

Alexander says there are several success stories in anaerobic digestion.

One is an installation of a dry fermentation anaerobic digester at the University of Wisconsin-Oshkosh. Now in operation for a year, the campus' BIOFerm Energy Systems biodigester

is the first industrial-scale dry fermentation anaerobic digester (AD) in the Americas.

BIOFerm Energy Systems, founded in Madison, WI, in 2007, is a member of the Viessmann Group, a \$2.5 billion family-owned business since 1917. Viessmann has installed more than 30 dry AD and 250 wet AD facilities through the biogas companies of the Viessmann Group.

The company's technology harnesses the naturally produced gas emissions rising from fermenting organic materials, converting the renewable energy into natural gas to be used in vehicles or to supply power, heating, cooling, and gas.

In contrast to wet AD, dry AD technology uses a higher solids content of 25% and greater feedstock, according to BIOFerm. The material stays stationary within the chambers with no additional liquid input required, and feedstock is moved by frontend loader rather than pumped as a slurry, enabling the output to be further composted.

At a total footprint of 19,000 square feet, including a storage area of 2,000 square feet and a mixing area 7,800 square feet, the system at the University of Wisconsin includes four fermentation vessels measuring 70 feet by 23 feet by 16.7 feet.

Each cycle is 28 days long, with a maximum of 13 material exchanges per year, generating 150 tons of fresh material per exchange.

The plant is designed to handle up to 8,000 tons of organics such as foodwaste, yardwaste, and crop residuals per year from materials sourced under contractual agreements between the university and its suppliers, such as the city of Oshkosh.

An enclosed mixing lobby—ventilated with up to 2.6 air exchanges per hour—prevents odorous process air from escaping into the environment. The process air is released to the atmosphere via a biofilter.

The university estimates the plant will provide up to 10% of its electricity needs. Power production is provided by a 370 kW continuous combined heat and power unit from 2G Cenergy rated at 86.76% overall efficiency. Electric capacity is at 370 kW and thermal capacity is at 495 kW. Average energy production, based on 370 kW in the summer and 225 kW in the winter is 2,320,000 kWh or 7,918 MMBTU.

A methane displacement of 8,813 metric tons carbon-dioxide equivalent provides an emission reduction. Electricity generation from renewable sources is 1,942 metric tons carbon-dioxide equivalent.

The \$3.5 million capital investment was

funded in part by a \$500,000 federal grant and \$232,587 from the state of Wisconsin's Focus on Energy program.

BIOFerm recently completed a phase connecting wastewater treatment gas to the plant.

"Now it's also utilizing the wastewater treatment gas from the wastewater treatment plant down the street, so it's producing its own gas from greenwaste and foodwaste and the engine is also combining the gas that we're collecting, which was originally being flared," says Nadeem Afghan, president and chief executive officer of BIOFerm's Americas operation.

Afghan says more waste management operations are embracing the idea that greenwaste has value.

Some people in the industry get caught up on wet versus dry anaerobic digestion, he says, adding that the end product is what dictates the use of either system.

A dry fermentation system is best suited for processing greenwaste into compost, he says.

Afghan acknowledges that a lack of control over what gets into the wastestream can be a challenge for collection operations. Community approaches range from enforcing and fining practices to onsite mechanical separation and sorting.

The middle road is education, he says, adding that this practice has influenced behaviors in Oshkosh and has been successful.

"We would like people to understand the value of compost, but when you talk to communities about producing compost, that's not exciting to them," he says. "But everyone enjoys the fact that their waste is producing energy."

Many developers building a renewable energy plant do not control behavior changes and want to tie mechanical separation in with their project, says Afghan.

"The amount of energy it would take to separate contaminants would offset the energy you're producing, so the net benefit looks pretty poor to the total project," he says. "If you want robots separate your waste, it's great, but don't sell it as an electrical production or gas production point, because you're going to have to run those robots and machines on a significant amount of power."

Education and economics are what it will take for greenwaste recycling to take a stronger foothold, he says.

Tipping fees are often at the center of the discussion.

"If you can prove to the landfill operator that keeping organics and greenwaste out of the landfill does not cost you more, it's a different way of looking at it—maybe that's a big victory," says Afghan.

With respect to waste-to-energy, "the deeper answer is we have record-low energy prices, and as long as our energy is cheap, it's difficult to tie these other benefits to waste processing. It just becomes an environmental aspect, and that's a lot of education."

Afghan sees anaerobic digestion for organic waste continuing to expand its footprint.

"We would need larger composting operations like Cedar Grove to continue to get support from their communities," he adds. "The best behavior shift over time is you have landfills, then you have composting operations, and then you get into the energy production. We in the industry would like to see a good solid behavior shift towards greenwaste and organic waste recycling, then looking at that screening, bringing in a robust composting program and bringing AD to it as an attachment."

Another program that Alexander finds notable: Harvest Power owns and operates a large permitted food scrap and yard debris composting facility, Fraser Richmond Soil & Fibre, located in Richmond, BC, near Vancouver.

The company uses covered aerated static pile (CASP) composting and odor-control technologies with biofilters designed to produce hundreds of thousands of cubic yards of high-value, compost-based product each year.

Harvest Power produces renewable energy at the Richmond site using high solids anaerobic digestion (HSAD) from municipal foodwaste and yard debris.

Although Alexander doesn't deal much with equipment selections for processing greenwaste, he points out that municipal operations managers should speak with others in the industry to ascertain what works.

"Half the battle with the equipment is how difficult, costly, and time-consuming is maintenance and are all the promises given about the equipment real?" he adds.

Greenwaste processing is as effective as the technology used to do so.

Companies such as SCARAB offer everything from windrow turners and tow-behind turners to machines that slice bags open and solutions that control odor.

SCARAB systems are used to recycle foodwaste and yardwaste, among other materials. Windrow turner models accommodate 6-foot through 27-foot self-propelled straddle-type and pull-behind windrows in both hydraulic and belt-driven machines.

The company's Model 15 Bag Breaker releases waste material from plastic bags by slicing the bags open instead of grinding or shredding them into small pieces.

SCARAB's Odor Solutions is designed to

be an affordable option for composting operations in need of reducing odors and emissions by capturing VOCs.

Travis Lint, large equipment sales manager for Bandit Industries, notes that green waste recycling at municipal facilities has grown “tremendously” over the last 15 years.

“More municipalities are seeing the importance of diverting green-waste from landfills,” he says. “Communities enjoy the benefits of either free or low-cost landscape mulch, which helps subsidize the cost of the recycling program. Some also utilize a compost program providing the same benefits.”

Bandit Industries manufactures four different sizes of horizontal woodwaste grinders.

“There are municipalities running our Beast Recyclers in all size ranges, from 200 horsepower to 1,200 horsepower,” he says. “These machines are ideal for producing a landscape mulch product from woodwaste and greenwaste.”

Bandit Industries offers the Model 2680, designed for tree services, loggers, governmental agencies, and land-clearing contractors looking for an easily transportable heavy-duty grinder.

The unit features a 24-inch by 60-inch mill opening with engine options ranging from 365 to 440 horsepower.

The 2680 has numerous teeth and screen options to enable customized grinding. The machine has been noted to produce in excess of 300 yards per hour.

Its cuttermill system breaks material apart by cutting and splitting as opposed to the beating action used by traditional grinders, and uses a high-torque drive to reduce large diameter materials.

It handles such materials as brush, logs, whole trees, stumps, logging

waste, land clearing waste, C&D, railroad ties, telephone poles, sawmill waste, pallets, slabs, bark, and chunk wood.

The unit converts materials into such useable products as compost, landscaping mulch, boiler fuel, and animal bedding. A tether remote control is standard equipment. An optional radio remote allows the unit to be controlled from an excavator or other remote locations.

“As grant money is given to the municipalities from the state level for recycling projects, more and more are looking to divert greenwaste from the landfills,” says Lint. “Greenwaste is one of the easiest materials to recycle. We expect the trend to continue with more communities developing greenwaste recycling programs.”

Lint notes that when recycling greenwaste, there will always be the issue of “ungrindables” finding their way into recycling yards.

“One way that helps deter that is having a yard manager or municipal employee monitor the material as it is brought in,” he says. “The Beast Recyclers are designed with the operator in mind in making repairs to the machine caused by ‘ungrindable’ material as easy and inexpensive as possible.”

Dick Edwards, regional manager for the mid-South for the Peterson Pacific Corp., agrees with his peers that over the past decade, people are trying to recycle new products as commodities—although he notes a slowdown occurred during the recession.

Now during the comeback, Edwards is noticing wood products being used for a variety of applications, such as mulch and hog fuel. One of his company’s clients is a large sawmill operation that uses the ends and pieces from cutting logs into conventional lumber for fuel to produce steam for energy to operate its equipment.

As for the challenge of contaminants, Edwards says he sees more operations hiring “trash police”—people who look into the green garbage bins to see what type of waste is being placed in them.

“When the material is loaded into the truck, the drivers are on guard for any metal sound and noises they hear,” he says. “When they dump the material at the site where it’s going to be processed, many of the sites are making them spread the material out so they can get a good birds-eye view of what’s inside of that load.”

One of the driving factors is that metal can cause damage to the processing equipment, Edwards points out.

“A lot of times, they’re making the people who dump these dirty loads pick that stuff up and take it wherever it needs to go, which would be a different class of landfill or a metal recycler,” he says. “I’ve even seen people try to hide toxic material like paint cans and chemicals in greenwaste loads.”

“Human beings are as honest as you make them be,” says Edwards. “Most of us want to be honest people, but economics plays a role in that, and whatever little character defects we have, it shows up in our wastestreams as well. I hate to think what they’re going to have to do to get people to conform a little bit more with this, but it’s probably going to lead to more government control.”

Edwards points out that when waste products become a commodity with an economic reward, “then you have government regulations telling you how you have to do it. The more convoluted and complex they make this, the less people are willing to expend the effort to get it done.”

Education through consortiums and groups that study composting is the solution to that challenge, Edwards says.

“We used to think solid waste was a skull-and-crossbones thing, and now we found out there are thresholds we can set for all kinds of substances in our wastestream that we can introduce to the recycling trade at certain levels and dispose of them that way without piling them up in some corner somewhere,” he adds.

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Kevin Fretz agrees with Edwards that trash can be treated as a commodity. The owner of Green Alliance, Fretz once worked for BFI's Vancouver, Canada operations.

The division's primary focus was on managing greenwaste generated by the landscape maintenance industry and homeowners. Businesses created by the landfill diversion mandates have been able to survive on tipping fees alone, says Fretz.

He took it one step further, creating safe organic products from greenwaste at higher standards, and started Greenways Environmental to develop and market nutrient-rich, "toxic free" compost derived from select clean green organic wastes and sell it in bulk. He has tested more than one million cubic yards of composted materials to ensure they meet higher standards.

Fretz says economics and environmental impacts play a factor in successful programs.

"It has to be an approach like any other business: If it doesn't make money, it's not going to work, and if it's going to pollute, you shouldn't be doing it," he says. "[United States citizens] are the creative people, the leaders in the world. Let's do it the right way.

"It's not going to solve problems if you take waste from one place and just dump it in another place. You're just moving the pollution somewhere else. There are technologies out there that are available. You just have to make sure they make economic sense, and then you'll encourage investors."

Ten years ago, the business mix of Engineered Compost Systems included a higher percentage of municipal clients, notes Steve Diddy, the company's director of business development.

"Now our business mix has a higher percentage of private compa-

nies, and of those companies the majority are either traditional waste hauling companies or compost processing companies that are increasing facility size or wanting technology upgrades," Diddy adds.

ECS is an engineering and manufacturing firm that provides compost design, technology, and ongoing technical support to composting clients. The company markets its aerated static pile (ASP) systems and in-vessel compost systems primarily to mid- to large-size facilities and to the biosolids composting industry.

"Our design philosophy is to combine high-value systems development with appropriate integration of commodity products and technologies," says Diddy.

When a new project or facility upgrade proves feasible, ECS develops the detailed process design with the client's other team members, such as engineers, environmental consultants, and contractors.

The company's scope of work includes providing drawings and calculations to support permitting by others, onsite technical support for construction oversight, providing the manufactured system components, conducting facility startup and acceptance testing, training facility staff to use ECS equipment, educating on the fundamentals of composting, and providing product service, ongoing technical support, and annual site inspections.

Compost product market opportunities are heading towards municipal parks, roads, and agriculture because of the continued escalation of petro-fertilizer costs, says Diddy.

Diddy cites several reasons why waste haulers and existing compost facilities seek to invest in compost operations:

- Municipal clients want to offer organic recycling to their citizens and businesses.

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- Municipal requests for proposal will often require composting.
 - Waste hauling companies will try to extend or leverage existing municipal contracts by offering compost collection and processing.
 - Waste hauling companies could lose tonnage to their landfills if composting facilities are built without them.
 - Waste hauling companies can increase revenue streams by selling the compost product.
- Facilities face several challenges when it

comes to composting, Diddy notes.

They include handling seasonal surges and variations, ever-increasing contamination, changing the mindset of a traditional landfill mentality to one of a product producer, and finding qualified compost facility operators.

Permitting is still the largest impediment to building compost facilities, says Diddy.

“New compost facilities are typically state of the art—they are either ASP, in-vessel or ASP systems with odor and volatile organic compounds capture and control,” he says. “Compostable plastics and other compostable

packaging are being tipped at compost facilities at an ever higher percentage. There are pros and cons involved.”

Sean Grieve, business development manager for Doppstadt US, says landfills are less likely to be the final destination for greenwaste.

“The processing of greenwaste to produce beneficial end products like mulch, biofuel, or compost is becoming more common,” Grieve points out.

Doppstadt US offers portable shredders, trammel screens, and high-speed grinders for greenwaste processing.

“The shredders will enable an efficient primary material reduction while affording the utmost in protection from tramp contamination,” says Grieve. “The trammel screens are used for screening material to separate by size and control the final material spec. The high-speed grinders will produce a finished ground material for use as mulch or further processing for compost.”

Todd Dunderdale, sales and marketing director for Komptech USA, notes that while 10 years ago, municipal greenwaste programs were established only on coastal states, “now we’re seeing more and more programs moving to the middle of the country.

“A big trend is green waste composting for agricultural land use where compost is taking the place of chemicals to help the soil with water retention and nutrient replacement,” says Dunderdale. “I also note many more cities are implementing foodwaste programs.”

Komptech offers equipment for all the steps in greenwaste processing, including shredding, chipping, turning, mixing, cleaning, screening, bagging, and spreading. Komptech also provides complete anaerobic systems for greenwaste and foodwaste.

Dunderdale sees future market opportunities in more greenwaste and woodwaste used in biomass. He also sees a growing composting market growing for agriculture.

His company also is involved in a number of anaerobic digestion programs in North America.

Twenty years ago in Edmonton, AB, landfill space was becoming less available.

Everything entering Edmonton’s waste processing facility goes through a sorting plant to separate the organic fraction for composting, which includes yardwaste on a seasonal

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basis. The facility also culls more dry, recalcitrant organic material for waste-to-energy purposes.

Sorting uses a combination of mechanical equipment and hand picking. Edmonton uses a windrow turner and a portable star screen from Komptech.

“We’re trying to get a three-fraction sort from that by size,” says engineer Alan Yee, who oversees organic processing. “There’s a minus-2-inch fraction that goes from the trammel via conveyer to the composting plant. Then there’s a 2- to 5-inch fraction that ends up going to the composting plant and everything over five inches in size eventually goes over to the refuse-derived fuel plant.”

The minus-2-inch fraction is virtually all organic and is in the 75% to 85% range most of the year, says Yee. The 2- to 5-inch fraction varies on a seasonal basis during the warmer months of the year.

“It will be largely organic, probably to the tune of 70-plus percent, and then during the winter months the organic percentage drops because we’ll also get in there some plastic containers, frozen disposable diapers, and the like,” says Yee.

Edmonton is “actively investigating” an anaerobic digestion system, Yee says.

“We’re thinking of this as a potential add-on to the deal with some industrial, commercial, and institutional source-separated organics,” he adds. “We look at that as a way to increase our composting capacity in a complementary process.”

Material from the composting plant is cured outdoors and finished for various niche markets, such as growing cereal crops. Among the other agricultural uses is the production of a dry material that can be used for dairy cattle bedding.

Other niche markets include the horticultural industry for landscape construction, top-dressing for sports fields, erosion control, and department of transportation road slope work.

Some material is dried out and sold as an industrial absorbent.

“We are able to recover some money for it, but it certainly doesn’t cover the cost of all of this processing,” Yee notes. **MSW**

Carol Brzozowski specializes in topics related to waste management and technology.

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