Compost for Rhode Island White Paper

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Greg Gerritt, February 2011

Rhode Island Resource Recovery Corporation's Central landfill has only a limited amount of space, and is filling fast. Replacing that capacity will be very expensive. Reducing the amount of waste tossed into the landfill will extend its life.

Plants need nutrients in order to grow into the food we eat. As fertilizers made from natural gas become more expensive it seems logical to consider recycling the nutrients in food scrap back into our food growing system.

There is a conjunction of interest. Rhode Island would like to reduce what goes into the landfill and extend its life, and one of the things we toss away in great quantities, food scrap, would provide much greater benefits to the community if we we recycled it.

Here is what Krystal Noiseux of the Rhode Island Resource Recovery Corporation reports about the amount of food scrap landfilled annually in Rhode Island and what that costs:

Composting & the RI Municipal Waste Stream Krystal Noiseux, RIRRC

In CY09[*] RI municipalities generated **514,811 tons** of materials. The last waste characterization study completed by RIRRC in 1990 classified 23.2% of the entire stream as "other organics," including food scraps. More recent data from the EPA (12.7%) and neighboring states such as CT (13.7%), DE (18%) and VT (21%) would make **20%** a more reasonable estimate. In the absence of an updated, statewide waste characterization study, this estimate is the best number we can put forth to complete some theoretical calculations. Under this 20% assumption, **102,962 tons** of RI municipal CY09 waste stream would have been food scraps, and 100% of these food scraps went to the landfill as refuse.

Municipalities are charged $32/ton to dispose of refuse, up to an allotted cap, and an over-the-cap rate of the lower between (1) $75/ton or (2) the current, lowest commercial contract rate. In FY10 RI municipalities, as a whole, delivered 318,835 tons of refuse at $32/ton,13,933 tons at $54/ton, 9,823 tons at $58/ton, and 146 tons at $75/ton. If RI municipalities had been able to capture 100% of the potential 102,962 tons of food scraps through a compost collection system, the total savings on landfill tips fees would have amounted to $3,862,986.

At 75% capture this number would be $3,039,306, and at the more likely **50%** capture this would be **$2,215,594**. **Of course, to put a municipal composting system into place, there would be additional costs to provide composting bins for every household, expanded collection services, and to pay tip fees at another compost facility.**

[*] Municipalities report totals for materials sent to other facilities to RIRRC on the calendar year, so the use of CY figures is necessary when considering total material generation.

The state goal for the rate at which municipal materials should be diverted from the landfill is presently 50% for each municipality. Diversion rates for municipalities are calculated on the calendar year, but if we assumed the same 102,962 tons of food scraps over the calendar year, keeping these food scraps out of the municipal stream would have also boosted the state average diversion rate from **28.1%** in 2009, to either 48% (at 100% capture), 43% (at 75% capture) or more likely, to **38%** (at 50% capture).

In FY10 RI municipalities delivered 29,548 tons of leaf and yard waste to RIRRC and generated another 32,617 tons CY09* that they either composted at their own municipal site or sent to another facility. At RIRRC, municipalities are charged $0/ton to dispose of L&YW up to their allotted cap, and an over-the-cap rate of $25/ton. A new policy allowing for municipalities to gift their excess cap went into effect in FY10, but 11 municipalities still went over by a total of 9,000 tons.

If we assume a municipal composting facility would have kept 100% of this overage away from RIRRC through a competitive tip fee, the total municipal savings on RIRRC leaf & yard waste tipping fees in FY10 would have amounted to **$225,000.** This would make total municipal tip fee savings from organics collection (both foods scraps and leaf and yard waste) to be $4,087,986 (at 100% capture), $3,264,306 (at 75% capture), or more likely **$2,440,594** (at 50% capture). **There could also be additional, potential savings on the 32,617 tons of municipal leaf and yard waste composted elsewhere, but these saving would be predicated on operating costs/ton or tip fees at other sites.**

It is also worth mentioning here that the municipal under-the-cap tip fees of $32/ton (refuse) and $0/ton (leaf and yard waste) have proven to be barriers for private companies looking to develop a composting operation in RI.

Providence-specific Example

In CY09* Providence generated a total of **77,970 tons** of municipal materials. Under the 20% food scrap composition assumption described above, **15,594 tons** of Providence's CY09 waste stream would have been food scraps, and 100% of these food scraps went into the landfill as refuse. In FY10, the City of Providence went over their solid waste cap by **3,429 tons** and was charged an over-the-cap rate of $54 for each of these additional tons. If the city had been able to capture 100% of the potential 15,594 tons of annual food scraps through a compost collection system, the total savings on landfill tips fees would have amounted to $574,446 (at 100% capture), $449,710 (at 75% capture), or more likely **$324,974** (at 50% capture). Of course composting bins for every household, expanded collection services, and tip fees at a compost facility_would all carry costs. In FY10 the City of Providence also delivered **3,159 tons** of leaf and yard waste to RIRRC. Providence traditionally remains under their leaf and yard waste cap, and for this reason is not charged any fee to deliver the materials to_RIRRC.

* Municipalities report totals for materials sent to other facilities to RIRRC on the calendar year, so the use of CY figures is necessary when considering total material generation.

Composting & the RI Commercial Waste Stream

Unlike municipal waste which is obligated to come to RIRRC by state law, commercial waste can come here or be_brought elsewhere. Also, the characteristics of commercial waste depend heavily on the type of commercial operation they are generated from. The best way to estimate potential savings in the commercial sector might be to look at a commercial waste characterization done elsewhere, broken down by industry type, and then apply those estimates to Rhode Island.

This was done in 2000. CalRecycle (California) completed such a detailed commercial waste characterization, and applying their numbers to data from the Rhode Island Economic Development Corporation (RIEDC) which breaks down employees/industry type, an estimated **56,226** tons of food scrap could have potentially been removed (14% of overall commercial trash). Tips fees for commercial waste vary greatly in and out of Rhode Island as well. If we were to use the lowest present commercial rate at RIRRC of $54/ton as a general estimate, then removing food scraps from the RI commercial waste stream could have resulted in landfill tip fee savings of $3,036,204 (at a capture rate of 100%), $2,277,153 (at a 75% capture rate), or more likely **$1,518,102** (at a 50% capture rate).

Using the same method to make a leaf and yard waste estimate for the commercial sector, we could assume generation of 17,441 tons (in CY09, 9,318 tons were delivered to RIRRC). Again, if we use RIRRC's rate ($25/ton) as an estimate for all tip fees, then by diverting 100% of commercial leaf and yard waste to another facility with a more competitive tipping fee commercial entities could have saved a total of $436,025 on "RIRRC rate" tipping fees. This would make total commercial tip fee savings from organics collection (both foods scraps and leaf and yard waste) to be $3,472,229 (at 100% capture), $2,713,178 (at 75% capture), or more likely **$1,954,127** (at 50% capture). **As with the municipal sector, there would be additional costs to provide composting bins for every business, expanded collection services, and to pay tip fees at another compost facility.**

Around the country and the world more and more communities are adding up the numbers for the total cost of their trash systems and opting for composting their organic materials. The cost of disposing of food scrap in landfills or incinerators varies from place to place. As Noiseux notes, tipping fees in RI are on the low side despite the severe lack of long term disposal capacity and that has probably slowed the development of our compost industry compared to other places. Even so, it is likely that communities and businesses throughout RI, in cooperation with RIRRC, will eventually find that the separation and collection of organic compostable materials will make sense here if we look at all of the costs of burying them and the benefits of recycling organic nutrients.

Community Benefits

Landfills are the number one source of methane emissions in the US and food scrap produces much of that methane. Methane is a potent greenhouse gas, reflecting at least 21 times as much heat energy back to the earth as the same amount of Carbon Dioxide. Composting and putting the compost back into the food system dramatically reduces the tonnage of greenhouse gases emitted and can really further a community's efforts to achieve carbon neutrality.

There was a study done a few years ago in Portland Oregon, in a metropolitan area similar in population to Rhode Island:
http://www.portlandonline.com/bps/index.cfm?a=111051&c=41789

Using the EPA WARM model to calculate greenhouse gas emissions from the entire food scrap system including transport of food scrap to either the landfill or the composting facility the author found that "Diverting food scrap to composting would save roughly between 14,500 and 44,000 tons CO2 equivalent per year and reduce total greenhouse gas emissions in the metro area by between 0.1% and 0.4%." Even though the study did not account for the emissions of greenhouse gases in the composting process this is thought provoking as the landfill was already piped for methane capture as is the landfill in Johnston. Rhode Islanders also have lower per capita energy use than the people of Oregon, so a similar reduction in food scrap emissions might reduce our carbon footprint by a larger percentage.

Landfilling food scrap also causes us to lose the soil building capacity of the food scrap, leaving it underground instead of returned to the topsoil to grow more food. One of the fastest growing industries in Rhode Island is agriculture for local consumption. Not returning all the food scrap to the soil definitely will impede future growth in the industry as farmers will struggle to sustain their soil fertility.

Collecting organics and composting will create jobs in the compost industry, in the food industries, and possibly in the clean renewable energy sector.

Composting costs

There are costs in transforming from a food scrap in the dump system to a composting system. These costs include developing and implementing the proper separation and collection system and the development of compost facilities. The usual place to find the funds to implement the various aspects of the compost system is in reduced tipping costs, as in many places tipping at a compost facility costs less than tipping at the landfill. Rhode Island's low municipal tipping fees mean that model might not work as well here, as there is likely be little in the way of savings in tipping fees available to offset the expanded collection costs. We may have to look at this issue a bit more broadly to understand our savings.

Other Communities

Other communities around the country are already collecting and composting food scrap. California leads the nation in this effort and Seattle Washington has also instituted the mandatory separation of organics from the rest of the waste stream. Here is a bit of communication directly from the company that manages San Francisco's collections

San Francisco

Direct communication from Robert Reed of Norcal Waste in San Francisco:

We collect nearly 500 tons of compostable material – mostly food scraps – a day. Here are other stats:

Households: The City tells us there are approximately 340,000 households in San Francisco. That includes single-family homes, apartment units, condominiums, duplexes, and other types of residential households. The Department of the Environment estimates at least 225,000 households of those households have compost collection (green cart) service. So more than two-thirds (67%) of all households in San Francisco, according to the city, have access to compost collection service.

Restaurants: The Department of the Environment estimates there are between 4,000 and 5,000 restaurants, coffee shops, and other food related businesses in San Francisco. By the City's count more than three-quarters (75%) of restaurants participate in the compost collection program.

Apartment buildings: We count 8,547 apartment buildings in San Francisco with six or more units. Our records show 4,419 (52%) of apartment buildings with six or more units participate in the compost collection (green cart) program. This is the largest group of apartment buildings in North America to participate in the food scrap compost collection program. The number of apartment buildings participating in this program has doubled in six months. This may be the best example of progress in a recycling program in the country.

Tons composted: Sunset and Golden Gate are collecting nearly 500 tons of compostable material a day in San Francisco. That is up from 400 tons a day one year ago. That is an increase of 25 percent in one year.

The most important thing for people to know about urban compost collection programs is why should a community implement such a program. We need to help people better understand the true upside of urban compost collection programs and that upside includes much more than saving landfill space.

Efforts in Other Communities

Just a small sampling of what is available on the web:

From http://www.cool2012.com/community/collection/

Durham, Ontario

The Durham Region of Ontario lies east of the city of Toronto within the greater Toronto metro area and is home to more than half a million residents. Residents separate food waste for weekly curbside collection, including meat, dairy and paper products. More than 175,000 households received bins through two phases. The green waste cart contains a metal handle for locking and is collected by a two compartment truck handling either trash and compostables, or compostables and recycling. In several towns of the region, trash collection was switched to every other week with recycling and composting collection weekly. The remaining towns offer trash and compostables collection weekly and recycling biweekly. Yard waste is not collected in the bin and is serviced curbside with rigid open-top containers or kraft yard waste bags.

Cambridge, MA

The city of Cambridge ran a pilot program in 2008 to collect food scraps from residents at the recycling drop-off center. Curbside pickup is available for businesses. Residents are eligible for a free 2.5 gallon bucket to collect kitchen scraps and are encouraged to line the bucket with paper bags. Biodegradable bags are not permitted. Yard waste is not accepted as it is collected weekly from residents at the curb throughout the growing season. Meat, bone and dairy products are accepted, as are paper towels, soiled paper products (no tissues), and other paper products certified by the Biodegradable Products Institute.

Here is an excerpt from a story in the 3/21/10 Boston Globe Magazine

The case for mandatory composting

It works in San Francisco. And it could work in Boston.

By: Aubin Tyler

Could a composting law work in Massachusetts? It turns out, it can, and it does. Nantucket has mandated composting for more than a decade, ever since the island's landfill started running out of space. Food, yard waste, and other organic matter — about 50 tons a day — go into a 185-foot-long "digester" that accelerates decomposition to accomplish in three days what normally takes Mother Nature six weeks. Over the past decade, the composting has kept more than 60,000 tons of methane out of the atmosphere, says Nantucket public works director Jeff Willett.

For island residents, it's now second nature to divide trash into two streams: recycling and organic waste. They can haul it away themselves for free or pay for a pickup service. "For every 100 tons of trash that comes into our facility, only 8 tons go into the landfill," Willett says. That's a 92 percent diversion rate. What's left? Mostly film plastic, like plastic bags.

Voluntary programs, while helpful, have limited impact. In Cambridge, residents unloaded 44 tons of food scraps last year at two drop-off centers, and 60 Cambridge businesses and institutions compost their food waste through a curbside collection program funded by a grant from the state's Department of Environmental Protection. Through another MassDEP program, some 200 supermarkets and groceries across the Commonwealth compost about 27,000 tons of food waste per year, saving each store $20,000 to $40,000 annually in disposal costs. But that's nothing compared

with the estimated 1.1 million tons of food waste produced each year by Massachusetts businesses and institutions. (In its forthcoming 2010 solid waste master plan, the state environment department is considering a ban on landfill and incinerator disposal of all commercial food waste.)

Last year, the city of Boston issued a call to the private sector to gauge interest in developing a type of digester operation, pioneered in Toronto, which captures methane gas and then uses it to generate electricity. But Boston environment department director Bryan Glascock says the economic downturn has "sucked a little wind out of the room."

So why wait for the private sector? The city already pays $80 a ton for private haulers to pick up its 200,000 tons of residential trash annually. That's about $16 million a year in garbage fees.

So far, San Francisco and Seattle are the only major US cities that require residential organics collection, according to the December issue of BioCycle, although more than 90 cities and towns offer some type of food-waste collection.

Does it add up in Rhode Island?

More and more communities are composting more and more materials every day. New programs are springing up all over. From Toronto, to State College PA to San Francisco collection and composting programs are blossoming. Massachusetts has a number of composting operations. Only careful examination of situation in RI and each particular set of conditions and contracts will tell us how it will work here.

From materials provided by RIRRC:

Food Scrap by Business Sector on an Annual Basis

	Tons of trash	Food Scrap Tons	Leaves Tons	%Compostable	%Food Scrap
Food & Kindred Products	6,264	1,405	0	22.4%	22.4%
Food Stores	26,841	10,683	223	40.6%	39.8%
Eating & Drinking Places	30,990	17,345	56	56.2%	56.0%
Total for all Industries	389,480	56,226	17,441	18.9%	14.4%

Average daily tons of food scrap from food industry sectors: 80 tons

Average daily tons of commercial food scrap in RI: 154 tons

Percentage of Commercial food scrap from Food Industries in RI: 52.3%

Average daily tons of residential food scrap in RI: 282 tons

Total Available food scrap: 436 tons per day

At 50% recovery rate: 218 tons per day

If food industries had 75% recovery, tons per day available: 60 tons

If food industries recover 75%, and 50% of the rest is collected, available per day: 238 tons

Anaerobic Digester capacity: 150 tons of food scrap a day

Additional capacity needed to compost collectable (50% of) food scrap beyond what a digester would use and the digestate coming out of a digester: 100 tons per day

To gather enough food scrap for a digester collection from the 3 food sector industries would need to be supplemented by both commercial and residential collection.

(Gathered from informants. Much thanks.)

YEARLY COST OF COLLECTION IN PROVIDENCE IS $5,494,000 PER YEAR

$3,600,000 FOR TRASH

$400,000 FOR YARD WASTE collected 8 months year

$1,100,000 FOR RECYCLABLES

57,000 UNITS $100 PER UNIT PER YEAR

TIPPING $2 MILLION A YEAR

EAST PROVIDENCE LEAF COMPOST FACILITY $120,000 A YEAR TO RUN IT
INCLUDING 2 SALARIES AND EQUIPMENT COSTS
6000 CUBIC YARDS OF LEAVES COMPOSTED PER YEAR

What is Composting?

Composting is the breaking down of organic materials such as food scrap, leaves, and manure by bacteria in the presence of oxygen, and transforming it into what is essentially the organic and high nutrient portion of topsoil. Composting recycles the nutrients and organic matter in what we have thrown away so that plants can reabsorb the nutrients and use them to grow again. In a forest the leaves fall to the forest floor each year, but they never fill the forest because below the surface of the leaf litter bacteria are turning the leaves back into soil, the original composting. In the north woods it can take several years for leaves to disappear, in tropical forests the process of recycling nutrients moves much more quickly. Topsoil builds rather slowly.

The breakdown of organic matter takes place in several steps over the course of time, each step in the breakdown being done by a different mix of bacteria. The speed at which organic matter breaks down and turns to compost varies according to conditions. Reducing the size of the organic matter to be composted provides more surface area for the bacteria to work and speeds things up. Other factors effecting the speed of composting include the oxygen flow to the compost pile, which can be controlled by either an aeration system or by turning the windrows, moisture, and temperature. By regulation, and sound composting practice, commercial compost piles have to heat up through bacterial action to over 160 degrees Fahrenheit for several days or they are not acceptable for agricultural purposes. Properly managed composting operations can turn food scrap and leaves into finished compost in about 8 weeks.

Another approach that is considered to be within the realm of composting is to use worms to process the organic matter. Vermiculture turns food scrap into worm castings which can be directly returned to the soil safely, working exactly like compost. Mostly practiced at home, there are large scale vermiculture operations selling compost. Worms can compost all vegetable matter, but there are limits to what they can eat, so to fully capture food scrap vermiculture must be supplemented with another approach.

What a Complete Compost System Might Look Like

Types of compost facilities needed if we are to capture and compost the majority of compostables created in RI:

- Home composting in all its diversity, including vermiculture.
- Community garden composting School composting.
- Farm composting.
- Commercial composting operations.
- Municipal composting operations.
- Centralized large scale composting operation.
- Food scrap fueled Anaerobic Digester/clean energy facility.
- Sewage treatment plant composting and digesting

What We Have Now

- **Home composting**

Composting begins at home and thousands of Rhode Islanders currently compost. We use back 40 piles, bins we got at RIRRC, home made bins, and worms. We compost leaves, yard trimmings, grass, and plant based food scrap. Community gardens also compost, on a scale not much different than home composting. Most farms compost. Many schools in RI compost, with elementary, middle, and high schools having tumblers in the yard and worms in the classroom, and several Rhode Island universities are researching their options and starting to compost food service scrap. It should be noted that there are many compostable items, such as expired dairy products and meats, that can be successfully composted, but require a higher temperature than is usually created in a home compost pile. Therefore home composting on its own will never meet the need for complete organics composting even for the most ambitious home composters. Therefore a complete system must include facilities handling large quantities of compostables collected from the community and businesses and able to compost the hard to compost items.

There is a variety of information and resources available to all home and other small scale composters in Rhode Island including the Master Composter and Recycler program run by the URI Outreach Center, publications on composting from RIRRC and other sources, and compost bins sold inexpensively by RIRRC and commercially. Some of theses resources are listed in the references section.

For the post modern there are electronic counter top compost units for sale that create compost right in the kitchen, and I have friends who think they can really improve the design.

• **Larger facilities currently in operation**

Currently several Rhode Island municipalities compost leaves and yard waste, and the RIRRC composts leaves and yard waste for communities without their own composting facility. Several private firms compost leaves and yard waste disposed of by the landscaping industries. A few businesses have the necessary permits that allow them to compost other people's food scrap in large quantities, but only Earthcare Farm in Charlestown is regularly composting commercial food scrap and selling high grade composts. Earthcare Farm inspires all Rhode Island composters and farmers with their high quality compost and willingness to share information. Currently no municipality in RI collects and composts food scrap, though Bristol has the capacity and willingness to work with potential partners using the facility that composts Bristol's sewage sludge. RIDEM maintains a list of licensed compost facilities by category with contact information. The list is included as Appendix 1.

What We Need

Looking again at the list at the beginning of this section Rhode Island needs a variety of composting facilities, probably located conveniently around the state, if we are to have a complete system. My first thought is always that until there are facilities to process the food scrap there is no point in collecting it, though we can encourage all small scale and home composting and continue to educate the community about this process. Once composting facilities are in place or at least in process, the planning for the collection of food scrap will be more focused and can be developed with technologies to match the capacity of the composting facilities. It is hoped that the members of the hauling industry will be helping the rest of us develop appropriate ways to capture and transport food scrap and that they will invest to meet the evolving system.

• **Anaerobic digesters**

Anaerobic digestion is the bacterial breakdown of organic matter with no oxygen present, as opposed to the composting process which is the breakdown of organic matter in the presence of oxygen. The bacteria in the anaerobic series of processes create different gases than the bacteria that work in the presence of oxygen, with methane being the leading end product of the stages of digestion. Burying food scrap in a landfill causes it to breakdown without oxygen, creating the smells no one wants to experience and much methane that no one wants in the atmosphere, methane being molecule for molecule 21 times as potent a greenhouse gas as carbon dioxide. The RIRRC landfill in Johnston collects between 50 and 75% of the methane produced by food buried in the landfill with a piped collection system and it is burned in a turbine to create electricity. The rest eventually escapes into the atmosphere.

If one is actively pursuing anaerobic digestion in a closed system (essentially some kind of vat or chamber with pressure controls to keep out oxygen and keep in the gases to be captured) it is possible to capture all of the methane and other gases. The gas captured is then burned in turbines to produce electricity or in heating systems for water or buildings. Another alternative is to clean up the gas and then put it into the commercial gas pipeline system, as methane is the basic component of natural gas. Natural gas is simply the product of anaerobic digestion millions of years ago that remained trapped in the ground or under the sea. Burning turns methane into carbon dioxide which can be absorbed by growing plants in limited quantities. A properly managed system can help the trash and food sectors achieve a better carbon footprint, often significantly.

Large scale digesters integrated into a compost system cost an order of magnitude more than

windrow compost facilities handling the same amount of food scrap due to the advanced systems necessary for the control of the anaerobic process and the burning of gas. There are hundreds of digesters in Europe where energy costs and tipping fees are high, and environmental standards are stricter than here. Toronto, and a handful of other communities in North America are digesting source separated organics collected in the community, and a few other communities, like San Francisco are in the process of having food scrap digestion systems built. Currently most digesters in the US are found on farms for manure management or at sewage treatment plants. Over 200 sewage treatment plants in the US currently anaerobically digest sewage sludge. Some of these operations, including Berkeley, California are now taking in food scrap to increase their gas production as it adds to the bottom line.

Food scrap collection is the wave of the future and food scrap focused digesters are being built, often by businesses that believe there is a profit to be made in the electricity business, with compost an additional value center. Large scale digesters will only be built with power purchase agreements in hand from electricity utilities or if a community has a need for the power at the digester facility such as powering a sewage treatment plant. It has been suggested that with the price of oceanic wind power in RI coming in so high, digesters working food scrap could come in with cheaper green power that is reliable, unlike wind, for 24/7 power. It relies upon a sustainable source for its fuel. As long as people eat and have processing scrap and uneaten food, the digester has fuel. Densely populated places like Rhode Island have more food scrap per square mile than other places making us an efficient place to set up a digester. The proposed size for a commercially viable Anaerobic Digester/electricty production facility is one capable of digesting 150 tons of food scrap per day.

The other end of the scale are the very low cost small scale digesters being built on farms in the developing world that generate methane from animal manure. Essentially thick plastic bags placed in trenches, the gas that accumulates can be piped to kitchens and replace the fire wood and cow pies that are currently used for cooking. Burning the methane instead of the cow pie allows most of the nutrients in the cow pie to be returned to the soil and reduces the amount of smoke the people breathe while cooking. Where the methane replaces firewood it dramatically reduces deforestation and the firewood collection duties of women and children. I have seen pictures of methane powered cars with plastic bags of farm generated methane serving as fuel tanks.

When a digester is finished what is left over is a sludge like material called digestate. The digestate can be composted with leaves creating a nutrient rich compost. Another alternative, one suggested to me by several different people in the digester business, is that the waste heat from the electricity production could be used to dry the digestate, and that dried digestate can be pelletized into a commercial nutrient rich organic fertilizer with some properties similar to compost

- **Windrow compost facilities**

Whether one digests food scrap and produces clean renewable energy or not, Rhode Island needs facilities for commercial or municipal scale compost piles for composting food scrap and/or for composting the digestate left over after the gas is collected as an alternative to pelletizing. Windrow facilities can be operated in several different ways. Some rely upon regular turning of the compost by large machines, either some sort of bucket loader or specialized compost turning machines. Others rely on air being pumped through the compost windrows to maintain the aerobic conditions. Both practices work well. The cost of these facilities varies directly with the size and capacity of the facility and the size of facilities can be scaled to the amount of food scrap available.

- **Alternative large scale aerobic systems**

There are a variety of products being sold on the market that allow businesses and institutions to compost all of their own food scrap right on the premises in a relatively small space, so that almost all transport of food scrap and finished compost can be eliminated from the equation. Well know in Europe, colleges and food manufacturers are the early adopters in the US installing various of these in vessel systems. They are not available in household sized units, as a household sized unit would be unable to heat up sufficiently to kill pathogens, but they could serve communities as an alternative to hauling to a central facility.

How Much Capacity Does RI Need And Where Could We Put It?

Neighbors are sometimes reluctant to have a composting facility next door, but a properly operated compost facility ensures that the gases that create offensive odors are not produced in appreciable quantities. Still, special care must be taken in locating compost facilities. In Windrow facilities food scrap and leaves are shredded, mixed at approximately a one to three ratio, piled in long windrows, and turned every 3 days or aerated through pipes. The piles reach at least 160 degrees Fahrenheit to kill off pathogens and weed seeds early in the process eventually transforming into a nearly uniform brown mass with an earthy aroma and incredible fertility. Compost can be stored for months before sale without losing its qualities, but not indefinitely.

A facility that could handle all of the collectable food scrap in RI (mixed with an appropriate amount of brown material like leaves or wood chips) would cover approximately 9 acres. Such a facility or even a much smaller one would have to adhere to DEM permitting requirements. There are rules for runoff, odor, setbacks, wetlands, etc. A facility would operate on a engineered pad with a leachate collection and treatment pond. Truck traffic will have to be accounted for. A site within the perimeter of the RIRRC operations and related businesses in Johnston seems a logical choice for a large composting facility, while smaller facilities might be created in other favorable locations throughout the state. As the compost facilities prove that they are good neighbors, it will be easier to site future facilities.

- **Evolving Facilities**

Think about this as an evolutionary process, changing over time. Starting small and simple has smaller up front costs for developing the facility and buying the equipment needed to run it. A small facility can work out its kinks and processes, on site and in the realm of collection, more easily than a large one, and it would allow composting facilities to grow with the capacity and willingness of Rhode Islanders to separate out their organic matter for collection. Small systems also make it possible to work with early adopters and the businesses that are most ready for this advancement and produce some compost while educating the community about separation, collection and composting. Even building upon current systems it is going to take a while to work out all of the partnerships and technology and figure out how best to fit it together.

If an Anaerobic Digester/Clean Energy project is developed in Rhode Island, we shall not need all of those 9 acres of aerobic composting space as the act of digesting the food scrap dramatically reduces the volume. About 40% of the volume of materials fed to the digester comes out as sludge to be composted, and as it is partly broken down already it composts faster. A facility that met half of Rhode Island's needs for composting if all the food scrap was simply composted, may meet all of the need if much of the food scrap was digested and used for energy production first before composting.

If the digester operator goes with pelletizing, less aerobic composting capacity may be needed.

• The Cost of Facilities

A home composter can begin composting as long as they have some vessel to collect compost in the house, a place to put the compostable material in a pile, and a fork or shovel for turning it and moving it around.

Commercial Composting facilities require water, sewage, electricity, an engineered pad, proper drainage, a grinder, large equipment for moving and turning compost, space for large equipment to maneuver, loading docks for compostables being dropped off and finished compost being shipped out, office space and computers, phones, desks…. Built and equipped from scratch a 2 acre aerobic compost facility capable of handling the commercial food scrap from the food industries (60 tons per day) would cost approximately $500,000 to set up and several hundred thousand dollars a year to operate. It could generate $500,000 or more in yearly sales. A 9 acre facility would cost over $1 million to set up.

An Anaerobic Digester and its associated power plants sized to digest 150 tons per day of Rhode Island's food scrap would cost in the range of $10 to $20 million. This can be justified by the selling of electricity or natural gas to the grid. No one will build a free standing commercially operated anaerobic digester/energy facility unless they have a power purchase agreement in place with an electric utility and can contract for sufficient food scrap. Electricity generated by burning the methane produced in digesters is more expensive than electricity from old coal fired power plants, but appears to be significantly less expensive than what some of the oceanic wind power projects say they need to be paid to be profitable.

• Collecting Compostables

People composting at home can only compost a limited range of potential compostables. There are things to compost that should not be composted at home. They require the higher temperatures that large compost piles can generate, especially when using materials that have gone through some type of shredding or grinding to reduce particle size, a shredding or grinding that rarely is practiced by home composters.

For collecting compostables in the kitchen there are a wide array of containers on the market. Some people use a plastic container with a sealing lid and keep it in the refrigerator or freezer until either placed on the compost pile or in the collection rolling bin. There are a variety of ceramic, metal and plastic containers that can sit on the counter until dumping. Many people in San Francisco use a small stand on their kitchen counter with a compostable bag that aerates and therefore does not stink prior to collection. And there are new things on the market all the time.

Collecting source separated organics from homes must account for the variation in collections seasonally, and the fact that many people will opt to keep most of their compostables, but even so will have materials that must be collected. Other folks will send out all of their compostables. Our current collection system deals with similar issues all the time, and the economics and regulatory climate of the industry can cope with this issue. Educating the public in the proper separation and collecting of compostables will take some time and effort. This is one reason to phase in any sort of household collection systems, possibly starting with businesses and early adopters.

Restaurants and other food businesses can provide source separation by trained employees, and commercial composting operations may provide some sort of pre process screening and removal of

inappropriate materials, either manually or mechanically. Often it is combined with a shredding or grinding process to reduce the particle size and increase surface to volume ratio.

The question of what type of bin or collection system has been looked at frequently. The consensus is that if you are collecting from homes, a wheeled cart like Providence uses for trash works fine except for the few weeks when there are autumn leaves to cart away. At that point something like the leaf bags many people use now can be part of the collection or some other innovation.

If we are going to a wheeled cart, right here in Providence Ecotope is developing the next generation of carts for collecting. The MORPH ™, can function in exactly the same way that San Francisco and other cities use a wheeled cart that I adapted for a system with a truck mounted mechanical arm for lifting and dumping. But in addition, because of unique design features, it can serve as a collection system while at the same time being a compost system which dramatically reduces odors prior to collection. This may allow for less frequent collections as the compostable materials shrink in size as they begin composting in the bin. Food businesses in pilot efforts have noticed the advantage for them of having carts in rotation and letting them be filled one and a half times before being collected due to in MORPH™ composting while producing less smell than their trash ever did. A home composter or institution that was going to use the compost could, with a little care, use the MORPH™ to complete the entire composting cycle.

- **Trucks**

All manner of trucks can be used to collect compostables.

Toronto now uses garbage trucks that have two compartments, one side for trash, the other for compostables, allowing them to make one trash pick up run. The two compartments can be sized based on the ratio of collection between trash and compostables. Other communities use trucks dedicated to picking up compostables so as to not intermix trash and compostables. Both systems work. MORPHs™, like their non aerated rolling kin can be dumped by the mechanical arms used in collections. In the commercial arena an additional option is that rolling collectors can be rolled onto trucks with lifts and exchanged and cleaned if that is the appropriate service for a particular niche. Commercial collections can also use some of the same variety of collection devices currently in use for other trash making for a relatively smooth transition from trashing food scrap to collecting it for composting.

- **How to Start**

Some communities have started collecting compostables with a drop off location, where people bring their compostables and drop them off for composting. The early adopters can then be a source of education for the rest of the community and prepare the way for a more complete collection while facilities continue to evolve. Other communities have started with subscription pick up services including bicycle trailer collection systems as well as more traditional pick up services. Some places start with commercial customers, especially food related businesses. Composting can provide substantial benefits for the hospitality industries and large institutions, and they are among early adopters where it provides a cost savings. It also fits well with the local and healthy food movements, and in fact if RI is to continue to grow its re-emerging agriculture, it is going to be critical to recycle the nutrients now being landfilled. Less compost, less soil fertility, less emerging agriculture, less food security.

- **Next Wave Developments in Rhode Island**

Earthcare Farm continues to set the standard for Rhode Island composting.

In the last year, Ecotope has been developing and testing the MORPH ™ which is a transforming of rolling trash containers such as Providence currently uses into containers for the collection of compostables in a way that virtually eliminates odors by beginning the composting process.

RIRRC has developed new handouts and web resources on composting and is beginning testing of the MORPH™ as home composting units.

ECORI.org is using MORPH's to collect compostables from patrons of the Farm Fresh Pawtucket winter market.

Brown, URI, and RISD all have composting initiatives moving forward on campus. RISD is experimenting with the MORPH™ and desk top composting machines available commercially. Brown students are convening Brown dining services and community partners to further develop Brown's efforts. URI has the Outreach Center Master Composter program, efforts to collect food scrap from the cafeteria to be composted at the experimental farms associated with the Kingston campus, and a professor who is testing the small scale use of anaerobic digestion of compostables to generate cooking gas for small farmers in developing countries and greenhouse heating in RI before the materials are composted.

Schools all over the state have started using worm bins and other compost systems to provide compost for their gardens.

There are at least two organizations in the process of trying to get a commercial Anaerobic Digester fueled electric power plant project off the ground.

Aquidneck Island has a variety of people interested in composting and has developed some momentum for the development of a large scale facility to serve the island.

Some small farmers are expanding their composting operations and selling compost at farmers markets.

RIRRC is offering free leaves to anyone who develops commercial compost facilities at the RIRRC industrial park to compost food scrap.

Agricultural interests are looking into digesters that would process horse manure instead of it ending up in the landfill, and possibly supplement the manure with food scrap.

REFERENCES

- **General/Resources**

http://www.americanrecycler.com/0504municipal.shtml

http://www.jgpress.com/biocycle.htm

http://www.jgpress.com/compostscience/current.html

Beyond recycling January 2010
The report is available on the web (not in hard copy) at:
http://beyondrecycling.org/pdf_files/FinalReport.pdf.

- **Food Scrap**

http://www.jgpress.com/archives/_free/001469.html

http://www.alternet.org/environment/91732

- **Rhode Island Resources**

The Worm Ladies of Charlestown

http://www.uri.edu/cels/ceoc/ceoc_programs_mcrp.html

http://www.rirrc.org/content/index.php?id=resident/composting/

http://www.rirrc.org/content/search.php?search=1&query=compost

http://www.rirrc.org/content/index.php?id=resident/composting/

Deal for Large-Scale R.I. Composting Facility in Final Stages

- **Communities That Compost**

San Francisco

http://www.sunsetscavenger.com/residential/composting.php?t=r

http://www.garbagepit.com/

http://www.sfenvironment.org/our_policies/

http://www.sfenvironment.org/our_policies/overview.html?ssi=15

http://www.commondreams.org/headline/2009/09/09-6

http://www.sfrecycling.com/residential/index.php?t=r

http://www.sfrecycling.com/index.php

http://www.sfrecycling.com/residentialFoodScraps.htm

http://www.sfrecycling.com/commercialCompost.htm

- **Other Communities**

http://www.boston.com/bostonglobe/magazine/articles/2010/03/21/the_case_for_mandatory_composting/

http://www.haringey.gov.uk/index/environment_and_transport/refuseandrecycling/recycling/food_waste.htm

http://www.centrecountyrecycles.com/

http://www.ecocycle.org/zws/index.cfm

http://www.wickedlocal.com/hamilton/features/x1499085874/Organic-Waste-Recycle-program-launches-this-month

http://www.lhpowerandlight.org/article.asp?articleid=5989

http://www.lhpowerandlight.org/article.asp?articleid=6037

http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=5606

http://www.toronto.ca/compost/index.htm

http://green.blogs.nytimes.com/2009/04/27/composting-dirty-diapers-yes-in-toronto/

- **Source Separated Residential Composting in the U.S. (2007)**

http://www.jgpress.com/archives/_free/001526.html

- **Collection Programs in the U.S.**

http://www.cool2012.com/community/collection/

http://www.pedalpeople.com/

- **Smaller Scale Composting Technologies**

http://www.wired.com/reviews/product/pr_kitchen_composter

http://www.natradinghouse.com/

- **Supermarkets**

http://www.mass.gov/dep/recycle/supermkt.htm

- **Digesters**

http://www.vecgreenvalley.org/projects.htm

http://calrecycle.ca.gov/SWFacilities/Compostables/AnaerobicDig/default.htm

http://www.uwosh.edu/today/5815/groundbreaking-for-nation%E2%80%99s-first-dry-anaerobic-biodigester-sept-15/

Compost Turning Equipment and Large Scale Facilities

http://www.scarabmfg.com/

http://www.jgpress.com/archives/_free/002206.html#more

Appendix 1

Licensed RI compost facilities

Information included for each facility includes Site Name, Address, Town, Owner Phone, Contact Person, additional description of compostable materials (if appropriate), compostable materials input approximate annual capacity, composting method, composting facility acreage.

DEM Office of Waste Management Regulated Facilities:

Registration Type: Leaf and Yard Waste Composting Facility

1. BARRINGTON COMPOST FACILITY, WAMPANOAG TRAIL, BARRINGTON, (401) 247-1907, Joe Piccerelli, 25,000 cubic yds. (cy) annual input cap., windrows, 5 acres

2. BURRILLVILLE COMPOST FACILITY, 325 WHIPPLE AVENUE, BURRILLVILLE, (401) 568-4300, Michael Wood, 3500 cy annual input cap., windrows, 0.5 acres

3. CHARLESTOWN COMPOST FACILITY, SAND HILL ROAD, CHARLESTOWN , (401) 364-1230, Alan Arsenault, 4000 cy annual input cap., windrows, 1 acre

4. EAST PROVIDENCE COMPOST FACILITY, FORBES STREET, EAST PROVIDENCE, (401) 435-7710, Steve Mutter, 30,000 cy annual input cap.,windrows, 12 acres

5. JAMESTOWN COMPOST FACILITY, NORTH ROAD, JAMESTOWN , (401) 423-7220, Steve Goslee, 600 cy annual input cap., windrows, 1 acre

6. NORTH KINGSTOWN COMPOST FACILITY, 345 DEVIL'S FOOT ROAD near COMPASS CIRCLE, NORTH KINGSTOWN, (401) 268 -1500 x600, Phil Bergeron, 8000 cy annual input cap. (est.), windrows, 0.7 acres

7. PASCALE COMPOST FACILITY, 17 Old Mendon Rd., Cumberland, (401) 334-2700, Ken Pascale, 500 cy annual input cap., windrows, 0.4 acres

8. PAWTUCKET COMPOST FACILITY, 240 GROTTO AVENUE, PAWTUCKET, (401) 728-0500, ext. 284 , Ron Leitao, 5000 cy annual input cap., windrows, 2.8 acres

9. SITE-READY MATERIALS + CONSTRUCTION CO. , 322 Eagleville Rd., Tiverton, (508) 676-3962 , Marcello Louro, 10,000 cy annual input cap., windrows, 1 acre

10. SMITHFIELD PEAT COMPOST FACILITY, 295 WASHINGTON HIGHWAY, SMITHFIELD, (401) 231-0400 , Jackson Despres, 100,000 cy annual input cap., windrows, 12-15 acres

11. WARREN COMPOST FACILITY, 21 Birch Swamp Rd., Warren, (401) 245-0200 , John Massed, 3700 cy annual input cap., windrows, 1 acre (est.)

12. WARWICK COMPOST FACILITY, 111 RANGE ROAD, WARWICK, (401) 738-2000 x6500 , David Picozzi, 52,000 cy annual input cap.(est.), windrows, 5.4 acres

Registration Type: Putrescible Waste Composting Facility

1. BRISTOL COMPOST FACILITY, MINTURN ROAD, BRISTOL, (401) 253-4100, Fred Serbst, leaf and yard waste and compostable food service ware (plates &utensils), 4000 cy annual input cap., in-vessel with forced aeration/agitated bin + outdoor curing, 0.6 acres. Also compost sewage sludge separately in this same facility, per approval of DEM Office of Water Resources.

2. RICHMOND SAND & GRAVEL FACILITY, STILSON ROAD, RICHMOND, (401) 539-7770, John Giarusso, leaf and yard waste, ground-up tree waste, and have taken chocolate waste from food processors & paper pulp waste, 150,000 cy annual input cap. (est.), windrows, 10 acres (est.)

Sanitary Landfill Permit and Registered Leaf and Yard Waste Composting Facility

1. RI RESOURCE RECOVERY CORP. Compost Facility, 65 SHUN PIKE, JOHNSTON, (401) 942-1430 , Bill Anderson, 220,000 cy annual input cap. (est.), windrows, 21.5 acres . Landfilling details are not included here.

DEM Division of Agriculture Regulated Facilities:

Putrescible Waste Approval

- Earthcare Farm, 89 Country Drive, Charlestown, (401) 364-9930, Mike Merner, leaf & yard waste, farm and zoo manure, fish waste, food scraps, paper by-products, wood ash &wood chips, sawdust, seaweed, & shells, 15,000 cy average annual input, windrows, 3 acres

Leaf and Yard Waste Approval

1. Rhode Island Nursery, 736 East Main Rd., Middletown, (401) 846-0721, Bruce Vanicek, also horse/cow manure & animal bedding, 25,000 cy annual input, windrows, 1.5 acres

2. Seven Cedars Farm, 7 John Mowry Rd., Smithfield, (401) 231-3117, John Emin, very small amount of waste (not specified), windrows, 0.1 acres

3. Good Earth Organic Gardening Center, 1800 Scituate Ave., Hope, (401) 826-3130, Joyce & John Holscher, 100 cy annual input, windrows, 0.25 acres

4. Ledge Ends Produce, 830 South Rd., East Greenwich, (401) 884-5118, Erik Eacker, also horse manure, 350 cy annual input, windrows, 0.25 acres

5. Wood River Evergreens, 101 Woodville Rd., Hope Valley, (401) 364-3387, Frank Crandall, 650 cy annual input, windrows, 0.4 acres

6. Perry's Matunuck Farm/Clark Farms Inc., 2984 Oliver Perry Highway, South Kingstown, (401) 783-8844, 2000 - 3000 cy annual input, windrows, 1-2 acres