Tulane University and Composting

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Introduction

As the Green Wave, Tulane University has made an effort to encompass all aspects of the term "green". For quite some time, Tulane has been taking steps- some small, some large- towards being a greener, more responsible university. The university has introduced recycling plastic bottles and aluminum cans to campus, built LEED certified buildings, and installed new lighting fixtures that have motion sensors fixed to them to help improve energy efficiency, to name a few things.

In an effort to continue this endeavor, I believe Tulane should implement a method of composting. According to the EPA, over 20 million tons of waste in the US was recovered from composting [11]. As landfills begin to reach their maximum capacity at an accelerated rate, it becomes increasingly important to recover and reuse as much waste as possible. As a university, Tulane produces large amounts of waste- most of which is sent to landfills. Because Tulane prides itself on setting an example for its community, it is important to show New Orleans that Tulane is going to take responsibility and front the way for sustainable living. This could be done alone or with partners in the community. For a quick recap (or perhaps introduction), composting is a process of taking organic waste such as food or yard waste, breaking it down, and reusing it as soil or fertilizer. Essentially, it is just trying to speed up Mother Nature's degradation procedure.

Organic Waste Estimations

	Bruff	LBC	Clippings	Total
Compostable Waste Minimum	150.483 tons/year	163.645 tons/year	273.9375 tons/year	588.0655 tons/year
Compostable Waste Maximum	810 tons/year	163.645 tons/year	479.39 tons/year	1,453.035 tons/year

The topic of organic waste from Tulane's uptown campus is one filled with formulas, guestimates, and a pinch of doubt; so, as a fair warning, let it be known that these estimates are in no way perfect and, to be more accurate, Tulane should conduct a thorough run-through on organic waste output on campus. However, these are some nice ball-park figures on the organic waste output from the major buildings on the uptown campus that would produce compostable material.

Bruff has two compactors with a total volume of twelve cubic feet that are emptied daily. Using conversion factors of food waste volume to weight [1], it can be seen that roughly 150.5 tons of compostable waste are produced in the dining hall annually. It should also be noted that a worker estimated the weights to be higher. With the workers estimates, annual output may be as high as 810 tons of compostable waste.

The LBC produces over 327 tons of waste on a yearly basis. Assuming that half of this is compostable material, the building produces almost 164 tons/year of organic waste. A previous project looked at the contents of the LBC's trash, but- unfortunately- the organic matter wasn't weighed. To be more accurate (instead of estimating the LBC's percent compostable material), a project should be implemented to find an accurate percentage.

For yard clippings, the total amount of organic waste ranges from 588.0655 tons compostable waste/year to 793.518 tons compostable waste/year.

After doing these estimates, Kristi Moriarty of the National Renewable Energy Laboratory (NREL) was contacted and was able to provide a document that has a formula for university output of food material. Using this formula, the food waste of the uptown campus is estimated to be 597 tons/year. Adding the weight of grass and leaf clippings, a total output of 1,076.5828 tons compostable waste/year was found.

Possible Systems

There are innumerable ways to go about composting, among these being Earth Tubs, In-Vessel Composting, anaerobic digesters, and Biotowers. As a university located in an urban area, space is the largest limiting factor to this proposed project. Based on space requirements, cleanliness, compactness, and efficiency, these four systems have been chosen as fitting Tulane's needs for a clean and compact method of composting most accurately.

Earth Tub

Green Mountain Technologies, the company that sells this product, reports that the tubs are capable of processing 100 pounds of waste daily [9]. These systems aren't especially large, having a diameter of 90" and a height of 68" (meaning a 56.25 ft^2 patch of land is required for every individual unit). The system heats the organic mixture to help decompose any food scraps at a quicker rate and must be mixed at least twice a week.

Because Tulane's daily output is thought to be one to three tons (2,000-6,000 pounds) [1], a minimum of twenty and a maximum of sixty of these tubs would be needed. This is an extraordinarily high amount, and may in fact be incorrect.

Lafayette College, a liberal arts and engineering college housed in Easton, Pennsylvania recently bought two Earth Tubs and has found this to be perfect for their output of food waste [7]. The university houses approximately 2,600 undergraduates who, for the most part, live on campus. Because Tulane is a larger university with an undergraduate population of roughly 8,400, it can be expected to have a higher waste output than Lafayette College. Based off of student population ratios, Tulane would need more than three times as many tubs as Lafayette, requiring a total of seven Earth Tubs for food waste. Tulane, however, is also hoping to compost grass/leaf clippings. Because Lafayette College's tubs don't process their yard waste, this brings in to question how many more tubs would be required to process both food waste and yard clippings. By using the estimates on food waste weight and yard waste weight [1], it can be seen that yard waste at Tulane may even be as high as food waste output, meaning a total of fourteen Earth Tubs may be required.

For fourteen units, a total area of 787.5 ft^2 is required. However, fourteen units is a large number and it can become confusing and difficult to remember which tubs need to be filled and which need to be emptied.

In addition, not all of the tales of Earth Tubs are as happy as Lafayette College's. In fact, even Lafayette College seemed to struggle at the beginning. While they insist that Green Mountain Technologies sent out a representative to help with each problem, problems still remained: "…the lids got stuck, one lid popped off, they didn't send a biofilter connection for one tub so we had to make one, etc.." [7]. Going on, Nicholas Smith, who has worked for both Montclair State University and Keane University, states that "I have also used an Earth Tub; however, my experience was completely negative…I did not find it efficient and the turning of the auger to mix the feedstock is extremely difficult" [5]. The only drawback to his statement was that he didn't state at which university this happened, but the fact remains that someone in charge of composting at a university was very let down by this system.

In-Vessel Composting

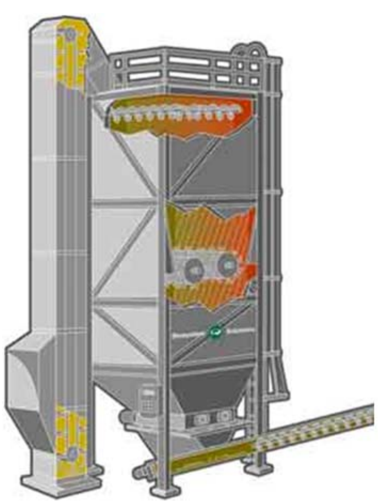
CompostSystems has devised a roll-off composting system that, from the exterior, bears resemblance to a semi-truck-trailer. After talking with Steve Diddy (an employee of CompostSystems) on the phone and explaining the estimates, he gave some approximate details on a system that can process 1 ton a day. He appraised the cost of installing such an endeavor to require a budget of three to four-hundred thousand dollars and enough land as to equal the size of a parking lot that can fit 20-30 cars. In addition, the system needs to be run by someone. While Mr. Diddy says it can be run by one person who understands biology and mechanics, it is better to have two people in control of the system. He goes on to say that these should not be students, as the students have no long-term interest and thus are more careless. The last requirement for this project is that a roll-off truck (or pull) would be necessary for the containerized vessels. However, these are readily available for hire from most garbage companies.

Anaerobic Digester

Anaerobic digesters are unique in that, in addition to composting organic material, they collect the gases that are produced during the decomposition process. This mixture of gases mainly comprises methane- a greenhouse gas that can be recycled and used to fuel electricity on campus. Michigan State University currently has a functioning digester that uses a portion of this energy to fuel the system itself, making it energy-cyclic and, consequently, even greener. In addition, up to this point it is unknown whether or not the proposed systems can take more than vegetation as compostable waste. Anaerobic digesters, however, differ on this note. A digester is also capable of decomposing meat and dairy products as long as there is also vegetable matter. Because most universities' food waste is typically 50% fruits/veggies and 50% protein/baked goods [8] this could drastically increase Tulane's green factor by disposing of even more waste in a green manner.

The only unfortunate let-down of these digesters is that they aren't space sensitive. Using the formula "volume of digester = volume of feed/day * retention time" [3], a volume of 693 cubic yards is needed for a digester for Tulane. This is obviously too large of a facility to be held on campus or in the immediate area, but Baton Rouge currently has a land permit for an anaerobic digester as well as a company interested in building one in the foreseeable future [4]. This company has built a digester in Columbia, South Carolina and is currently observing its effectiveness before building another project in Baton Rouge.

In addition, the state of Louisiana was looking into starting an anaerobic digester project in St. Bernard Parish. The newly released findings, however, show that the land that was being scoped for the project is unfit for an anaerobic digester and it is assumed that the project is to be abandoned.



BioTower

A BioTower system is a vertical composting system that is specifically structured for areas of limited space. BioSystem Solutions, the company that makes the BioTower composting system, claims that the structure is capable of processing up to twenty tons of waste daily- including meat, dairy, and fish products [2]. As mentioned earlier, the maximum estimated output of compostable waste on Tulane's uptown campus is thought to be roughly three tons. This means that the system will be able to handle any type of expansion that the university is planning in the foreseeable future, being able to treat more than sextuple the amount of estimated organic waste now produced. In addition, the edifice is structured vertically for space-restricted areas. In addition, the BioTower is treated with a biofilter to control any possible odor release. The system also runs at higher than average temperatures, eliminating most pathogens for a cleaner and safer system. Unfortunately, no dimensions nor energy ouputs could be found on the BioTower due to a lack of response from their information desk.

Obstacles

According to the EPA, New Orleans' tipping fee comes in at an extremely low $30 per ton. A tipping fee is the fee required to dispose of waste at a location (i.e. landfill). Unfortunately, most people want a lower tipping fee for compost than what they pay for waste disposal. Should the composting system be implemented to take in waste from other parts of New Orleans besides Tulane, it can be expected that people will be somewhat averse to composting unless the fee is roughly $27 per ton.

This presents a problem, as to be financially feasible the tipping fees for an in-vessel system need to range between $60-80+ per ton [6], depending on the size of the system. If a static pile were used, the cost would likely be around $20 per ton, but this form of composting requires a lot of time and space, has no odor control, still releases methane and other gases from decomposition into the atmosphere, and may not be suited for the immediate New Orleans area.

Urban composting presents several additional problems: several permits will be required to be able to handle solid waste as well as sewer discharge (see Appendix B for further information on permits) [10], equipment (such as a tractor) will need to be bought, odor control may become a problem, and vectors- vermin such as rats and gulls- will likely increase in the area. Most of these are manageable, as these systems are relatively closed off, preventing odor release and minimizing vector interest. A more accurate measurement of Tulane's tonnage per month (with tonnage peaks) must be procured. The quality of this organic waste also needs to be measured, as the more wet it is the more bulking agent will be needed. Lastly, Autocad drawings of the area must be made to show any slope or drainage.

Recommendations

Bearing in mind all of the facts just given, the choices can easily be boiled down to composting with either an anaerobic digester, a BioTower system, or even in-vessel composting through CompostSystems. The digester poses a problem with space and complexity. It may be possible however, should other community partners (or the city) express enough interest in composting. If the composting is to be kept on a relatively small scale, then the BioTower system is the best solution. It would be able to take on composting from several other partners as well, and takes up much less space (though the exact dimensions aren't given). CompostSystems should be contacted again and, if their system can decompose meat and dairy (as with anaerobic digesters and the BioTower), should be seriously considered as a third option. Otherwise, it may be best to exclude this system on the basis that inability to decompose meat and dairy will reduce Tulane's composting impact by reducing the amount of waste that can be composted.

Last Thoughts

While it is my belief that these three systems are the most suited for Tulane's composting needs, a waste conference known as "Waste Expo" will be held the third week of May. Many compost system vendors and groups interested in composting will be in attendance, including Steve Diddy. It is highly encouraged for a university representative to attend to see if any other systems are preferable to the ones listed and researched here. In addition, I recommend that Tulane start a project to accurately assess its organic waste production. This will give more precise estimates that can be used to better determine how much land would be required for each potential system.

References

1. Appendix A

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7. Earth Tub Composting | Association for the Advancement of Sustainability in Higher Education (AASHE). (n.d.). *Earth Tub Composting | Association for the Advancement of Sustainability in Higher Education (AASHE)*. Retrieved from http://www.aashe.org/forums/earth-tub-composting

8. *Feasibility Study of Anaerobic Digestion of Food Waste in St. Bernard, Louisiana*. (2013,

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9. In-Vessel Systems. (n.d.). *Green Mountain Technologies*. Retrieved April 12, 2013, from http://compostingtechnology.com/products/compost-systems/earth-tub/

10. Lagard, E. (2013, March 28). New Orleans Composting Requirements [E-mail to the author]. (Appendix B)

11. United States Environmental Protection Agency. "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010." N.p., n.d. Web. <http://www.epa.gov/osw/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf>.

Appendix A

Organic waste output:

Bruff:

2, 6 cubic yard containers; emptied daily

3 1/3 55 gallon drums = 1 cubic yard = roughly 412 pounds

x 2 = 824 lbs./day = 0.412 tons/day

x 365.25 = 150.483 tons waste/year

all waste compostable

*compactor estimates may be as high as 3,750 lbs. per compactor (number may be from Galo)

576-810 tons/year with this estimate

Clippings:

Roughly 200-350 lbs. clippings = 1 cubic yard

7.5 cubic yards per day of clippings

7.5 x (200 to 350 lbs.) = 1,500 to 2,625 lbs./day = 0.75 to 1.3125 tons/day

x 365.25 = 273.9375 to 479.39 tons waste/year

all waste compostable

LBC:

roughly 50%+ compostable waste

327.29 tons = total tons waste/year

X 0.5 = 163.645 tons/year compostable waste

Total:

Minimum = 588.0655 tons compostable waste/year

Maximum = 793.518 tons compostable waste/year

With Galo's estimate:

Minimum = 1,013.5825 tons compostable waste/year

Maximum = 1,453.035 tons compostable waste/year

Doesn't take into account if LBC has more than 50% organic waste http://www.epa.gov/wastes/conserve/foodwaste/docs/feasibility_stdy_st_bernrd_la.pdf

Formula for organic food wastes from universities:

University food waste (lbs./year) = # of students * 0.35 lbs. (food waste/meal) * 405 (meals/student/year)

Using this info, Tulane should have:

8,423 *.35*405 = 1,194,385.5 lbs./year = 597.19275 tons/year

This is within the 500-1,000 tons/year estimation

However, does not include grass/leaf clippings

With grass clippings, 1,076.5828 tons/year

2.9556151 tons/day

http://www.chemicalforums.com/index.php?topic=36925.0

Volume of digester = volume of feed/day * retention time

v = (bruff volume + lbc volume + clippings volume) * retention time

v = (12 + 12(ish) + 7.5) * 22

v = 693 yards^3

Appendix B

Hi Tyler,

I've provided comments below from LDEQ staff in air and water permits to your question regarding permitting of an vessel system for composting. I don't know if permits would be required for EPA or the other agencies.

If Tulane is just composting organic material, an air permit wouldn't be required. If they intend to use the methane generated from anaerobic digestion to fire a small boiler or engine, a permit or some other form of authorization may be needed. You can contact Bryan Johnston with any additional questions regarding air permitting at 225-219-3450 or by email at Bryan.Johnston@la.gov.

If the facility proposes to discharge pollutants to waters of the state from the composting process, an individual LPDES permit will be required. Since composting falls under SIC Code 2875, the facility will need to have stormwater coverage (either through the individual permit or the Multi-Sector General Permit) unless the facility can demonstrate 'NO EXPOSURE' by completion of a No Exposure Certification. You can contact Eura Dehart with any additional questions regarding water permitting at 225-219-3213 or by email at Eura.Dehart@la.gov.

As far waste, we had a few questions about the operation that need to be answered before we could determine whether or not a permit would be required.

What types of waste will be composted, food waste, vegetative debris, etc.?
Where would the site be located?
Provide a brief description of how the waste would be handled (transportation, storage, etc.).
Provide a brief description of the digester operation.
What is the final use/disposition of compost?

Thanks,
Evita